Evaluating Textbook Questions and Classroom Instructional Questionsfor Grade 6 Science in a Private School in Dubai based on the Revised Bloom's Taxonomy

تقييم الأسئلة المضمنة في الكتاب المدرسي و الأسئلة التي يتضمنها سياق التدريس بالفصل الدراسي لمادة العلوم للصف السادس في مدرسة خاصة بإمارة دبي وذلك باتباع تصنيف سلم بلوم المعدل
(Bloom's Taxonomy Revised **)**

By

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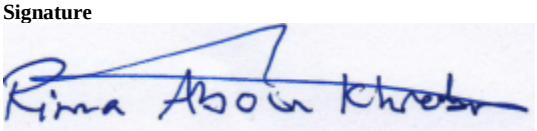

ABSTRACT

This study attempted to analyse Grade 6 Science textbook and classroom instruction questions. The textbook and instructional questions were analysed using the Revised Bloom's Taxonomy to ascertain the type of cognitive process and knowledge that is being taught in a Grade 6 Sciencecurriculum in a private international school in Dubai, U.A.E. Since questions play an important role in critical and creative thinking it is important to investigate the levels of questions used in the textbook and during instruction to determine the level of higher order thinking and critical thinking being taught in schools. The research used a qualitative approach of textbook analysis using the Revised Bloom's Taxonomy where questions were tallied and analysed according to the appropriate cognitive dimension and knowledge dimension. Based on the results, it was found that lower order thinking questions are more commonly found both in the textbook and during instructions than higher order thinking questions. Furthermore, questions in the textbook emphasized "Remember" process, while instructional questions emphasized the "Understand" cognitive process. The most common knowledge dimension in both textbook and instructional process is the "Conceptual" knowledge. Based on this study's findings it is recommended that textbook writers and educators include more higher order questions within curriculum and pedagogy to help improve critical thinking among learners.

Keywords: Revised Bloom's taxonomy, curriculum, instruction, knowledge dimension, cognitive dimension, questions.

ABSTRACT
(Arabic Version)

تنطوي هذه الدراسة على محاولة لتحليل الأسئلة التي يشملها الكتاب المدرسي لمادة العلوم للصف السادس، وكذلك الأسئلة التي يتم طرحها في سياق التدريس بالفصل الدراسي. و في تحليل الأسئلة تم استخدام تصنيفسلم بلوم المعدل Revised Bloom's Taxonomy وذلك بغرض التحقق من النهج المعرفي والإدراكي الذي يتم اتباعه في التدريس ضمن منهج مادة العلوم لطلاب الصف السادس بمدرسة خاصة في إمارة دبي، الإمارات العربية المتحدة. ونسبة للدور الهام الذي تضطلع به الأسئلة في التفكير النقدي والابداعي فإنه يصبح من الضروري أن يتم عمل دراسة استقصائية لمستويات الأسئلة المضمنة في الكتاب المدرسي وتلك التي تكون في سياق التدريس بالفصل الدراسي حتى يمكن الإنتهاء الى مرتبة أعلى في التفكير النقدي والإبداعي في المنهاج الدراسي بالمدارس. وتم في الدراسة اتباع النهج النوعي في تحليل الكتاب المدرسي عبر تصنيف سلم بلوم المعدل من خلال تسجيل وتصنيف الأسئلة وتحليلها وفقاً للبعد الفكري والبعد المعرفي المناسبين. وتبين من واقع النتائج التي خلصت اليها الدراسة بأن أسئلة الكتاب المدرسي ذات المرتبة الصغرى في التفكير هي أكثر شيوعاً من الأسئلة ذات المرتبة العليا. بالإضافة الى ذلك، هناك تركيز في أسئلة الكتاب المدرسي على ناحية " التذكر" بينما التركيز في الأسئلة ضمن سياق التدريس على ناحية " الفهم". والبعد المعرفي الأكثر عمومية في كل من الكتاب المدرسي وسياق التدريس هو المعرفة "المفاهيمية". وبالاستناد الى نتائج هذه الدراسة، يوصى بأن يقوم مؤلفي الكتب الدراسية والمعلمين بتضمين أسئلة ذات مرتبة أعلى في المنهاج الدراسي وضمن خطط الدروس حتى يمكن الارتقاء بمستوى التفكير النقدي لدى الدارسين.

Dedication

To the spirit of my beloved father and sister Sawsan

Acknowledgement

First, I am grateful to Allah for all I have been given and for giving me the will and power to finish this work, without the blessings from Allah this work would not have been possible.

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To my mother, you always believed in me and gave me the strength to move ahead in life.

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Chapter 1

INTRODUCTION

1.1 Statement of Problem

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Teaching and learning is a complex process that consists of many components such as the teacher, the student, the curriculum, and the school or classroom environment. The process of teaching and learning is usually dictated by the curriculum, instruction, and assessments. The teacher and the student within these contexts are at the heart of the learning process that takes place in classrooms all around the world

The manifestation of the curriculum occurs in many forms, one of which is the textbook. Schools in the United Arab Emirates (UAE), like many countries all around the world, use the textbook as the core mode for delivering the curriculum. The textbook dictates in many instances what the curriculum and what the instruction will be specifically in the UAE. Teachers in classrooms across the UAE rely greatly on the textbook as a medium of instruction, and often develop their questions during instruction and assessment from the textbook.

In classrooms, textbooks guide the instructional and practical flow of the lessons no matter how much educators nowadays try not to rely on them (Ball and Cohen 1996). It does not matter which school of teaching a teacher belongs to, the textbook is an important core material in the teaching and learning process and its influence in providing a framework for the teaching and learning cannot be ignored. Martin et al. (2005) argues the profound impact textbooks have on instruction, teachers, and curriculum since textbooks are used by teachers and students as guides that influence the questions levels used during the teaching and learning process.

Although, modern teaching methodologies have evolved, the textbook remains to play an integral role in delivering the curriculum. The role the textbook plays in education is more apparent in the UAE. The social educational context of the UAE remains more dedicatedto using the textbook as the main form of delivery of the curriculum and thus parents, teachers, and students tend to utilize the textbook as the main tool in the learning process.

Based on the researcher's experience in education and in the UAE, it was observed that although there exists many schools in the UAE each with different curriculum and following different standards, what has guided the teacher in delivering the standards in the classroom is the textbook. This reliance on the textbook as a form for delivering standards is because many educators and specifically teachers come from different backgrounds with different experiences in the education field and from different curriculums. Many of these teachers find it difficult and inconvenient to develop novel materials to deliver the curriculum, thus, they depend on the

textbook as a mode of deliverysince the textbook presents the material in an organized and simple manner, and provides direction and security (Hutchinson and Torres 1994).

In addition to the latter, many teachers lack time, experience in the UAE, and are not able to develop innovative instructional materials. Until recently, teachers hired by many schools in the UAE did not necessarily have an education background as their qualification and thus,are likely to struggle with many of the teaching strategies required. In addition, on many occasions the schools do not provide the necessary professional development for teachers to develop their teaching skills. Therefore, teachers rely on what is provided and that is the textbook guide to dictate their instruction and their teaching methodologies inside the classroom.

Since the textbook plays an integral role in dictating instruction, curriculum, and assessments which in turn influence the teaching and learning process, it is useful to examine a textbook's content and how this content is being delivered to the students.Furthermore, when examining the textbook it is important to examine the levels of questions and how questions play an important role in the teaching and learning. Martin et al. (2005, p. 222) view questions as "tools for planning, teaching, thinking, and learning." Questions presented in the textbook dictate the type of learning that will take place in the classroom since these questions are used bythe teacher to deliver the content of the textbook. They also influence student learning since the type of question posed determines the type of knowledge the student gains.

Accordingly, to develop creative and critical thinking which are the core skills needed nowadays in the globalized world markets, questions are the key to developing these skills. According to Tofade, Elsner and Haines (2013), questions assist teachers in uncovering what is learned by the student, stimulate higher order thinking, enhance creativity, and critical thinking and build confidence.

Questions assist in directing and focusing student learning; furthermore, questions play a big part in the delivery and practice of the course content (Swart 2010). Therefore, investigating the questions in the textbooks and questions used during instruction will show the impact questions have on student learning and thinking processes.

1.1 Statement of Problem

Questions come in many forms. They can be presented in students' textbooks and workbooks, or can be questions used inside the classroom by the instructor to teach the subject

content or assess student learning. Larson and Lovelace (2013) view questions as a tool for learning, encouraging students' interest in the subject, stimulating critical thinking and helping in the evaluation of students' understanding. Therefore, in addition to examining questions presented in the textbook, it is important to examine and evaluate the types of questions used by the teacher during instruction to help deliver the content of the curriculum.

In order to examine textbook questions and instructional questions, many studies have utilized Bloom's taxonomy as a tool to analyse levels of questions and to assist in categorizing questions as low or high order questions. Although this taxonomy was originally used to examine learning objectives, many studies have utilised it in the categorization of questions. Recently, Anderson et al. (2001) have proposed the **R**evised **B**loom's **T**axonomy (**RBT**) which will be used in this study as a tool for analysing textbook and instructional questions.

Since educators often use textbooks across the UAE to deliver the curriculum, and since questions are an integral part of assisting teacher evaluate students understanding, they can be potentially helpful in building creative and critical thinking skills. This study will examine textbook questions and instructional questions of Grade 6 Science in an international school delivering the Indianapolis American Common Core standards in Dubai, the UAE for the academic year 2013 – 2014 using the RBT as a basis for the analysis.

By analysing the question content of the textbook and the instructional questions used in the classroom analysis, the level of thinking that is being taught in Science in the school in the UAE will be evaluated. This will provide a representative study of what level of questions are used across schools in the UAE and whether critical thinking and higher order thinking questions are being used in Science classrooms across the UAE.

As mentioned earlier, this study's relevance to the context of the UAE is important, since textbooks are used often in the classrooms and as a mode of delivering the curriculum. It is unique since it is the first study of its kind that examines textbook questions and instructional questions of a Grade 6 Science textbook and instructional questions analysis in Dubai.

Therefore, the purpose of this study is to investigate the Grade 6 Science textbooks used by an international private school delivering the Indianapolis Common Core Standards in Dubai for the academic year 2013 - 2014. Along with the textbooks content analysis, non-participatory classroom observations will be administered as part of the research to answer the research questions investigating:

1) To what extent questions presented in the Grade 6 Science textbooks of a private school in Dubai are varied or frequent according to the six levels of the **R**evised **B**loom's **T**axonomy (**RBT**)?
2) What percentage of the Grade 6 Science textbooks' questions fall in the RBT **L**ow **O**rder **T**hinking **Q**uestions **S**kills (**LOTQS**)?
3) What percentage of the Grade 6 Science textbooks' questions fall in the RBT **H**igh **O**rder **T**hinking **Q**uestions **S**kills (**HOTQS**)?
4) What is the dominant knowledge domain in the Grade 6 Science textbooks?
5) Does a relationship exist between the cognitive domain/knowledge domain content textbooks analysis and the in-class teaching instruction in Grade 6 Science in a private school in Dubai?

1.2 Scope of work

Taxonomical analysis of 1,482 textbook questions from the three textbooks currently being used by the Grade 6 Science class in an international school in Dubai following the Indianapolis American common core curriculum for the academic year 2013 – 2014 will be the main subjects of the study. In addition to the latter, 174 instructional questions of one teacher teaching the Grade 6 Science classes in the same international school in Dubai will be analysed using the Revised Bloom's Taxonomy proposed by Anderson et al. (2001). One teacher will be the subject of the non-participant observations since only one teacher teaches all six classes of Grade 6 Science. The classroom observations were done during the months of September until the month of November for the academic year 2013- 2014. The three textbooks are published by Houghton Mifflin Harcourt company, an American publishing company.

1.3 Structure of dissertation

This chapter has presented the importance and significance of investigating use of questions within textbooks and classroom instruction. The following chapter will review literature on similar research that has been carried out in the same field. In the third chapter, the methodology applied to obtain the data will be presented, followed by the results and discussion. Finally, the conclusion will discuss the main research findings, the limitations of the study, recommendations, and further research suggested within this area.

Chapter 2

LITERATURE REVIEW

2.1 Revised Bloom's Taxonomy (RBT)

2.2 The Case for RBT

2.2.1. Science Related Studies

2.2.2. English, Islamic, and Social Science Studies

2.3 Importance of Higher Order Thinking for Learning

Curriculum is at the heart of the learning and teaching process, the textbook is the core content of the curriculum and often it becomes the curriculum; teachers depend on the textbook as a mode for delivering the curriculum (Hutchinson & Torres 1994). Along with the textbook, the teacher's instructional delivery of the content of the curriculum is crucial in analysing the type of student learning in any educational institution.The alignment between the textbook content, classroom instructional component as well as the assessment would provide a clear picture of the teaching and learning process inside the classroom (Anderson et al. 2001).

This study aims to investigate the Science textbook questions and the instructional questions of a Grade 6 Science in school in Dubai delivering the Indianapolis American Common Core Standards for the academic year 2013 - 2014. The researcher chose to evaluate the textbook and instructional questions according to the **R**evised **B**loom's **T**axonomy (**RBT**) as presented by Anderson et al. (2001). Although the taxonomy was first introduced to evaluate the learning objectives, Bloom's Taxonomy has been used in many studies to evaluate questions in assessments, instructional questions, and textbook questions.

In order to judge the teaching and learning taking place in any educational setting, questions provide the means of identifying what, how and how much is being taught in the classroom. Therefore, the analysis of the questions used along the whole process of teaching and learning would assist in providing an overview of the types of cognitive and knowledge skills students gain during the learning process. Questions play an important role in developing critical thinking, creative, and reasoning skills, which are considered as being some of the core skills that are required in the globalized world market.

Chadwick (2013) views questions as an integral part in teaching children to think critically and creatively. Furthermore, for effective instructions to take place in class, Jones et al. (2009) and Swart (2010)consider questions as an important part of the instructional process, and the teaching and learning. Both identify questions as a way of stimulating reasoning, thinking, and creativity. Swart (2010) identifies questions as a method used by instructors to assess their instructions, help focus and draw students' attention to a particular topic, and as means of stimulating and motivating students to master the delivered content.

Alul (2000) discusses questions as being divided into two types. One type of questions is considered direct questions, which involves providing facts that can be easily retrieved from the textbook. The other type of questions such as analysis, synthesis, comparison, and creativity

problems require the application and the critical thinking of the facts or knowledge in order to be answered.

2.1 Revised Bloom's Taxonomy (RBT)

Although there exists many taxonomies that help in analysing questions and learning objectives, since it was initially introduced in 1956, Bloom's taxonomy has been the most widely used by educators. It is commonly familiar to most educationalists, easily understood and adheres to the psychology of learning.

Ghanem et al. (2013) classify Bloom's taxonomy as the most commonly used taxonomical classification system in educational research, and as being 'easily characterized', thus providing a way to measure educational processes. When evaluating the educational process using Bloom's taxonomy, it provides ideas on ways of improving questions and objectives chosen to be used in the educational process. Below is an explanation of the RBT that will be used for the taxonomical content analysis of the questions presented in the textbook and during instruction in this study.

Anderson et al. (2001) revised the 1956 Bloom taxonomy, which included the cognitive, affective, and psychomotor domains. In their book, Anderson et al. (2001) concentrated on the cognitive domain and introduced the knowledge domain. Bloom's taxonomy cognitive domain consisted of six levels made up of nouns arranged from the lowest cognitive process 'knowledge', 'comprehension', 'application', 'analysis', 'evaluation', 'synthesis' to the highest cognitive process 'evaluation'.

In the Revised Bloom's Taxonomy (RBT), the nouns were changed into verbs arranged from the lowest cognitive process to the highest cognitive process in such manner 'remember', 'understand', 'apply', 'analyse', 'evaluate' and 'create'. Besides the cognitive domain process, Anderson et al (2001) proposed a knowledge domain consisting of 'factual', 'conceptual', 'procedural', and 'metacognitive'.

The matrix used to analyse the questions was based on the RBT proposed by Anderson et al. (2001). The matrices used for both the knowledge domain and the cognitive domains are found in Appendix A (Table 19) and B (Table 20) respectively. Still, a brief description of each cognitive and knowledge domain will be explained below.

Revised **B**loom's Taxonomy (RBT) Cognitive Domain as proposed by Anderson et al (2001):

1. **Remember:** This type of cognitive process involves the recovery of significant information from long-term memory. The primary goal of this type of process is 'retention' of information. It involves simple 'recall' and 'recognize' tasks. Recall tasks include searching for information in the long-term memory and bringing it to working memory. While 'recognize' tasks include finding the information in long-term memory and comparing it with given information.

   While the 'remember' cognitive process is concerned with 'retention', the other five cognitive processes on the other hand are more concerned with 'transfer' of knowledge.

2. **Understand:** The 'understand' cognitive process is recognized as the largest transfer process in education; it refers to the construction of meaning from instructional material. Understanding takes place when a connection is built between prior knowledge and newly presented knowledge. It often involves the transfer of 'conceptual knowledge' since it is concerned with integration and building of 'schemas' and 'framework'. Some of the categories it involves include summarizing, classifying, interpreting, inferring, comparing, explaining, and exemplifying.
3. **Apply:** It is associated with 'procedural knowledge' since it uses procedures to solve exercises and answer questions using a sequence of steps or conventions. It is made up of executing, and implementing categories. Execute is concerned with a task to solve afamiliar problem, while implement is involved with solving an unfamiliar problem.

For the purpose of this research paper, **L**ow **O**rder **T**hinking **Q**uestions **S**kills (**LOTQS**) are concerned with the first three cognitive processes 'remember', 'understand', and 'apply' presented and explained above. While **H**igh **O**rder **T**hinking **Q**uestions **S**kills (**HOTQS**) are concerned with the last three cognitive processes 'analyse', 'evaluate', and 'create' which will be explained below.

4. **Analyse:** This cognitive process is considered to involve high order thinking skills, and it involves taking a problem and dividing it into its parts, then determining how these parts are interrelated to each other and to the overall structure. 'Analyse' objectives or questions are concerned with categories such as 'differentiating' the message and its

important pieces; 'organizing' how the different message pieces are organized, and 'attributing' the main purpose of the message.

5. **Evaluate:** Evaluate involves judgment making based on certain standards or criteria. The criteria include 'effectiveness', 'consistency', 'efficiency', and 'quality'. Standards can be categorized as qualitative or quantitative, and these standards can be applied to the criteria. Categories included involve checking, and critiquing.
6. **Create:** It is the synthesis of a new product, where small elements are placed together to form a 'coherent whole'. It is the mental organization of parts into a new never before made whole. It involves the categories of generate, plan, and produce.

Revised Bloom's Taxonomy Knowledge Domain as presented in Anderson et al (2001):

1. **Factual Knowledge:** This type of knowledge refers to foundations of a discipline that are needed to help acquaint in solving problems and communicating in that discipline. It can be alphabets knowledge, scientific terms, facts about a culture or a health discipline, and other elements or sources of information.
2. **Conceptual Knowledge:** This type of knowledge is concerned with 'classifications' and 'categories' and how they are interrelated. It "includes schemas, mental models, or implicit or explicit theories in different cognitive psychological models" (Anderson et al. 2001, p.48). It also encompasses 'structures', 'models', 'theories', 'generalizations', and ' principles'.
3. **Procedural knowledge:** This type of knowledge comprises the process of how something is done. It usually involves a series of steps to be followed. Some of the knowledge it requires includes 'procedures', 'techniques', 'algorithms', and 'methods'. With procedural knowledge, the student is required to identify criteria to be used to carry a certain procedure.
4. **Metacognitive knowledge:** This type of knowledge refers to the self-knowledge, or knowledge of own cognition. It involves awareness of different knowledge a person has, the strategies one uses to learn, think, or solve problems. Furthermore, it includes knowledge of 'cognitive tasks' which assist the learner in choosing which strategy to use. Examples include knowledge of simple tasks such as recall, simple memorization, paraphrasing, summarizing, social, or conventional norms and how to use these strategies.

2.2The case for RBT

After being introduced to the RBT, this section will summarize related studies found in the literature that have used Bloom's taxonomy to analyse questions and/or learning outcomes. RBT has been used as a valid method of analysis in various contexts such analysis of language textbooks, university level instruction and scientific subjects. Some of the key studies and their findings will be discussed here.

2.2.1. Science Related Studies

Question analysis within textbooks is not a recent phenomenon. Research has been conducted in this area as early as the 1970s. In Egypt, while analysing 7th, 8th, and 9th Science textbooks questions Zaki (1973) calculated questions frequency according to Bloom's taxonomy and discovered that 73% of the questions were *knowledge* questions, and 26% were *comprehension* questions in the 7th grade textbook. Similarly, in the 8th grade textbook the percentage of *knowledge* and *comprehension* were 87%, and 12% respectively.

In examining instructional questions according to Bloom's taxonomy in Science classrooms in 48 schools in Nigeria, Black's (1980) study results showed that the highest percentage was given to the *knowledge*process, then to the *comprehension* and *application* processes respectively. No questions were posed that fell into the categories of *analysis, synthesis,* and *evaluation*.

Both Zaki's (1973) and Black's (1980) studies are very similar to this current study, which analyses Grade 6 Science textbook questions and instructional questions using RBT. Based on educational and professional experiences, it is expected that even with the many current changes and innovations that have taken place in the educational setting, that the present study's results of Grade 6 Science textbook questions and classroom instruction questions will be similar to the results of Zaki's (1973) and Black's (1980) study.

Azar (2005) focussed on comparing the physics questions cognitive levels in university entrance exams (76 questions)and high school physics exams (600 questions) according to Bloom's Taxonomy. The results showed that the percentage of *knowledge* and *comprehension* of the high school physics exams questions were 8.27% and 12.05 % respectively, while the *application, analysis, synthesis,* and *evaluation*questions were 74.64%, 4.32%, and 0.72%

respectively. On the other hand, the university entrance exam questions were as follows: 0% *knowledge*, 1.32% *comprehension*, 56.58% *application*, 35.53% *analysis*, 5.27% *synthesis*, and 1.32% *evaluation*.

Unlike previous studies presented earlier in this literature review where *knowledge* and *comprehension* are the most dominant cognitive levels, Azar's (2005) study shows that *application*cognitive level questions are very common. This result is expected since most of the physics content at the high school level includes solving problems and procedural type of knowledge requiring *application* cognitive processing. Also, Azar's (2005) study results point out that although the high school physics exams in Turkey provide good *application* practice questions, these exams fail to prepare students for higher order thinking skills such as *analysis* which are required for university entrance exams.

Within the context of tertiary education, Jones et al. (2009) studied and analysed 29 examination papers for eight programmes in the Bachelor of Engineering and Science degrees that ranged from technology to engineering subjects in the electronics field in the United Kingdom. Furthermore, the learning outcomes related to the examination papers were also reviewed to study if there exists a relationship between the learning outcomes and the type of questions presented on the examination paper.The results show that there exists a significant alignment between the learning outcomes and the examination questions. In addition, there were very few learning outcomes and questions which belonged to high order cognitive skills; most of the questions and learning outcomes fell in the category of lower and intermediate order cognitive skills. Although, higher order thinking questions and outcomes should be more common at tertiary education, Jones et al.'s (2009) study results proves that such higher cognitive processes are rarely planned for and practiced in tertiary education.

Swart (2010) examined the five years' examination papers from the year 2002-2006 for an Electronic module (Levels 1-4) in the Republic of South Africa University using Bloom's taxonomy of cognitive domain. In terms of the distribution of the cognitive domains of Electronics module I and II, it was similar with both having *application* cognitive process as the most dominant cognitive process 59% and 58% respectively. Lower order thinking processes (*knowledge* and *comprehension*) were lower at 36% and 33% each respectively. While higher order thinking skills *(analysis* and *synthesis*) were 0% and *evaluation* at 5% and 9% each respectively. Both Electronic module III and IV showed lower order cognitive skills

(*knowledge* and *comprehension*) to be 45% and 46% respectively. *Application* questions scored 31% and 8% respectively, lower than the pre-requisites modules Electronics I and II. *Analysis* was 0% and 5% respectively, *synthesis* scored 12% and 37% respectively and *evaluation*was 4% for both.

As shown from Swart (2010), modules I and II are considered introductory courses, and are therefore expected to have more *knowledge* and *comprehension* questions, but this is not the case. Furthermore, at higher levels (Electronics III and IV) as discerned by Swart (2010), modules are considered more advanced and should offer questions that are categorized as higher order thinking. However, the results show that the professors are still testing more *knowledge* and *comprehension*at higher level modules, rather than higher order thinking skills. In addition, the exams have lower number of *application*questions when compared to the pre-requisite courses, causing concern. However, Electronic module IV level contained a higher number of questionsat the *synthesis* showing a good sign since it shows higher order thinking skills represented in advanced modules in engineering promoting critical and creative thinking.

The variability in distribution of cognitive domains shown in Swart (2010) shows that although the modules are requirements and prerequisites of each other, the knowledge contained within could vary and it depends on the content of the subject on how it is categorized according to what skills need to be acquired. This also was shown in Azar (2005) where the distribution of the cognitive domains varied according to the type of knowledge presented in the curriculum and subject.

Ayvaci and Türkdoğan (2010) evaluated examination questions (1592) of grade 6 science and technology course using the RBT during 2008 – 2009 academic year. The results showed that 38.4% of the 1592 questions were *remembering*, *understanding* was 16.3%, *applying* was 13.5%, *analysing* was 8.5%, *evaluating*23.1%, and 0.5% was given to *reorganizing* level. Furthermore, Ayvaci and Türkdoğan's (2010) study showed that the questions represented a *factual* knowledge of 38.8%, *conceptual* knowledge of 38.7%, *procedural* knowledge of 18.9%, and *metacognitive* knowledge of 3.5%. Another important finding from this study was the fact that the questions targeting scientific awareness were very low. This indicates that there were minimal instruction and questions given by teachers to help students inquire about the knowledge, but rather memorization and recall of knowledge were high.

In terms of knowledge at Grade 6 level, what is presented in the results in Ayvaci and Türkdoğan's (2010) study is what would be predicted to be taught at this level. In grade 6 the building and acquisition of knowledge is still occurring, therefore, questions would be more concentrated on the lower order thinking skills. Also, in terms of knowledge, conceptual and factual knowledge are considered the most common types of knowledge at this stage of learning. Nevertheless, more higher order thinking and *synthesis* questions should be included as part of the questions.

Jideani and Jideani (2012) analysed a random of nine Food and Science Technology (FST) courses' learning outcomes and assessments from two universities according to the new Revised Bloom's Taxonomy of learning. The codes for the nine food courses were (FOCF, FOCS, FOCH, FOPR, FOPG, FOTC, FOCO, FOQA, and FODT). Conjoint analysis of the cognitive process dimension and the knowledge dimension was used to describe the courses lecturers' choice for the aforementioned dimensions.

Similar to Swart's (2010) study the distribution of cognitive domain and knowledge varied across nine courses in Jideani and Jideani (2012). In terms of the most common *cognitive/knowledge*combination learning outcomes it varied from *Apply/Procedural* for the FOCS and FOCF course, to *Apply/Conceptual* knowledge for the FOCH. For FOPR subject, the most common cognitive and knowledge domain was *Understand/Conceptual* knowledge, while FOPG, was *Understand/Procedural* knowledge, the FOTC subject scored 16.7% on the learning outcomes focusing on *Understand/Conceptual*knowledge, the FOCO subject scored 25.8% on *Understand/Factual/Conceptual* knowledge. While the learning outcomes of FOQA scored 18% on *Apply/Conceptual*knowledge. Finally, the FODT subject was formulated for learners to *Apply/ Procedural* knowledge with a percentage of 21.2%.

Jideani and Jideani (2012) also focussed on the assessment questions of the nine Food Science and Technology courses and the overall statistics show that the questions posed in the nine courses assessments were assessing the students ability to *Understand/Conceptual* knowledge at a percentage of 13.2%, in addition to *Remember/ Procedural* knowledge at 8%.Accordingly, Jideani and Jideani's (2012) study show that low order thinking skills are still common in learning outcomes and questions used at the university level. While in terms of knowledge, the most common types of knowledge are *conceptual* and *procedural* knowledge which is expected for Science courses. Again, the results are varied across the nine subject in

terms of learning outcomes, but there is a lack of alignment between learning outcomes and assessment questions which is similar to what was seen in Azar (2005) where there was little alignment between high school questions and university entrance exam questions.

Lovelace and Larson (2013) examined "questioning strategies" in a lecture environment to investigate the types of cognitive levels of questions asked during lectures and to measure the students' response time. Focusing on two Science courses taught by four different instructors, Lovelace and Larson (2013) examined the instructional questions at cognitive levels among other variables using the RBT. Based on their findings, it was found that the questions at cognitive level mainly inclined towards the lower skill levels of RBT; the percentage of questions were 78.2% *remember* and *understand* and the high order level questions of *evaluate* and *create* were mainly 4.7 %.

Other findings from Lovelace and Larson's (2013) study suggest that the professor who was considered as the highest-ranking in teaching in a particular university asked the lowest order thinking questions. Furthermore, it was found that the levels of the questions did not influence the students' response rate, meaning students' response was not dependent on the cognitive level of the question and students would be willing to answer high order cognitive question. Lovelace and Larson's (2013) study is relevant to the current study since in this study instructional questions are also being examined. From the results it can be seen that there has not been much change in terms of the levels of questions being asked during instruction since the early 1980s as presented in Black's (1980) study which was discussed earlier in this literature review. Both studies show that lower order thinking questions are still being posed during instruction in Science classrooms.

2.2.2. English, Islamic, and Social Science Studies

Alul (2000) examined Grade 8 English textbooks used in Palestine during the academic year 1999 - 2000. In her study, she analysed questions in the student book, workbook, and stories according to Bloom's Taxonomy. The results show that the most frequent cognitive process was *comprehension* at 41%, followed by *application* at 25%, *knowledge* at 20%, *synthesis* at 9%, *analysis* at 4%, and *evaluation* at 1%.

Although, Alul's (2000) study showed that lower order thinking skills dominate the textbook questions in Grade 8 English; the *knowledge* cognitive process is not the most dominant

process. Given it is English textbook questions, it is expected that more emphasis would be given to *comprehension* questions, unlike Science textbooks where more *knowledge* questions would be expected to be presented in the textbook. Furthermore, *analysis* and *evaluation* questions would be expected to be higher at this level in English textbook but surprisingly, this is not the case.

Riazi and Mosalanejad (2010) evaluated high school English textbooks learning objectives in Iran using the six levels of cognitive domains in Bloom's taxonomy. Three senior high school English textbooks and one pre-university textbook were used for the analysis. In all four textbooks lower level learning objectives were much higher than high level learning objectives.

Similar to Alul (2000) and Zaki (1973), Riazi and Mosalanejad's (2010) study shows that higher order cognitive skills are less represented in the English textbooks in Iran when compared to lower order cognitive skills. Thus far, most studies have shown that lower thinking skills are more represented in textbooks' learning objectives and questions and although many changes have taken place over the years across primary, secondary, and tertiary education the lower order thinking skills are still taught and learnt at each level rather than higher order thinking skills.

Seif (2012) evaluated the presence of higher order thinking skills in Grade 8 English reading exercises in the student book and workbook in Palestine. Seif (2012) wanted to ascertain to what extent the reading exercises in the student book and workbook of the Grade 8 English were included in the three higher level of cognitive process of Bloom's taxonomy *analysis*, *synthesis,* and *evaluation*. In terms of both the workbook and student book, the *analysis* cognitive level was represented in 51.92% of the reading exercises, the *synthesis* cognitive level was represented 41.35%, and the *evaluation* cognitive skill was represented 6.73%. This study shows that higher order thinking questions are well represented in Grade 8 English textbooks, however, the author fails to provide an indication to what percentage of lower order thinking are represented in the books. Seif's (2012) content analysis did not discern how much and whether lower order thinking questions are present in the textbooks.

Ghanem et al. (2013) analysed three Islamic Textbooks' questions according to teachers' opinions, these textbooks were used in Iraq's secondary schools. In all three textbooks it was found that the questions posed were identified by the reviewers as being high in terms of *knowledge* and *comprehension*and low in terms of *application*, *analysis*, *synthesis* and

evaluation. This indicates that overall, the low order thinking skills were highly represented in the textbooks and the high order thinking skills were under represented in the textbook. Since the study evaluated the textbooks using teacher's opinions, it provides an indication on how the teachers would also present the content to the students in the class, thus, showing that minimal higher order thinking occurs in the teaching of Islam in secondary schools in Iraq.

In his study, Igbaria (2013) sought out to identify and examine the frequency of Bloom's taxonomy cognitive processes represented in the questions starting with WH- in grade 9 English Horizon textbook. After thorough examinations of the questions, the results of the study showed the distribution of the questions as follows: 23.09 % as *knowledge*, 29.66% as *comprehension*, 11.29% as *application*, 23.36% as *analysis*, 10.24 % as *synthesis*, and 2.36 % as *evaluation*. As can be seen from the results *comprehension* was the most frequently represented cognitive domain similar to Alul (2000). Unlike previous studies on English textbooks, *analysis* questions were frequently represented. However, Igbaria's (2013) study only analysed WH- questions in the books and these questions tend to include more *analysis* types of processes since they are more open-ended questions and therefore require the students to break down the questions into its component to be able to form an answer.

Naomee and Tithi (2013) performed a document analysis of the learning outcomes of the social science curriculum in Bangladesh and carried out semi-structured interviews providing an insight on the learning outcomes from curriculum specialists. The 199 learning outcomes were specified and analysed according to Bloom's taxonomy. The results show that the most represented cognitive domain was *comprehension* at 63%, followed by *knowledge* at 31%, 5% belonged to *analysis* cognitive domain, and 1% *application* cognitive domain. There were no learning outcomes that represented the *synthesis* and *evaluation* cognitive domains.

The results of Naomee and Tithi's (2013) study are very similar to Alul's (2000), and Igbaria's (2013) in terms of all three studies having *comprehension*as the most represented domain. What can be seen is that these three studies deal with social studies, and English which in terms of the content of the subject require skills of understanding rather than remembering facts, thus, the trend of having *comprehension* as the most common cognitive process is seen. If compared to Science, engineering and physics studies represented by Ayvaci and Türkdoğan(2010), Swart (2010), and Azar (2005), the most common cognitive domain was *remember* for Ayvaci and Türkdoğan (2010) which dealt with Grade 6 Science, and

apply/application for Swart (2010) and Azar (2005) since the content of the subjects differ. In the subjects that Swart (2010) and Azar (2005) studied, more facts are required for development of procedural knowledge leading to the different cognitive skills.

In general, from the literature presented thus far, the results show that the extent of the distribution of the cognitive domain depends on the subject being analysed and the levels taught. Questions in Physics, engineering, and Science technology courses at high school and university level varied in terms of the cognitive domains compared to English, Social studies, and Islamic studies. The latter subjects were more common in the *comprehension* cognitive domain compared to the other subjects which were more common in the *application* cognitive domain. However, what is common is that lower order thinking skills are still more commonly represented compared to higher order thinking skills.

In summary, the result of all the previously presented studies show that low order thinking skills are highly represented, while high order thinking skills tend not to be highly represented in learning outcomes, instructional questions, textbook questions, and assessments or exams questions. It is also seen from the literature that there is variability in terms of the distribution of the cognitive domains according to the subjects' content and level.

2.3 Importance of Higher Order Thinking for Learning

Earlier it was discussed that questions are important for the enhancement of critical and creative thinking. This section will present arguments in support of higher order thing skills and why they need to be taught in today's classroom and included as part of the curriculum outcome, assessment, and textbook questions.

Dam and Volman (2004) view critical thinking and higher order thinking as being important to help students function in a democratic society, and to be able to have 'citizenship competence'. They see higher order skills as a requirement for individuals nowadays to be able to solve problems, using analytical, and thoughtful reasoning and to get involved in decision making, and infer and judge what is important in the society.

Resnick (2010) argues that 21st century schools need to concentrate on enhancing students higher order thinking through the enhancement of collaboration among educators to help students acquire the skills needed for the reform changes taking place in the world.

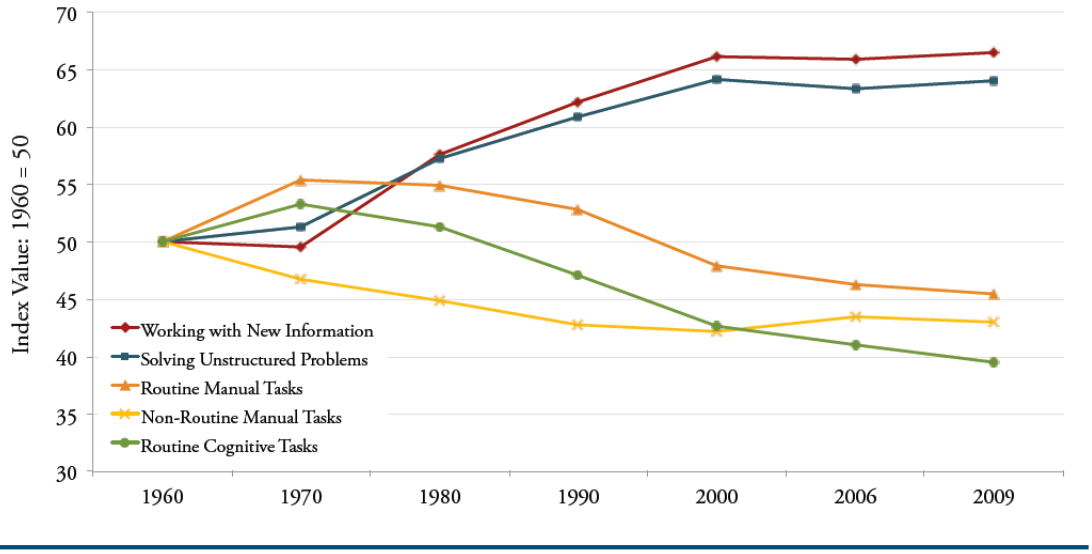

Figure 1: U.S. Job type distribution based on skills (1960-2009) (Adopted from Levy and Murname 2013, p.18)

Levy and Murname (2013) support Resnick's (2010) argument by demonstrating that jobs requiring 'working with new information' and 'solving unstructured problems' have been increasing in the United States since the 1960s (Figure 1) and they predict they will continue to rise. These jobs require higher order thinking skills such as inference, skills based knowledge, analysis, and rational judgement.

Therefore, as discussed earlier, since textbook questions assist in delivering the curriculum. Thus, the curriculum manifested in the textbooks needs to be improved to include higher order thinking skills in questions used in textbooks and during instruction to help improve the teaching and learning process. It is important to study and analyse the questions included in the textbook and during instruction.

From the review of literature above, almost all of the studies show that higher order thinking questions and skills are hardly being used and taught in classrooms from the past until current times. There exists a gap between what educators know what is important and what is actually materializing in the curriculum and instruction nowadays. This gap is probably due to the lack of material and resource availability for teachers to promote critical thinking and higher order thinking.

In light of the research conducted thus far, there appears to be little or no research done in analysing questions used within an elementary Science textbook and class instruction in the Gulf

region. Thus, the present study aims to conduct such an analysis to compare types of questions with the previous studies. Based on the results of other studies already presented, it is believed that this study will show a similar trend in terms of the cognitive domain and knowledge distribution where lower order thinking may be more common and dominant in textbook and instructional questions. The next chapter will outline the methodological approach undertaken to collect reliable data towards proving this hypothesis.

Chapter 3

METHODOLOGY

3.1 Research Design

3.2 Subject and Site Selection (Subjects/ Participants)

3.2.1. Description of the Textbook

3.3 Research Approach

3.3.1. Textbook Content Analysis

3.3.2. Non-participatory Observations

3.4 Instruments and Research Design

3.4.1. Question Analysis Procedure Example

3.5 Validity and Reliability of the Research Tool

3.6 Research Ethics

3.7 Summary

As presented in the preceding chapters, this study aims to investigate the use of questions within the Grade 6 Science textbook and teachers' instruction. The purpose of this chapter is to present the approach chosen to answer the research questions, subject selection, instruments design and usage, and research methodology procedure.

3.1 Research Design

The study used the Revised Bloom's Taxonomy (RBT) cognitive process and knowledge domains to analyse the levels of questions of each lesson within the following fields: in the three textbooks used by the school to deliver the Grade 6 Science curriculum, and the questions posed by the teacher during instruction. The researcher investigated the extent of Grade 6 Science textbooks questions variability or frequency according to the six levels of the Revised Bloom's Taxonomy proposed by Anderson et al. (2001).

Although there exists many evaluative taxonomies as listed by Swart (2010) such as Biggs and Collis: The Structure of the Observed Learning Outcomes (SOLO), Gagné: verbal information and intellectual skills criteria, Martin and Säljö: surface and deep approach to learning, Kolb: 'concrete', 'reflective', 'abstract, and 'active' experience, Haring et al. 'acquisition', 'fluency', 'generalization', 'adaptation', and other taxonomies such as the ones proposed by Kinscey, Weaver, and Guilford (Igbaria 2013), Bloom's taxonomy has been the most widely used taxonomy for evaluating content analysis and document question analysis (Igbaria 2013). Furthermore, Bloom's taxonomy has been characterised as "a tool to design, assess, and evaluate student learning"(Lord & Baviskar 2007, p.41).

Igbaria (2013) studied the questions in Grade 9 English textbook using Bloom's taxonomical analysis. Although, a few studies have evaluated Science textbook questions such as Zaki (1973), most studies have evaluated Science exam and assessment questions. Other researchers have found RBT to be useful in analysing instructional questions such asLovelace and Larson (2013) Jideani & Jideani (2012), Swart (2010), Ayvaci & Türkdoğan (2010), Azar (2005), and Black (1980). Jideani and Jideani (2012) used the RBT to align assessment objectives with instructional objectives in four food science and technology courses.

In addition to Bloom's Taxonomy being used in many curriculum studies to evaluate objectives, and questions, there exists many other advantages to using Bloom Igbaria (2013) described Bloom as being:

a. logical and well defined
b. suitable for education
c. pyramidal or having transitional levels from simple to complex where all levels depend on the previous level
d. aligned with the psychology of learning
e. inclusive: where behaviours can be categorized with regards to the taxonomy
f. Uninterrupted: objectives are continuous leading to each other

The proposed research study is unique since it is the only study that tries to align textbook questions with instructional questions in a Grade 6 Science curriculum delivering the Indianapolis American Common Core standards in a private school in Dubai. Furthermore, the usage of Bloom's taxonomy in many previous studies as presented above justifies the researcher selections for using this type of taxonomy to address the research questions identified earlier.

However, it is important to point out that when Bloom's taxonomy and RBT were introduced, it was designed to analyse learning objectives and learning outcomes rather than to analyse questions. However, Lovelace and Larson (2013), Igbaria (2013), Swart (2010), Ayvaci & Türkdoğan (2010), Azar (2005), Alul (2000), Black (1980), Zaki (1973) used Bloom's taxonomy to analyse questions, therefore, there is a good amount of research of utilizing this taxonomy to analyse questions and thus, this justifies its usage in this study.

3.2 Subject and site selection (Subjects/Participants)

Since the study investigates the Grade 6 Science curriculum in a private Dubai school, the Grade 6 Science curriculum is delivered by using three main textbooks. Houghton Mifflin Harcourt publishing company publishes the textbooks. The content analysis was done on the questions in the three textbooks. The three textbooks names, author and ISBN are provided in Table 1 below.

Textbook Title	Publishing Company	Consulting Authors	ISBN
Science Fusion Holt Mcdougal: Matter and Energy	Houghton, Mifflin Harcourt	Michael A. DiSpezio Marjorie Frank Michael R. Heithaus Donna M. Ogle	9780547589510
Science Fusion Holt Mcdougal: The Diversity of Living Things			9780547589312
Science Fusion Holt Mcdougal: Space Science			978547589411

Table 1: List Grade 6 Science textbooks

3.2.1. Description of the textbook

The sixth Grade Science course was the subject of this research. It consists of three textbooks. The textbooks follow a constructivist inquiry based approach to learning, where lesson content is presented and taught through questions. At the end of each lesson there are summary questions and review questions. A content taxonomical analysis was done on the questions listed in the lesson, and at the end of each lesson using the RBT. The end of unit review questions were not selected and analysed due to their repetitive nature. The total number of questions analysed were 1482 questions.

In addition to choosing the questions in the three textbooks for the RBT analysis and content analysis, the instructional questions were analysed. Although there were five classes of Grade 6, they were all being taught by the same teacher. Therefore, non-participant observation was done on one teacher teaching the Grade 6 Science material.

Although, the researcher intended for homogenous sampling where the individuals are chosen based on specific criteria (Creswell 2009),this was not possible in the case of the observation participant and the type of textbooks due to the fact that only one teacher was teaching the classroom and these particular textbooks were used by the school. Therefore, homogenous sampling was difficult since there was no opportunity to choose the participants, or the type of textbooks for the sample. The sampling was opportunistic due to accessibility and availability issues. Opportunistic sampling is defined by Creswell (2008, p. 216) as a "purposeful

sampling undertaken after the research begins, to take advantage of unfolding events that will help answer research question."

3.3 Research Approach

To address the research questions, this study has adopted a qualitative research approach. Qualitative research is a common method used by researcher investigating similar types of questions as is evident in many studies (Zaki 1973, Black 1980, Alul 2000, Azar 2005, Jones et al. 2009, Swart 2010, Ayvaci and Türkdoğan 2010, Riazi and Mosalanejad 2010, Jideani and Jideani 2012, Seif 2012, Ghanem et al. 2013, Lovelace and Larson 2013, Igbaria 2013, and Naomee and Tithi 2013). Qualitative research methods consider inquiry approaches that are based on different philosophies, strategies, data collection and analysis methods (Creswell 2009).

Furthermore, Creswell (2009, p. 173) contends that "qualitative procedures rely on text and image data, have unique steps in data analysis and draw on diverse strategies of inquiry" and points out some advantages of qualitative research, such as its naturalistic approach of allowing data collection in the natural setting, and putting findings in their natural context.

In addition to the research being done in its natural setting as an advantage,other advantages of conducting qualitative research include the following: the researcher does the data collection and by doing so, the researcher therefore becomes the key instrument in the research with no reliance on questionnaires (Creswell 2009).

Qualitative research also allows for many different sources of data collection rather than using a single data source. Creswell (2009) expounds that it allows for an 'inductive' approach of data analysis where the researcher can go back and forth between the data and themes until a consensus is established; it involves participants own interpretation of an issue rather than the researchers perspective. As such, the process and the design of the research can be changed after data collection has started. It is 'interpretive' allowing the researcher to interpret what they see. Finally, it provides complete picture by including all perspectives.

The qualitative approach involved in this study involves a content analysis of the three Grade 6 Science textbooks, using a RBT as a base for the taxonomical analysis, and non-participatory observations of the classroom lesson as delivered by the teacher.

3.3.1. Textbook Content Analysis

Within the qualitative approach applied in this study, the specific methodology used was content analysis. This means a content analysis of the three Grade 6 Science textbooks used in a private International School in Dubai delivering the Indianapolis American common core standards was done in light of the Revised Bloom's Taxonomy (RBT) proposed by Anderson et al. (2001).

In a content analysis, a number of textual words are classified into smaller categories or concepts (Elo & Kyngăs 2008). These are then further categorized as qualitative approach for text data analysis, and is defined by Hsieh and Shannon (2005, p. 1278) as "a research method for the subjective interpretation of the content of text data through the systematic classification process of coding and identifying themes or patterns". The focus of the content analysis was the lesson questions, and end of lesson review questions presented in the three textbooks. The tool used for the content analysis is shown in Appendix C (Table 21).

3.3.2. Non- Participatory Observations

In addition to the taxonomical content analysis by Bloom of the three textbooks used for the Grade 6 Science, non-participatory observations of the classroom lessons were also administered. According to Creswell (2009), observations have many advantages such as allowing the researcher to experience participants in their natural setting, to record data as it occurs, to investigate uncomfortable issues that participants are unwilling to discuss, and finally to allow observation of unusual aspects However, Creswell also warns of some limitations in observations such as the observer being seen as an intruder, observation of private information, lack of skilled researcher as an observer.

In this study, non-participatory observation was administered, meaning the observer was not a participant in the lesson. The focus of the observation was the teacher's questioning strategies during the lesson's discussion. The observer concentrated on the questions asked by the teacher. Observations were randomly done with no prior announcement to the teacher, due to the researcher's work schedule. The researcher used 'selective verbatim' observation technique. 'Selective verbatim' provides the observer with a tool to listen or focus on select words of the participants albeit teacher or student (Zepeda 2009).

The 'selective verbatim' techniques allowed investigation of the proportion of lower order and higher order level questions used during the lesson (Zepeda 2009). Since questions are the focus of the textbook content analysis, having the observer focus on the teacher's instructional

questions would allow for a comparative analysis between the textbooks' content analysis and the observation. In both the textbooks' content analysis and the observations, questions became the focus for the RBT analysis.

For the purpose of the observations done in this study, the teacher's questions were the focus of the 'selective verbatim'. The tool presented in Appendix D (Table 22) was used, where the observer listened to the questions asked by the teacher during the classroom discussion and recorded these questions in the question column and later on categorized each question according to the RBT of cognitive processes and knowledge domain.

3.4 Instruments and Research Design

The two instruments used in the research are presented in Appendix C (Table 21) and Appendix D (Table 22) respectively. The instrument represented in Appendix C was designed to be used with textbook question content analysis. The design of this instrument was based on the two dimensional matrix taxonomy table proposed by Anderson et al (2001). In their table, Anderson et al. (2001) place the Knowledge dimension in the left column and the cognitive process dimension on the top row.

In their analysis, Anderson et al. (2001) gave each objective a number and placed it in the appropriate column and row. However, for the purpose of the research undertaken and the fact that the tool is to be used for the 1482 questions to be analysed, it had to be redesigned to fit the number of questions and avoid confusion with coding the questions. The questions were written in the column and both the cognitive and knowledge domain were placed next to each other in the top row. This allowed for each question to be written in the column and analysed according to the two domains. There was no need for coding of questions, however, this was still done for ease of reference later on during the analysis of data phase.

Appendix D represents the form used to perform the non-participatory observation. This form also followed a similar format to the instrument used for the content analysis. The 174 observation questions were placed in a column and numbered. The top row contained the cognitive processes and the knowledge domain dimensions.

The researcher initially performed the content analysis for all three textbooks. Initially, the questions were selected and transcribed in an excel spreadsheet, one sheet represented each lesson, during the transcription of the lessons, no analysis was carried, then each textbook was

transcribed into one spreadsheet. The questions were written exactly the way they were written in the book. Each question started with a key word in bracket summarizing the cognitive category as given by the author of the books. Example A and Example B given below are two examples of the way questions were written in the textbook. As mentioned earlier, only questions presented in the lesson and end of lesson review questions were used in the analysis. End of unit review questions were not included due to the content being repeated.

Example A:

(Apply) Determine whether each structure below represents a hydrocarbon, an organic acid, or a carbohydrate. The first one has been done for you.

Example B:

(Synthesize) Candle wax belongs to a class of organic compounds called lipids. Look up the relationship between lipids and organic acids. Share your findings with the class.

All the questions presented in the lesson started with a cognitive process category as shown in brackets. This assisted in the analysis of the questions. However, there was always a need to read the question to obtain the type of knowledge presented in the question and to ensure proper categorization of the question in the cognitive process dimension.

After the transcription of all the questions, they were placed into the Excel spreadsheet. The researcher for all 1482 questions in the textbook did the taxonomical analysis. The RBT was used as the base of the analysis, Anderson et al. (2001) was used to assist the researcher in categorizing the questions. Furthermore, the matrices in Appendix A and B were used as the main tools to assist the researcher in analysing the questions.

Instructional questions (174 questions) were transcribed during the observation in the Excel spreadsheet for eight observation lessons. After each transcription, the lessons were analysed and questions were categorized according to their respective cognitive process and knowledge domain.

As stipulated earlier, the content analysis and observation question analysis was based on the RBT taxonomical analysis proposed by Anderson et al. (2001). The matrices presented in Appendix A and B summarize the cognitive process domain categories and the knowledge domain categories. Appendix A represents the RBT cognitive domain common verbs and

categories, and Appendix B explains the RBT knowledge domain criteria and categories. Both tools were used to analyse and identify the questions in the textbooks and the observations.

The six cognitive domain categories and the four knowledge domain categories are presented in the literature review, each with its explanation and further clarification. Furthermore, for the purpose of this study **L**ow **O**rder **T**hinking **Q**uestions **S**kills (**LOTQS**) are concerned with the first three cognitive processes (*remember*, *understand*, and *apply*), while the **H**igh **O**rder **T**hinking **Q**uestions **S**kills (**HOTQS**) are concerned with the last three cognitive processes (*analyse*, *evaluate*, and *create*).

3.4.1. Question Analysis Procedure Example

This section presents an example of how the question analysis was carried out by the researcher.

Example A:

(*Apply*) Determine whether each structure below represents a hydrocarbon, an organic acid, or a carbohydrate. The first one has been done for you.

Example B:

(*Synthesize*) Candle wax belongs to a class of organic compounds called lipids. Look up the relationship between lipids and organic acids. Share your findings with the class.

To show how the analysis of each question was done, examples A and B provided above will be applied to explain the thoughts and analysis involved in analysing each 1482 questions and the 174 instructional questions.

As Example A is read and understood, it would be considered to be categorized as an application of cognitive process since the student is required to apply prior knowledge, in other words search long term memory to recall criteria and structures of hydrocarbons, organic acids, and carbohydrates. Furthermore, the student is required to follow the steps learned in identifying each structure according to its category.

Since, the student is required to recall steps involved in identifying and categorizing the different structures, the type of knowledge domain it would involve is *procedural* knowledge since it involves recalling information and steps that the student needs to take to identify and categorize each structure. In addition to procedural knowledge that is often associated

with*applying* cognitive process, *metacognitive* knowledge is required because the student would require thinking of a strategy of how to categorize the different structures. This involves the student knowing something about own self-knowledge

Example B is a *create* cognitive process, and it involves *metacognitive* and *conceptual* knowledge. It is considered to belong to *create*, since new material will be designed, based on the students' research there will be construction of a whole from parts of the information collected. The students need to know strategies to use to research and design the write up that will be presented to the class; therefore, this involves self- knowledge or *metacognitive* knowledge. *Conceptua*l knowledge is also needed since the students requires knowledge of lipids concept and organic acids and organic compounds and their characteristics.

As the researcher analysed each question, the same procedure and flow of thoughts were carried to ensure proper categorization of the questions.

The data was presented in frequencies and using descriptive statistics, using percentages or numerical data to describe the outcomes (Seif 2012).

3.5 Validity and Reliability of the Research Tool

As discussed earlier, the research tool was adapted from the Anderson et al. (2001) textbook and has been used by many researchers as a tool for RBT analysis; this establishes the validity of the tool.

Reliability was also ensured by having an inter-rater reliability done by a second analyst (a Professor in the Faculty of education). The second analyst and the researcher chose 93 random questions from the 1482 questions in the textbooks. An analysis of this sample was done by the second analyst and the researcher and the frequency of agreement and disagreement between them was then calculated. Therefore, in this method, the researcher examined the consistency coefficient between herself and the second analyst. Out of the 93 questions, there were 88 questions that were agreed upon and 5 that were disagreed upon. Using Holsti's equation (Igbaria 2013) the researcher calculated the reliability coefficient:

$$\text{Percent of Agreement/ Consistency Ratio} = \frac{\text{No. of Coincident answers}}{\text{No. of coincident answers + No. of different answers}} \times 100$$

$$\text{Consistency Ratio} = \frac{88}{88 + 5} \times 100$$

Consistency Ratio = 94.6 %

According to this reliability coefficient of 95 %, the results show that the research tool is reliable and thus can be used to analyse all 1482 questions and the 174 observation questions.

3.6 Research Ethics

To obtain permission from the school to carry out this research, the researcher worked as a consultant with the school. The researcher presented the school principal and the Head of the Science department with a letter from the university explaining the researcher will need access to carry out research. The nature and the type of the study was also explained in a meeting and on the consent form presented to the principal, Head of Science department and the teacher participating in the research to sign. After explaining the research and assuring school's and teacher's confidentiality through a clause written in the consent form, the school gave it's permission to provide the researcher with the textbooks copies and allowed the researcher to obtain access to administer observations. The teacher informed the students that the researcher will be visiting the class often to observe the lessons and examine the types of questions asked.

3.7 Summary

The methodology chapter presented how the research was carried out, the instrumentation, research design, data collection, record, and analysis. Furthermore, reliability and validity of the tool was presented and verified, and research ethics was explained. The next chapter will present research findings and will discuss the findings in light of the related literature obtained about similar types of studies.

Chapter 4

FINDINGS AND DISCUSSION

4.1 Results and Findings

4.1.1. Findings for Research Question #1

4.1.2. Findings for Research Question #2 and #3

4.1.3. Findings for Research Question #4

4.1.4. Findings for Research Question #5

4.2 Discussion

This study sought to investigate the Grade 6 Science textbooks used by an international private school delivering the Indianapolis American Common Core Standards in Dubai for the academic year 2013 – 2014 according to the Revised Bloom's Taxonomy (RBT). In addition to the textbooks' content analysis, non-participatory classroom observations investigated the instructional questions used by the teachers during the Grade 6 Science class time. This study aimed to examine the types of skills attained by the students based on the questions presented in the textbook and the questions used during instruction.

The purpose of this chapter is to present the results of the study, answer the research questions, and discuss the prospects of the results in light of the literature on Bloom's taxonomy and similar research studies already presented as part of the literature review of this study.

4.1 Results& Findings

A total of 1,482 textbook questions, and 174 instructional questions were analysed and classified according to the Revised Bloom's Taxonomy (RBT) proposed by Anderson et al. (2001). Table 2 shows the distribution of the questions among the three textbooks.

For the purpose of the textbook analysis, the "Matter and Energy" textbook will be referred to as the first textbook (since it was the first textbook to be used during the academic year 2013-2014), the second textbook by choice of the researcher is "The Diversity of Living Things", and the third textbook is "Space Science".

Fusion Science Textbook Name	**Total Number of Questions**	**Percentage of Questions in Each book**
1.Matter and Energy	660	45%
2.The Diversity of Living Things	358	24%
3. Space and Science	464	31%
Total	1,482	100%

Table 2: Grade 6 Science textbooks questions' percentages and frequencies

The study also analysed through non-participatory observations the types of questions used during instruction according to the cognitive and knowledge domain. Table 3 shows the non-participatory observation distribution of the instructional questions.

Observation	Questions Per Observation	Percentage of Questions
Observation#1	***28***	***16%***
Observation#2	***23***	***13%***
Observation#3	***29***	***17%***
Observation#4	***17***	***10%***
Observation#5	***22***	***13%***
Observation#6	***16***	***9%***
Observation#7	***18***	***10%***
Observation#8	***21***	***12%***
Total Questions per All Observations	**174**	**100%**

Table 3: Grade 6 Instructional questions percentages and frequencies

Descriptive statistics will be used to find the percentage given to each cognitive domain level and knowledge type. 1,482 questions were analysed and classified into the cognitive and knowledge levels shown in Appendix E (Tables 23 - 68).For the latter purpose, a special sheet was prepared and each question was categorized in the appropriate process and knowledge domain referring to the criteria found in the Appendix (see Appendices A and B, respectively). Appendix F (Tables 69 - 76) shows the eight observation which include the 174 instructional questions. Appendix G (Tables 77 - 79) shows the analysis of 93 questions by another analyst and shows the results of agreement and disagreement.

After the analysis, the questions frequencies and percentages for each level were calculated in each textbook and all three textbooks. The instructional questions frequencies and percentage representations of each domain and knowledge types were also calculated and represented. After the calculation, the results were obtained, then presented in tables, and plotted on different graphs; providing a summary of the findings and helping answer the research questions.

4.1.1. Findings for Research Question #1:

1. To what extent questions presented in the Grade 6 Science textbooks of a private school in Dubai are varied or frequent according to the six levels of the Revised Bloom's Taxonomy (RBT)?

Table 4 shows the cognitive domain levels results for the three books, as shown the majority of the questions were represented under the first three taxonomic levels. Out of the 1,482 questions, 555 (37%) were categorized as *Remember* questions. The second level *Understand*had the frequency of 484 (33%) questions. 164 (11%) were concerned with *Apply* questions. The remaining three levels *Analyse*, *Evaluate*, and *Create*were represented by the following frequencies and percentages respectively 118 (8%), 47 (4%), and 103 (7%). As represented by the data the least represented level was *Evaluate* with 4%. Figure 2 shows a graphical representation of the percentage distribution of the cognitive domain levels for all three textbooks.

Book	***Remember***	***Understand***	***Apply***	***Analyze***	***Evaluate***	***Create***	***Total***
Matter and Energy	239	216	88	50	26	41	660
The Diversity of Living Things	136	119	31	28	16	28	358
Space Science	180	149	45	40	16	34	464
Total of 3 Books	**555**	**484**	**164**	**118**	**58**	**103**	**1482**
Percentage Total of 3 Books	**37%**	**33%**	**11%**	**8%**	**4%**	**7%**	**100%**

Table 4: Cognitive domain taxonomic levels frequencies and percentages for the three textbooks

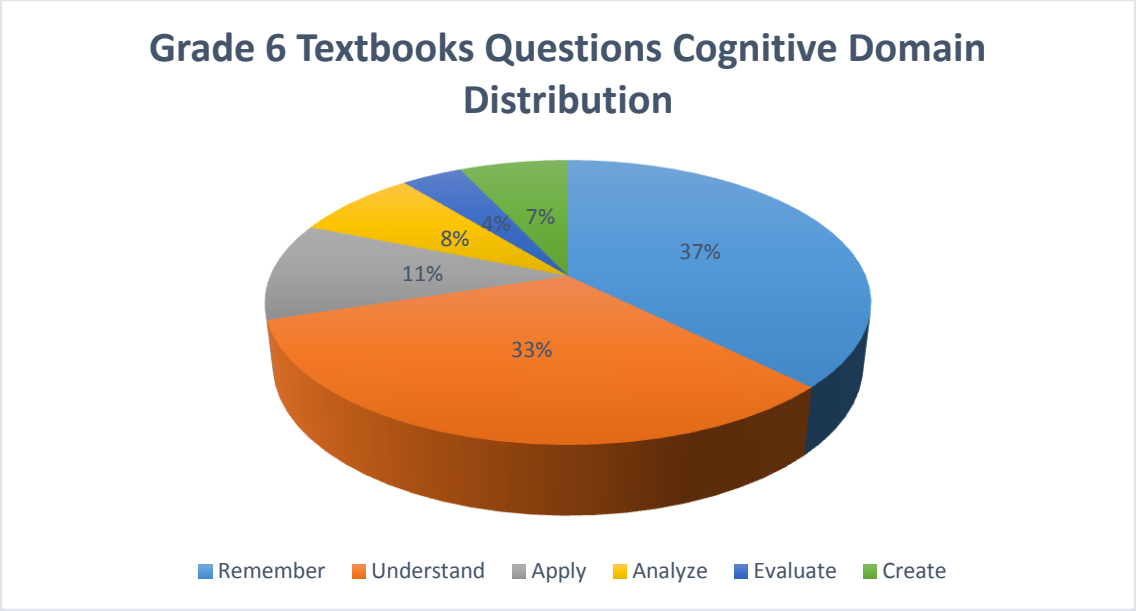

Figure 2: Overall Grade 6 Science textbook questions distribution according to cognitive domain levels

The results presented in this study are similar to the results of some previous studies presented in the literature review including Ghanem et al. (2013). In Ghanem et al. (2013) *knowledge*, followed by *comprehension* were the most common domain. Unlike Ayvaci and Türkdogăn (2010) the *evaluate* process was under represented in the questions in this study.

Apply domain is low when compared to Swart (2010) and Azar (2005). However, unlike Swart (2010) and Azar's (2005) studies, this study is analysing Grade 6 Science questions consisting of Chemistry, Biology and Physics questions; therefore, application questions will be lower compared to the Physics questions and Engineering questions examined by Azar (2005) and Swart (2010). Normally, the type of knowledge presented in Chemistry and Biology is more factual and conceptual knowledge when compared to Physics which is more procedural.

Although, the overall percentage distribution of the questions according to the cognitive domain is very similar in all three textbooks (Table 5) and the overall distribution of all three textbooks (Table 4), a close examination of each lesson in each book reveals a variation in the distribution of the cognitive processes across the lessons.

	Remember	*Understand*	*Apply*	*Analyze*	*Evaluate*	*Create*
Matter and Energy	36%	33%	13%	8%	4%	6%
The Diversity of Living Things	38%	33%	9%	8%	4%	8%
Space Science	39%	32%	10%	9%	3%	7%

Table 5: Cognitive domain percentage question distribution per textbook

Table 6 represents the distribution of the cognitive domain processes in each lesson in the first textbook "Matter and Energy". The results clearly reveal the differences in the questionsdistribution across the lessons in the same textbook. For example, if Unit 1 Lesson 1 percentage distribution of the cognitive domain is compared to Unit 5 Lesson 3, the distribution is highly varied.

In Unit 1 Lesson 1 *Remember* and *Understand* questions are the most common cognitive domain levels with 41% and 32% respectively. There are 0% *Analyse*, and 3% *Evaluate*, and 0% *Create*. While in Unit 5 lesson 3, although the *Remember* and *Understand* are still the dominant cognitive level, the percentage score is much lower for both and more equally distributed at 28%. *Analyse* and *Evaluate* questions are much higher compared to the Unit 1 Lesson 1 at 9%, and 19% respectively.

Accordingly, the latter results are expected since towards the start of the textbook the type of thinking is expected to be different than at the end of the textbook. Towards the beginning, the thinking would require more recall of basic knowledge, developing understanding of concepts, factual, and procedural knowledge. However, towards the end of the textbook after gaining the basic knowledge and understanding, more analysis and evaluation questions would be included. However, contrary to expectations where it is expected that *Create* level types of questions would be higher towards the end of the book, according to the results this was not the case. The *Create* questions scored low in both lessons mentioned, but vary greatly across the different lessons in the textbook. Therefore, Table 5 shows the variability in the cognitive domain across the first textbook.

Book #1 - Matter and Energy														
			Cognitive Process Dimension						**Cognitive Process Dimension – Percentage**					
Unit No.	**Lesson No.**	**Questions**	***Remember***	***Understand***	***Apply***	***Analyze***	***Evaluate***	***Create***	***% Remember***	***Understand***	***% Apply***	***% Analyze***	***% Evaluate***	***% Create***
1	1	34	14	11	8	0	1	0	**41%**	**32%**	**24%**	**0%**	**3%**	**0%**
	2	36	11	15	5	2	1	2	**31%**	**42%**	**14%**	**6%**	**3%**	**6%**
	3	29	10	14	3	2	0	0	**34%**	**48%**	**10%**	**7%**	**0%**	**0%**
	4	32	15	12	2	1	0	2	**47%**	**38%**	**6%**	**3%**	**0%**	**6%**
	5	28	8	9	5	2	3	1	**29%**	**32%**	**18%**	**7%**	**11%**	**4%**
	6	43	18	13	7	4	1	0	**42%**	**30%**	**16%**	**9%**	**2%**	**0%**
2	1	34	10	12	5	2	1	4	**29%**	**35%**	**15%**	**6%**	**3%**	**12%**
	2	21	7	6	3	0	1	4	**33%**	**29%**	**14%**	**0%**	**5%**	**19%**
	3	33	8	15	5	0	0	5	**24%**	**45%**	**15%**	**0%**	**0%**	**15%**
	4	32	10	7	2	4	4	5	**31%**	**22%**	**6%**	**13%**	**13%**	**16%**
3	1	30	11	8	6	4	0	1	**37%**	**27%**	**20%**	**13%**	**0%**	**3%**
	2	32	12	9	7	4	0	0	**38%**	**28%**	**22%**	**13%**	**0%**	**0%**
	3	30	9	10	5	3	0	3	**30%**	**33%**	**17%**	**10%**	**0%**	**10%**
	4	28	12	13	1	1	0	1	**43%**	**46%**	**4%**	**4%**	**0%**	**4%**
4	1	34	12	8	6	3	1	4	**35%**	**24%**	**18%**	**9%**	**3%**	**12%**
	2	38	16	7	6	4	1	4	**42%**	**18%**	**16%**	**11%**	**3%**	**11%**
	3	41	17	12	2	6	1	3	**41%**	**29%**	**5%**	**15%**	**2%**	**7%**
5	1	29	10	12	3	2	1	1	**34%**	**41%**	**10%**	**7%**	**3%**	**3%**
	2	44	20	14	2	3	4	1	**45%**	**32%**	**5%**	**7%**	**9%**	**2%**
	3	32	9	9	5	3	6	0	**28%**	**28%**	**16%**	**9%**	**19%**	**0%**
Total:		***660***	***239***	***216***	***88***	***50***	***26***	***41***	***36%***	***33%***	***13%***	***8%***	***4%***	***6%***

Table 6: Textbook #1 Matter and Energy cognitive domain question frequencies and percentage distribution Per Lesson.

Similarly, Table 7, and Table 8 represent data from textbook #2 and textbook #3 respectively. All six processes are distributed variably across the lessons just as the case in textbook #1. When examining all three Tables (6, 7, and 8), the *Create* cognitive process in five lessons of textbook #1 was not represented in few lessons. However, in textbooks #2, and #3 it (*Create* process) was always represented at a minimum of 3%.

In all three textbooks, contrary to expectations, the beginning lessons of each unit were not high in *Remember* and *Understand* questions, the *Remember* and *Understand* process varied, sometimes it was in the middle lesson higher than the first or last lesson of a unit. Overall, there was a wide range of distribution of all the cognitive processes among the lessons and this is observable in the results presented in Tables (6,7, and 8).

This variability across the lesson in this study is similar to the results obtained in Alul (2000), where there was variation in the types of cognitive processes obtained across the units in the Grade 8 English textbooks examined in this study. The variability in the lessons is expected since new information might be presented in different parts of the textbook that require different skills depending on the prior knowledge of the students and the connectedness of the content.

Book #2 - The Diversity of Living Things														
			Cognitive Process Dimension						*Cognitive Process Dimension- Percentage*					
Unit No.	**Lesson No.**	**Questions**	***Remember***	***Understand***	***Apply***	***Analyze***	***Evaluate***	***Create***	***% Remember***	***%Understand***	***% Apply***	***% Analyze***	***% Evaluate***	***% Create***
1	1	29	8	13	0	6	1	1	28 %	45 %	0%	21 %	3%	3%
	2	29	9	12	5	1	1	1	31 %	41 %	17 %	3%	3%	3%
	3	27	10	4	4	6	2	1	37 %	15 %	15 %	22 %	7%	4%
	4	29	11	8	2	2	1	5	38 %	28 %	7%	7%	3%	17%
	5	42	16	10	6	3	2	5	38 %	24 %	14 %	7%	5%	12%
2	1	33	9	13	4	2	4	1	27 %	39 %	12 %	6%	12%	3%
	2	34	14	13	1	1	0	5	41 %	38 %	3%	3%	0%	15%
	3	35	16	13	1	2	2	1	46 %	37 %	3%	6%	6%	3%
	4	37	15	11	3	2	2	4	41 %	30 %	8%	5%	5%	11%
	5	31	16	10	2	1	1	1	52 %	32 %	6%	3%	3%	3%
	6	32	12	12	3	2	0	3	38 %	38 %	9%	6%	0%	9%
Total:		**358**	**136**	**119**	**31**	**28**	**16**	**28**	**38 %**	**33 %**	**9%**	**8%**	**4%**	**8%**

Table 7: Textbook # 2 The Diversity of Living Things - cognitive domain question frequencies and percentage distribution per lesson.

Book #3 - Space Science														
			Cognitive Process Dimension						*Cognitive Process - Percentage*					
Unit No.	Lesson No.	No. of Questions	***Remember***	***Understand***	***Apply***	***Analyze***	***Evaluate***	***Create***	***% Remember***	***% Understand***	***% Apply***	***% Analyze***	***% Evaluate***	***% Create***
1	1	28	**11**	**8**	**4**	**2**	**1**	**2**	**39%**	**29%**	**14%**	**7%**	**4%**	**7%**
	2	29	**12**	**7**	**6**	**2**	**0**	**2**	**41%**	**24%**	**21%**	**7%**	**0%**	**7%**
	3	32	**14**	**13**	**1**	**0**	**2**	**2**	**44%**	**41%**	**3%**	**0%**	**6%**	**6%**
2	1	30	**12**	**9**	**1**	**1**	**2**	**5**	**40%**	**30%**	**3%**	**3%**	**7%**	**17%**
	2	30	**7**	**15**	**2**	**4**	**0**	**2**	**23%**	**50%**	**7%**	**13%**	**0%**	**7%**
	3	28	**11**	**10**	**3**	**2**	**0**	**2**	**39%**	**36%**	**11%**	**7%**	**0%**	**7%**
	4	35	**15**	**10**	**1**	**5**	**1**	**3**	**43%**	**29%**	**3%**	**14%**	**3%**	**9%**
	5	32	**11**	**12**	**5**	**2**	**1**	**1**	**34%**	**38%**	**16%**	**6%**	**3%**	**3%**
	6	34	**16**	**8**	**4**	**4**	**1**	**1**	**47%**	**24%**	**12%**	**12%**	**3%**	**3%**
3	1	27	**8**	**11**	**5**	**0**	**0**	**3**	**30%**	**41%**	**19%**	**0%**	**0%**	**11%**
	2	28	**10**	**11**	**2**	**3**	**0**	**2**	**36%**	**39%**	**7%**	**11%**	**0%**	**7%**
	3	29	**9**	**11**	**3**	**2**	**1**	**3**	**31%**	**38%**	**10%**	**7%**	**3%**	**10%**
4	1	32	**13**	**6**	**3**	**7**	**1**	**2**	**41%**	**19%**	**9%**	**22%**	**3%**	**6%**
	2	38	**19**	**9**	**4**	**1**	**3**	**2**	**50%**	**24%**	**11%**	**3%**	**8%**	**5%**
	3	32	**12**	**9**	**1**	**5**	**3**	**2**	**38%**	**28%**	**3%**	**16%**	**9%**	**6%**
Total:		**464**	**180**	**149**	**45**	**40**	**16**	**34**	**39%**	**32%**	**10%**	**9%**	**3%**	**7%**

Table 8: Textbook # 3 Space Science cognitive domain question frequencies and percentage distribution per lesson.

4.1.2. Findings for Research Questions #2 and #3:

2. **What percentage of the Grade 6 Science textbooks' questions fall in the RBT Low Order Thinking Questions Skills (LOTQS)?**
3. **What percentage of the Grade 6 Science textbooks' questions fall in the RBT High Order Thinking Questions Skills (HOTQS)?**

Book	***LOTQS***	***HOTQS***	***%LOTQS***	***%HOTQS***
1 .Matter and Energy	**543**	**117**	**82%**	**18%**
2.The Diversity of Living Things	**286**	**72**	**80%**	**20%**
3. Space Science	**374**	**90**	**81%**	**19%**
Total of 3 Books	**1203**	**279**	**81%**	**19%**

Table 9: LOTQS & HOTQS frequencies and percentages for each book and all 3 textbooks

In order to answer questions #2 and #3, Table 9 was generated showing the frequencies and percentages of the LOTQS and HOTQS in each textbook and all three textbooks. As Table 9 reveals, the LOTQS were represented more often in each of the three textbooks, with 82% in textbook #1, 80% in textbook #2, 81% in textbook #3 and all three textbooks.

On the other hand, HOTQS were under represented in the questions presented in each textbook, with a percentage of 18% in textbook #1, 20% in textbook #2, and 19% in textbook #3 and all three textbooks.

In terms of LOTQS and HOTQS, the results of this study are very similar to the results of Zaki (1973), Alul (2000), and Jones et al. (2009) where very few questions were higher order questions, and most of the questions and learning outcomes were categorized as lower

and intermediate order cognitive questions. Figure 2 provides a graphical representation of LOTQS and HOTQS question distribution.

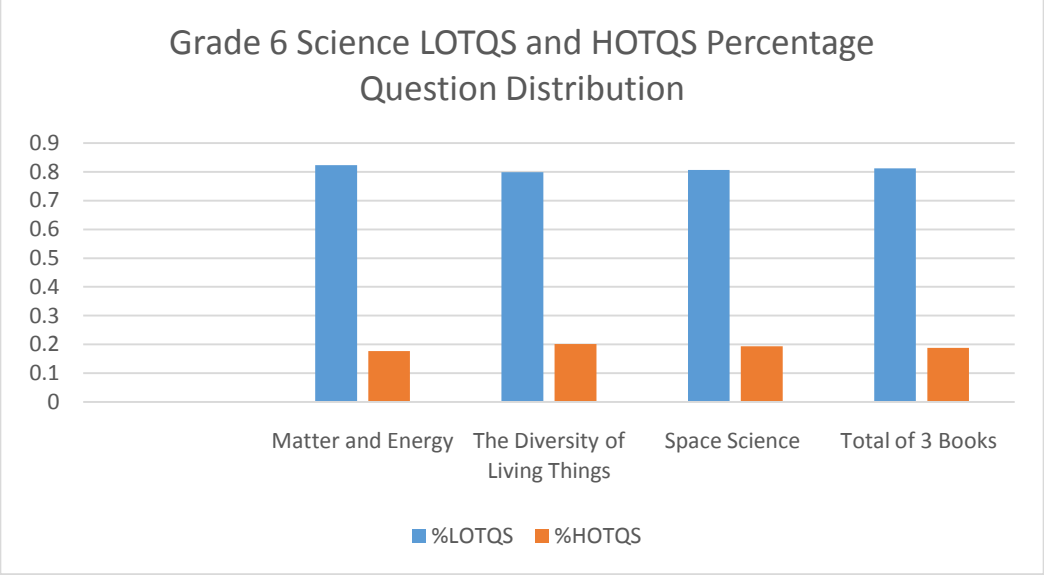

Figure 3: LOTQS and HOTQS question distribution in Grade 6 Science Textbooks

4.1.3. Findings for Research Question #4

4. What is the dominant knowledge domain in the Grade 6 Science textbooks?

Prior to answering this research question, it is important to mention that unlike the cognitive domain, the knowledge type's categorization was not straightforward; the questions often were classified according to one or more knowledge types. This is common since *Metacognitive*knowledge can overlap with other types of knowledge. In addition, the way of interpreting the questions can vary to the way it is taught by the teacher, the learning level and style of the student. Therefore, from the results obtained, the total percentage of the knowledge domain does not add up to 100% due to this overlap in the classification of the questions.

To answer the research question, as seen in Table 10 below, *Conceptual* knowledge is the most dominant knowledge type in all three textbooks scoring 53%, followed by *Factual* knowledge at 38%, *Metacognitive* knowledge at 16%, and *Procedural* knowledge at 11%. Figure 4 shows a graphical representation of the percentage distribution of the knowledge domain of all three textbooks.

Although, the result is consistent across the three textbooks, the percentage distribution and frequency of the questions across the books are slightly different as shown in Table 10. Similarly, in Tables 11, 12, and 13 which show the knowledge types distribution per lesson in textbooks 1, 2, and 3 respectively, it is clear that the percentage distribution of the questions differ greatly.

Book	*Factual*	*Conceptual*	*Procedural*	*Metacognitive*	*% Factual*	*% Conceptual*	*% Procedural*	*% Metacognitive*	Total
Matter and Energy	222	367	91	91	34%	56%	14%	14%	660
The Diversity of Living Things	152	160	31	87	42%	45%	9%	24%	358
Space Science	188	260	34	54	41%	56%	7%	12%	464
Total of 3 Books	562	787	156	232	38%	53%	11%	16%	1482

Table 10: Knowledge domain taxonomic levels frequencies and percentages for the three textbooks

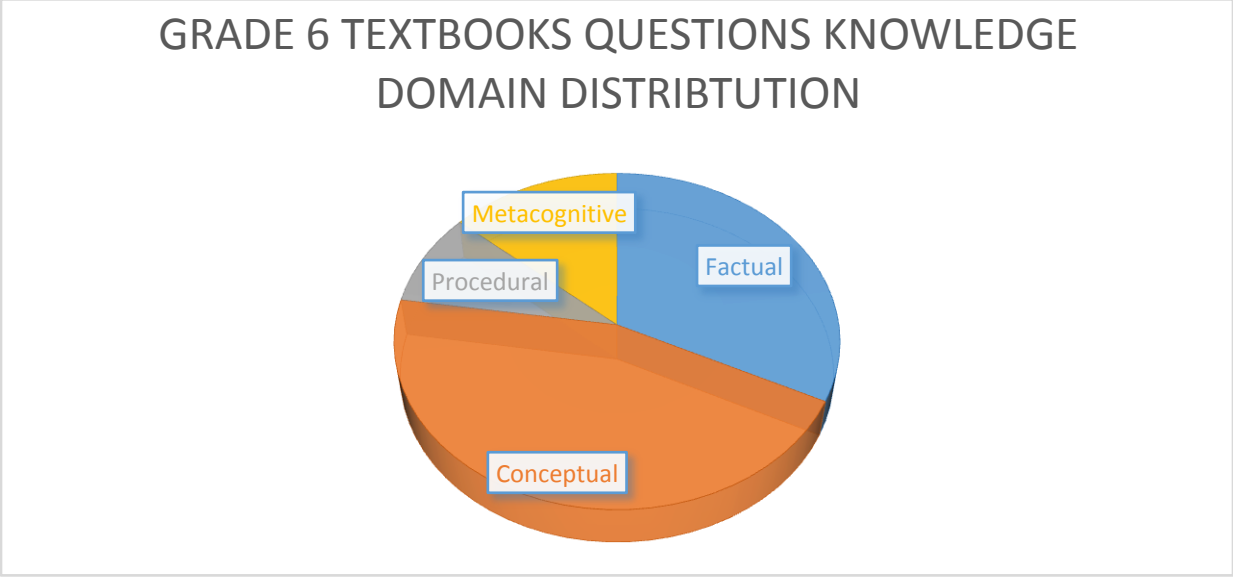

Figure 4: Overall Grade 6 Science questions distribution according to knowledge domain types

In Table 11 representing textbook #1, *Conceptual* knowledge is always dominant in the lessons, however, in textbook #2 (Table 12), three out of the eleven lessons have *Factual* lessons

to be the dominant knowledge type. Similarly, textbook #3 (Table 13), two out of the fifteen lessons are more dominant in terms of *Factual* Knowledge.

Book #1 - Matter and Energy										
			Knowledge Dimension				Knowledge Dimension - Percentage			
Unit No.	**Lesson No.**	**Questions**	***Factual***	***Conceptual***	***Procedural***	***Metacognitive***	***% Factual***	***% Conceptual***	***% Procedural***	***% Metacognitive***
1	1	34	12	11	13	0	**35%**	**32%**	**38%**	**0%**
	2	36	14	20	4	3	**39%**	**56%**	**11%**	**8%**
	3	29	2	23	4	3	**7%**	**79%**	**14%**	**10%**
	4	32	13	16	4	1	**41%**	**50%**	**13%**	**3%**
	5	28	7	13	7	7	**25%**	**46%**	**25%**	**25%**
	6	43	13	29	3	6	**30%**	**67%**	**7%**	**14%**
2	1	34	13	24	1	5	**38%**	**71%**	**3%**	**15%**
	2	21	8	9	2	4	**38%**	**43%**	**10%**	**19%**
	3	33	12	17	1	6	**36%**	**52%**	**3%**	**18%**
	4	32	11	17	2	7	**34%**	**53%**	**6%**	**22%**
3	1	30	7	17	8	2	**23%**	**57%**	**27%**	**7%**
	2	32	10	17	6	2	**31%**	**53%**	**19%**	**6%**
	3	30	10	16	6	3	**33%**	**53%**	**20%**	**10%**
	4	28	11	13	3	3	**39%**	**46%**	**11%**	**11%**
4	1	34	12	16	9	6	**35%**	**47%**	**26%**	**18%**
	2	38	13	15	8	8	**34%**	**39%**	**21%**	**21%**
	3	41	15	23	3	4	**37%**	**56%**	**7%**	**10%**
5	1	29	10	23	2	4	**34%**	**79%**	**7%**	**14%**
	2	44	19	27	1	6	**43%**	**61%**	**2%**	**14%**
	3	32	10	21	4	11	**31%**	**66%**	**13%**	**34%**
	Total:	***660***	***222***	***367***	***91***	***91***	***34%***	***56%***	***14%***	***14%***

Table 11: Textbook#1 questions knowledge domain types frequencies and percentages

Book #2 - The Diversity of Living Things										
			Knowledge Dimension				*Knowledge Dimension- Percentage*			
Unit No.	**Lesson No.**	**Questions**	***Factual***	***Conceptual***	***Procedural***	***Metacognitive***	***% Factual***	***% Conceptual***	***% Procedural***	***% Metacognitive***
1	1	29	8	18	1	8	28%	62%	3%	28%
	2	29	10	15	3	8	34%	52%	10%	28%
	3	27	10	14	1	6	37%	52%	4%	22%
	4	29	16	14	7	8	55%	48%	24%	28%
	5	42	18	27	8	6	43%	64%	19%	14%
2	1	33	8	19	4	11	24%	58%	12%	33%
	2	34	14	13	4	6	41%	38%	12%	18%
	3	35	22	6	0	8	63%	17%	0%	23%
	4	37	13	16	3	10	35%	43%	8%	27%
	5	31	20	6	0	5	65%	19%	0%	16%
	6	32	13	12	0	11	41%	38%	0%	34%
	Total:	**358**	**152**	**160**	**31**	**87**	**42%**	**45%**	**9%**	**24%**

Table 12: Textbook#2 questions knowledge domain types Frequencies and percentages

Book #3- Space Science										
			Knowledge Dimension				*Knowledge Dimension- Percentage*			
Unit No.	Lesson No.	No. of Questions	*Factual*	*Conceptual*	*Procedural*	*Metacognitive*	*% Factual*	*% Conceptual*	*% Procedural*	*% Metacognitive*
1	1	28	**13**	**13**	**2**	**6**	**46%**	**46%**	**7%**	**21%**
	2	29	**13**	**16**	**6**	**3**	**45%**	**55%**	**21%**	**10%**
	3	32	**9**	**21**	**4**	**5**	**28%**	**66%**	**13%**	**16%**
2	1	30	**17**	**11**	**1**	**6**	**57%**	**37%**	**3%**	**20%**
	2	30	**9**	**22**	**2**	**2**	**30%**	**73%**	**7%**	**7%**
	3	28	**10**	**14**	**5**	**2**	**36%**	**50%**	**18%**	**7%**
	4	35	**13**	**21**	**1**	**3**	**37%**	**60%**	**3%**	**9%**
	5	32	**11**	**18**	**1**	**3**	**34%**	**56%**	**3%**	**9%**
	6	34	**17**	**15**	**3**	**2**	**50%**	**44%**	**9%**	**6%**
3	1	27	**11**	**16**	**1**	**2**	**41%**	**59%**	**4%**	**7%**
	2	28	**10**	**18**	**1**	**2**	**36%**	**64%**	**4%**	**7%**
	3	29	**9**	**20**	**1**	**2**	**31%**	**69%**	**3%**	**7%**
4	1	32	**15**	**18**	**2**	**4**	**47%**	**56%**	**6%**	**13%**
	2	38	**19**	**20**	**1**	**4**	**50%**	**53%**	**3%**	**11%**
	3	32	**12**	**17**	**3**	**8**	**38%**	**53%**	**9%**	**25%**
Total:		**464**	**188**	**260**	**34**	**54**	**41%**	**56%**	**7%**	**12%**

Table 13: Textbook#3 questions knowledge domain types Frequencies and percentage

When looking at both cognitive and knowledge domain together, it is important to note that the *Apply* cognitive domain is highly associated with *Procedural* knowledge. In textbook#1

Apply, and *Procedural* knowledge were represented by 13%, and 14% of the questions respectively. In textbook #2 and #3 similar results were obtained, in textbook #2 both were represented by 9%. In textbook #3 *Apply* and *Procedural* knowledge scored 9% and 7% respectively.

Since *Apply* cognitive domain is highly associated with taking knowledge and using it according to methods, formulas, solving procedures, the latter result is expected. A question that involves the *Apply* cognitive process would have *Procedural* knowledge highly evident in it.

Accordingly, from the results obtained, *Conceptual* knowledge was the most common knowledge type represented in the textbook questions. The result of this study is very similar to the results of the study presented by Jideani and Jideani (2012) where *Conceptual* knowledge was the most common type of knowledge in Food Science courses examined.

However, in Jideani and Jideani's (2012) study the weight of the assessments were more *Understand/Remember/Conceptual* knowledge, while the results of this study show more emphasis on *Remember/Understand/Conceptual* knowledge as the most common cognitive and knowledge domains processes and types.

4.1.4. Findings For Research Question #5

5. **Does a relationship exist between the cognitive domain/knowledge domain content textbooks analysis and the in-class teaching instruction in Grade 6 Science in a private school in Dubai?**

To answer this research question, the researcher as a non- participant observer conducted eight classroom observations. The observations were randomly done due to the availability and access to the teacher's classroom. The researcher noted down all the questions used by the teacher during the lesson. All of the observations were done at the start of the year for an entire term. The teacher was using textbook #1 as the main tool of instruction, and most of the classroom observations conducted reflect lessons from textbook #1. Table 14 shows the corresponding textbook lesson to the observations.

Observation	Textbook#1 Lesson No.
Observation#1	1
Observation#2	
Observation#3	
Observation#4	2
Observation#5	3
Observation#6	
Observation#7	6
Observation#8	

Table 14: Textbook #1 lessons correspondence to each observation

		Cognitive Process Dimension						Knowledge Domain				Cognitive Process Dimension						Knowledge Domain			
Observation	Questions Per Observation	*Rem*	*Und*	*App*	*Ana*	*Eva*	*Crea*	*Fact*	*Conc*	*Proc*	*Meta*	*%Rem*	*%Und*	*%App*	*%Ana*	*%Eva*	*%Crea*	*%Fact*	*%Conc*	*%Proc*	*%Meta*
Observation#1	***28***	3	8	7	6	4	0	4	14	8	11	11%	29%	25%	21%	14%	0%	14%	50%	29%	39%
Observation#2	***23***	8	4	5	4	1	1	10	7	7	10	35%	17%	22%	17%	4%	4%	43%	30%	30%	43%
Observation#3	***29***	5	12	5	4	3	0	5	19	7	2	17%	41%	17%	14%	10%	0%	17%	66%	24%	7%
Observation#4	***17***	8	6	1	1	0	1	8	8	1	0	47%	35%	6%	6%	0%	6%	47%	47%	6%	0%
Observation#5	***22***	3	10	3	6	0	0	3	16	5	2	14%	45%	14%	27%	0%	0%	14%	73%	23%	9%
Observation#6	***16***	5	9	2	0	0	0	5	10	1	0	31%	56%	13%	0%	0%	0%	31%	63%	6%	0%
Observation#7	***18***	5	8	1	4	0	0	4	13	1	0	28%	44%	6%	22%	0%	0%	22%	72%	6%	0%
Observation#8	***21***	4	8	1	8	0	0	7	13	1	2	19%	38%	5%	38%	0%	0%	33%	62%	5%	10%
Total Questions per All Observations	**174**	**41**	**65**	**25**	**33**	**8**	**2**	**46**	**100**	**31**	**27**	**24%**	**37%**	**14%**	**19%**	**5%**	**1%**	**26%**	**57%**	**18%**	**16%**
LOQTS:	**75%**																				
HOTQS:	**25%**																				

Table 15: Observation instructional questions summary of cognitive and knowledge domain frequencies and percentage Distribution

Table 15 shows all the observations instructional questions cognitive domain and knowledge domain frequencies and percentage distribution. Overall, based on the 174 questions analysed, the *Understand* cognitive process is highly represented at 37%, followed by the *Remember*process at 24%, *Apply*, *Analyse*, *Evaluate*, and *Create* cognitive processes were represented at 14%, 19%, 5%, and 1% respectively.

In terms of knowledge domain, as shown in Table 15 the *Conceptual* knowledge was most represented as the type of knowledge in the instructional questions at 57%, followed by 26% *Factual* knowledge, 18% *Procedural* knowledge, and 16% *Metacognitive*knowledge.

When comparing the overall instructional questions distribution to the overall textbooks questions distribution (Table 4 and Table 15) in terms of the cognitive domain in all three

textbooks questions, *Remember* scored higher than *Understand*, while in the instructional observation questions *Understand* was represented more often than *Remember* questions. This indicates that during instruction the teacher is emphasizing that the students understand the concepts explained during the lesson.

Accordingly, in most instructional lessons to achieve the best lesson consistency, the first phase of the lesson, which is the warm up, should be the preliminary stage where the teacher ensures prior knowledge related to the lesson exists. This is only five to ten minutes of the lesson and most of the skills in terms of Bloom's taxonomy are *Remembering* skills and *Understanding* skills.

While during the main part of the lesson where most of the new knowledge is introduced and taught, the teacher should focus on ensuring more *Understanding* of the new concepts taught *Applying* of these concepts, and *Analysing*skills to be introduced on how to use the new knowledge taught. Therefore, it is evident from the results of the instructional questions that the teacher is ensuring lesson consistency in terms of questioning types poised during the lesson. Therefore, if compared to the results of the textbooks' questions *Understand*, *Apply*, and *Analyse* scored higher in the instructional questions than the textbooks questions.

However, *Evaluate* scored almost the same at 5% in the instructional questions and 4% in the textbooks questions. *Create* scored very low in the instructional questions at 1% as compared to 7% in the textbooks questions. Looking back at classroom consistency as mentioned earlier, the last part or ten minutes of the lesson should be challenging to the students, where the teacher should include questions and strategies that help the students develop the knowledge taught and use it in the higher order level of thinking as proposed by Bloom. Such questions should be *Evaluate* and *Create* questions. It is evident from the results presented earlier that the teacher failed to use many questions falling into the *Create* process, although, the textbook includes questions that the teacher could have utilised to encourage students to use higher order thinking skills.

It is suffice to mention that based on the observation, during most of the period the teacher failed to summarize the lesson and revisit the knowledge. This was due to the lack of time during the lesson since most of the lessons involved laboratory session and there needed time to transport the students from class to laboratory so it was cumbersome for the teacher to

ensure full classroom consistency with a short warm up session, main lesson, and a closure or summary of the lesson.

When comparing LOTQS and HOTQS in the instructional questions to textbooks questions, as seen in Table 15, 75% of the questions used during instruction are LOTQS compared to 81% in the textbooks questions, while 25% of instructional questions are HOTQS compared to 19% in the textbooks. These results show that during instruction the teacher uses a greater percentage of higher order questions than what is used in the textbook, meaning that the result shows that the teacher is not relying on textbook questions and is using instructional questions that meet the level of students. It also shows that the teacher is challenging the students during instruction.

In terms of the knowledge domain, the results of the instructional questions and textbook questions matched more closely than the cognitive domain. Both had *Conceptual* knowledge as the more dominant knowledge type with instructional questions scoring 57% compared to 53% in the textbooks questions. *Factual* knowledge scored slightly lower in the instructional questions at 26% compared to 38% in the textbooks questions. *Procedural* knowledge scored much higher in the instructional questions (18%), while it scored (11%) in the textbook questions. *Metacognitive* knowledge scored much lower in the instructional questions (10%), compared to (16%) in the textbooks questions.

		Cognitive Process Dimension						Knowledge Domain				Cognitive Process Dimension						Knowledge Domain			
Observation	Questions Per Observation	Rem	Und	App	Ana	Eva	Crea	Fact	Conc	Proc	Meta	%Rem	%Und	%App	%Ana	%Eva	%Crea	%Fact	%Conc	%Proc	%Meta
Observation#1	***28***	3	8	7	6	4	0	4	14	8	11	11%	29%	25%	21%	14%	0%	14%	50%	29%	39%
Observation#2	***23***	8	4	5	4	1	1	10	7	7	10	35%	17%	22%	17%	4%	4%	43%	30%	30%	43%
Observation#3	***29***	5	12	5	4	3	0	5	19	7	2	17%	41%	17%	14%	10%	0%	17%	66%	24%	7%
Total Questions per All Observations	**80**	**16**	**24**	**17**	**14**	**8**	**1**	**19**	**40**	**22**	**23**	**20%**	**30%**	**21%**	**18%**	**10%**	**1%**	**24%**	**50%**	**28%**	**29%**

Table 16: Observation #1,2,3 instructional questions cognitive and knowledge domain questions frequencies and percentage distribution

To gain a better understanding of the relationship between the textbook and the instructional questions, it is recommended that each lesson be analysed with the corresponding observations. As mentioned earlier, all observations correspond to textbook #1 since it was the main teaching textbook used during the observations. Observations #1, 2, and 3 correspond to Unit 1 Lesson #1 from textbook #1.

Table 16 above summarizes the results of observations #1, 2, and 3. When compared to textbook #1, Unit 1 Lesson #1 (Table 6 – Cognitive Domain) and (Table 11 – Knowledge Domain), in the observations instructional questions *Understand* was the dominant process at 30%, compared to *Remember* being the dominant process in Unit 1 Lesson #1 at 41%,. *Apply* process was very close in the instructional observational questions and Lesson #1 at 21%, and 24% respectively. However, during instruction the teacher posed many *Analyse* and *Evaluate* questions at 18% and 10% compared to 0% and 3% in the lesson. *Create* process was 1% in the instructional questions compared to 0% in Lesson #1.

In terms of knowledge in Observations #1, 2, and 3 *Conceptual* knowledge was much higher than Unit 1 Lesson #1 at 50% and 32% respectively. *Factual* knowledge was higher in Lesson #1 at 35% compared to 24% in the Observations instructional questions. *Procedural* knowledge was also higher in the Lesson at 38% compared to 28% in the instructional questions. Consequently, *Metacognitive*knowledge was 0% in the Lesson #1 while in the classroom observations it scored 19%.

Therefore, it is evident from the results presented above that there are differences in terms of the cognitive domain process, and knowledge types between what is taught in the class and what is presented in the textbook. The latter shows that the lessons are not necessarily being taught as presented in the book by the teacher and the instructional questions vary to a greater extent than the textbook questions.

Looking at observation #4 (Table 15) which corresponds to Unit 1 Lesson #2 (Table 6 & 11) in textbook#1, there exists differences in the distribution of the questions according to the cognitive domain. In the observation, the *Remember* process is the most common questions asked during the instructions at 47%, while in the Lesson, the most common questions are the *Understand* process questions at 42%. However, both observational questions and Lesson #2 questions scored the same on the *Analyse* and *Create* processes at 6% each. Unit 1 Lesson#2 contained more *Evaluate* process questions at 3% compared to 0% on the observational questions.

In terms of the knowledge domain, observation #4 had an equal distribution of knowledge questions types corresponding to *Factual* and *Conceptual* knowledge at 47%, followed by 6% for *Procedural* knowledge and 0% for *Metacognitive* knowledge. While, in Unit 1 Lesson #2 *Conceptual* knowledge was the most common type of knowledge questions

asked by the teacher at 56%, followed by *Factual* knowledge at 39%, *Procedural* knowledge at 11%, and *Metacognitive* knowledge at 8%.

		Cognitive Process Dimension						Knowledge Domain				Cognitive Process Dimension						Knowledge Domain			
Observation	Questions Per Observation	*Rem*	*Und*	*App*	*Ana*	*Eva*	*Crea*	*Fact*	*Conc*	*Proc*	*Meta*	*%Rem*	*%Und*	*%App*	*%Ana*	*%Eva*	*%Crea*	*%Fact*	*%Conc*	*%Proc*	*%Meta*
Observation#5	***22***	3	10	3	6	0	0	3	16	5	2	14%	45%	14%	27%	0%	0%	14%	73%	23%	9%
Observation#6	***16***	5	9	2	0	0	0	5	10	1	0	31%	56%	13%	0%	0%	0%	31%	63%	6%	0%
Total Questions per All Observations	**38**	**8**	**19**	**5**	**6**	**0**	**0**	**8**	**26**	**6**	**2**	**21%**	**50%**	**13%**	**16%**	**0%**	**0%**	**21%**	**68%**	**16%**	**5%**

Table 17: Observation #5, and #6 instructional questions cognitive and knowledge domain questions frequencies and percentage distribution

Table 17 above shows observation #5 and #6 which correspond to Unit 1 Lesson #3 in textbook #1(Table 6- Cognitive Domain, Table 11- knowledge domain); in terms of the cognitive domain there is a great similarity in terms of the distribution of the questions. Both the observational questions and Lesson questions have *Understand* as the most common process, and have *Evaluate* and *Create* at 0%. In terms of knowledge, both have *Conceptual* knowledge as the most common type of knowledge. In the instructional questions, there is a higher percentage of *Factual* questions asked by the teacher at 21% compared to 7% presented in the Lesson. *Procedural* knowledge is very close at 14% in the Lesson and 16% in the observations. *Metacognitive* knowledge is much lower in the observational questions at 5% compared to 10% in the Unit 1 Lesson #3 questions.

It is important to mention that during observation #6 the teacher was revising the concepts taught, and thus used the textbooks questions often as part of the instructional questions to help revise the concepts. This is why there is a great similarity between the textbook questions and the observational questions.

		Cognitive Process Dimension						Knowledge Domain				Cognitive Process Dimension						Knowledge Domain			
Observation	Questions Per Observation	*Rem*	*Und*	*App*	*Ana*	*Eva*	*Crea*	*Fact*	*Conc*	*Proc*	*Meta*	*%Rem*	*%Und*	*%App*	*%Ana*	*%Eva*	*%Crea*	*%Fact*	*%Conc*	*%Proc*	*%Meta*
Observation#7	***18***	5	8	1	4	0	0	4	13	1	0	28%	44%	6%	22%	0%	0%	22%	72%	6%	0%
Observation#8	***21***	4	8	1	8	0	0	7	13	1	2	19%	38%	5%	38%	0%	0%	33%	62%	5%	10%
Total Questions per All Observations	**39**	**9**	**16**	**2**	**12**	**0**	**0**	**11**	**26**	**2**	**2**	**23%**	**41%**	**5%**	**31%**	**0%**	**0%**	**28%**	**67%**	**5%**	**5%**

Table 18: Observation #7, and #8 instructional questions cognitive and knowledge domain questions frequencies and percentage distribution

Finally, Table 18 above represents observation #7 and #8 that correspond to Unit 1 Lesson #6 in textbook #1. Comparing the results presented in Table 18to the results shown in Tables 6, and 11 for Unit 1 Lesson #6. In terms of the cognitive domain in Lesson #6, the *Remember* process is the most common process at 42%, followed by the *Understand* process at

30%, while in the instructional observations questions *Understand* is the most common at 41% followed by *Remember* at 23%. *Apply* process questions are much higher in Lesson #6 at 16% compared to 5% in the instructional observation questions.

However, *Analyse* process questions are much higher in the instructional questions of observations #7 and 8 at 31% compared to 9% in Unit 1 Lesson #6. *Evaluate* process questions are slightly higher in the Lesson at 2% while it is 0% in the instructional questions. *Create* process questions are non-existent in both the instructional questions and Lesson.

When comparing the knowledge domain types of observations #7 and #8 to Unit 1 Lesson #6, both the observations and the Lesson have *Conceptual* knowledge as the most common type at 67%. Followed by *Factual* knowledge at 30% for the Lesson, and 28% for the observations. *Procedural* and *Metacognitive* knowledge types are lower in the observations at 5% each compared to 7% *Procedural* and 14% *Metacognitive* questions in the Unit 1 Lesson #6.

Overall, to answer whether there is a relationship between instructional questions and textbook questions, from the results obtained, one cannot say that there exists a relationship between instructional questions and textbook questions. Based on the observations, *Understand* was the most common cognitive process in most of the observations, while *Remember* was the most dominant cognitive process in Lessons from the textbooks. Observational questions included more *Analyse* and less *Create* questions than the textbooks questions, while *Evaluate* questions were closely similar in both observations and textbooks questions.

4.2 Discussion

In this section, the findings of this study will be compared to previous studies presented in the literature review.

This study was similar in terms of analysing textbook questions to Zaki (1973), Alul (2000), Ghanem et al. (2013), and Igbaria (2013). The results of this study agree with Zaki (1973), and Ghanem et al. (2013). In both Zaki (1973) and Ghanem et al. (2013) *Knowledge* was the most common cognitive process; similarly in this study, in terms of the cognitive domain, *Remember* is the most represented process.

However, unlike Alul (2000) and Igbaria (2013) which were high in *Comprehension* questions, this study results show that most of the Grade 6 Science textbook questions are high in

Remember cognitive process followed by *Understand* cognitive domain process. Alul (2000) and Igbaria (2013) analysed English textbooks, while this study analysed Science textbooks, it is expected that English textbooks would include more *Understanding* questions compared to Science textbooks that would include more *Remember* questions due to the subject content.

Alul (2000) also examined the overall distribution of the English textbook questions in terms of the high and low order thinking skills. The results of the current study agree with Alul (2000) in terms of both showing that lower order thinking skills are more highly represented than higher order thinking skills in the textbooks.

Although both this study and Seif's (2012) research analysed textbook questions, the results of this study do not correlate with Seif's (2012), as Seif's (2012) shows that the majority of the questions presented in the English textbooks analysed are higher order questions. While this study shows that most of the Science textbooks questions analysed show lower order thinking questions. However, when comparing these two studies, it is suffice to include that language learning is different than science learning and thus the content and concepts will be different leading to differences in results seen.

Similar to Black (1980), and Lovelace and Larson (2013), this study and the aforementioned studies sought to ascertain the cognitive levels of the instructional questions. The results differ in Black (1980) and Lovelace and Larson (2013) where the most common instructional questions were *Knowledge* questions, while in this study the most common cognitive process presented in the instructional questions were *Understand* followed by *Remember* questions.

While the current study concentrated on textbooks and instructional questions, some previous studies included in the literature review dealt with questions presented on assessment papers and examination questions such studies include Azar (2005) and Swart (2010), Jones et al. (2009), Ayvaci and Türkdogăn (2010), Jideani and Jideani (2012).

The results of Azar (2005) and Swart (2010) show *Application* questions as the common types, while in this study *Remember* was the most common types of questions. It should be mentioned that this result is expected since the textbooks used in this study cover Chemistry, Biology, and Physics questions at a lower grade (Grade 6 Science), while Azar (2005) examined Physics questions in high school and university entrance exams which are expected to have higher *Application* questions. Similarly, Swart (2010) examined Engineering examination

questions at University level, those also are expected to have higher percentage of *application* questions.

Parallels can be drawn with Ayvaci and Türkdogăn's (2010) findings with the results of this study in terms of both the cognitive and the knowledge domain dimensions. Both this study and Ayvaci and Türkdogăn (2010) had *Remember*, followed by *Understand* as the most common cognitive domain processes. Also, in both studies, knowledge was mostly represented in terms of *Conceptual* knowledge followed by *Factua*l knowledge.

In addition to the latter, the results of this study agree with Jones et al. (2009) who looked at examination questions at the University levels and found that most of the questions represented the lower order thinking questions, while the higher order thinking questions were under represented on the examination questions similar to the findings of this study.

This study findings are similar to Jideani and Jideani (2012) findings in terms of the knowledge dimension as being *Conceptual* knowledge on the examination questions. However, the cognitive domain process that were mostly represented on the Food Science courses examined were *Understand/Remember*, unlike the findings of this study which was *Remember/ Understand/Conceptual* knowledge.

Riazi and Mosalanejad (2010) and Naomee and Tithi (2013) analysed the learning objectives for English textbooks and Social Studies curriculum respectively. This present study's results had similar outcomes as Riazi and Mosalanejad's (2010) findings as both studies showed that lower order cognitive skills are more represented than high order cognitive skills.

In Naomee and Tithi (2013), the *Comprehension* cognitive process is more represented than the *Knowledge* cognitive process, unlike, the findings of this study. Nevertheless, this is again expected since this study sought to examine Science textbooks, which are high on factual knowledge requiring more *Remembering* skills as compared to Social Studies requiring more *Comprehension* skills.

This study was unique compared to the previous studies presented since it is the first study that looks at the Science textbooks questions and instructional questions in Dubai. The findings of this study show that lower order thinking skills are more common than higher order thinking skills, which is similar to what is found in most of the studies presented in the literature. Therefore, it can be concluded that in Grade 6 Science class of this particular International school in Dubai, lower order thinking skills are more commonly taught than higher order

thinking skills. Furthermore, Remember as being the most common cognitive process in the textbook questions, while Understand as being the most common cognitive process in the instructional questions. *Conceptual* knowledge is most common type of knowledge present in the textbook and instruction.

This chapter presented the findings and the discussion of the findings in light of the literature and studies conducted on Bloom's taxonomy. The next chapter will provide the conclusion with the limitations, further research, and recommendations.

Chapter 5

CONCLUSION

5.1 Summary of the Main Findings

5.2 Recommendations

5.3 Limitations of the Study

5.4 Further Research

The major purpose of this study was to determine the extent of the questions presented in the Grade 6 Science Fusion textbooks and instructional questions in a private international school in Dubai for the academic year 2013 – 2014 according to the six cognitive processes and four knowledge processes of the Revised Bloom's Taxonomy (RBT). The taxonomy was used to categorize the level of questions in two categories: LOTQS (*remember, understand, apply*) and HOTQS (*analyse, evaluate, create*). The study also examined the most common type of knowledge presented in the textbook questions and instructional questions, and determined if a relationship exists between the textbook questions and instructional questions in terms of the RBT.

In this chapter the key findings will be highlighted, limitations of the study will be presented, and further research and recommendations will be discussed.

5.1 Summary of the Main Findings

1) **To what extent questions presented in the Grade 6 Science textbooks of a private school in Dubai are varied or frequent according to the six levels of the Revised Bloom's Taxonomy (RBT)?**

Out of the 1,482 textbook questions analysed, 37% were *Remember* questions, 33% were *Understand* questions, 11% were *Apply*, 8% were *Analyse*, 4% were *Evaluate*, and 7% were *Create*. This shows that *Remember* and *Understand* are the most common cognitive processes as was observed in many studies presented in the literature review.

2) **What percentage of the Grade 6 Science textbooks' questions fall in the RBT Low Order Thinking Questions Skills (LOTQS)?**

As many previous studies have showed, LOTQS are more common in most questions presented in textbooks, instructions, or assessments. In this study, 81% of the questions were LOTQS.

3) **What percentage of the Grade 6 Science textbooks' questions fall in the RBT High Order Thinking Questions Skills (HOTQS)?**

In terms of HOTQS, 19% of the questions presented in the textbooks were considered to be HOTQS. This result is similar to previous studies confirming that questions used nowadays in the teaching and learning process are still not stimulating higher order thinking.

4) **What is the dominant knowledge domain in the Grade 6 Science textbooks?**

The most dominant knowledge domain level in the Grade 6 Science textbook was *Conceptual*knowledge at 53%. This is expected since in Science most of the content taught is based on concepts. Also, similar research shows *Conceptual* knowledge is the most common type of knowledge taught in Science.

5) **Does a relationship exist between the cognitive domain/knowledge content textbooks analysis and the in-class teaching instruction in Grade 6 Science in a private school in Dubai?**

Based the overall findings, it can be construed that there is a tenuous relationship between the in-class teaching instruction in terms of the questions posed and the textbook questions. In the textbook content analysis of the questions, *Remember* was the most dominant type of questions asked, however, in the observational results, the questions that were mostly asked were categorized as *Understand* question. In addition, in the instructional questions, more *Analyse* questions were asked as compared to the textbooks, with little number of *Create* questions being used in the instruction.

Overall, the LOTQS in the instructional questions were lower (75%) compared to 81% in the textbooks and the HOTQS were higher (25%) in the instructional questions compared to 19% in the textbook questions. Both the textbook questions and instructional questions had *Conceptual*knowledge as the most common type of knowledge.

5.2 Recommendations

Based on the findings of this study showing that lower order thinking questions are more common in the textbooks used and during instruction, it is recommended that teachers teaching Science to Grade 6 students and textbook developers should include more questions that are higher order thinking questions to help develop critical and creative thinking skills among learners.

In addition, it is recommended to textbook developers and teachers when including higher order thinking questions to ensure that the higher levels of *Evaluate* and *Create* are the most common types of questions since they help develop the highest levels of thinking among students. Moreover, teachers using the textbook should not rely completely on the textbook to deliver the curriculum and to generate questions of higher order thinking than what the textbook presents. The questions used should ideally fit the level of students.

Additionally, the teacher can use the textbook as a tool to differentiate between different levels of students, since the textbook may present more LOTQS, questions from it can be utilized for low achievers, which in turn give a chance for the teacher to develop HOTQS to medium and high achiever. During instruction specifically, it is recommended for the teacher to prepare activities that target *Create* cognitive process since this was not seen in this study, and the teacher should preferably utilize the questions presented in the textbook to challenge students with *Create* cognitive questions.

5.3 Limitations of the Study

The main limitation of this study was when analysing the textbook questions, the questions were categorised according to how the researcher best comprehended the purpose and content of the question. However, it is possible that on many occasions, the background of the students would affect how the question would be categorized, in other words, depending on whether the learners are novice or expert learners, the question would mean a different skill for the different type of learner. Thus, individual judgement played a major role in categorising questions.

As there was only one teacher teaching all five Grade 6 Science classes, the observation process was limited to this teacher. Varied observations with different teachers and teaching methods may have rendered different results. Furthermore, due to inaccessibility and time limit, tests and assessments questions were not accessible. An analysis of the tests and assessments questions would have provided a clearer indication of the overall teaching and learning process and helped in evaluating the alignment of the learning objectives with the textbook questions, instructional questions and assessment questions.

5.4 Further Research

Since the aim of the study was to examine the questions in the textbook and to examine their impact on teaching higher order thinking in the classroom, it is recommended that further research examine the extent of the use of the textbook questions by the students and the teacher during the academic year.

It is also suggested that further research aligns the common core standards being adopted by the school to the textbook questions and learning objectives presented in the textbook and examine if a relationship exists between the textbook and the common core standards since the textbook is the main core material assisting in the delivery of the curriculum.

Since part of teaching and learning is the assessment process, further research could be conducted to determine if a relationship exists between the textbooks' questions, instructional questions, and the assessments questions. This would provide an insight to whether what is being tested in the class using the textbook and during instruction are consistent across the school. In addition, the teacher's wait time after posing the questions can be analysed to investigate whether ample time is given to the students to think about the question prior to the teacher providing the answer.

It is apparent that textbook and instructional questions in any subject can have a significant impact on thinking and thus, learning of students. Thus, curriculum and pedagogical innovations need to be done in tandem in order for teaching and learning to improve towards creating a generation of critical thinkers.

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Appendices

Appendix A
(Cognitive Process Reference Matrix)

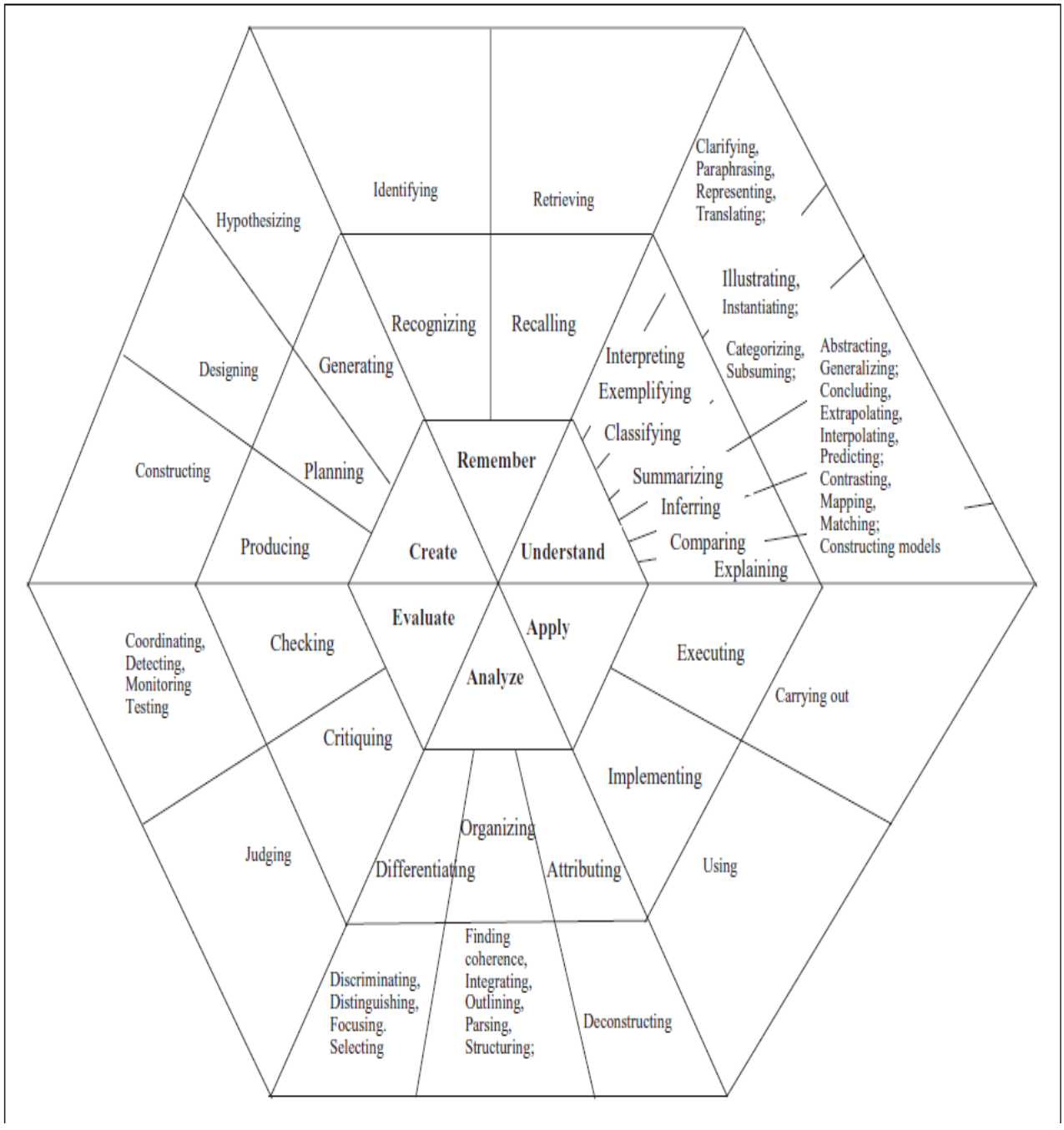


Table 19: Cognitive process domain action verbs (Adopted from Jideani and Jideani 2012, p.36)

Appendix B
(Knowledge Domain Reference Matrix)

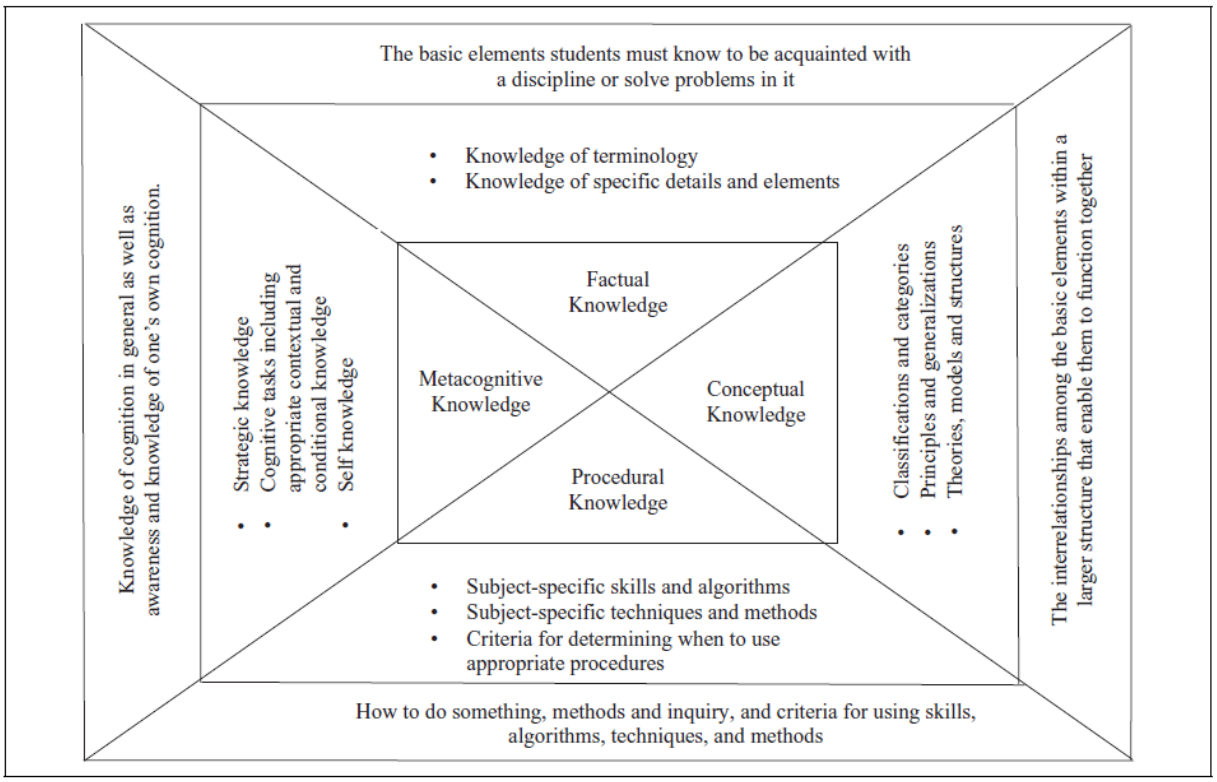


Table 20: Knowledge Domain Criteria (Adopted from Jideani and Jideani 2012, p.37)

Appendix C
(Textbook Lesson Questions Taxonomical Analysis Form)

						Cognitive Process Dimension						Knowledge Dimension			
Unit No.	Lesson No	Learning Outcome	Page No.	Question Number	Question	Rem	Und	App	Ana	Eva	Crea	Fact	Conc	Proc	Meta

Table 21: Textbook Analysis Instrument Used

Key: Rem – Remember **Und**- Understand **App**- Apply **Ana**- Analyse **Eva**- Evaluate **Crea** –Create
Fact – Factual **Conc**- Conceptual **Proc**- Procedural **Meta**- Metacognitive

Appendix D
(Instructional Lesson Questions analysis Form)

Grade 6		Date: Sunday October 6th, 2013. Time Started: 9:05 Time Ended: 9:50									
	Learning Objectives										
Question No.	Questions Asked	Cognitive Process Dimension						Knowledge Domain Dimension			
		Rem	Und	App	Ana	Eva	Crea	Fact	Conc	Proc	Meta

Table 22: Non- Participatory 'Selective Verbatim' Observational Questions Analysis Instrument Used

Key: **Rem** – Remember **Und**- Understand **App**- Apply **Ana**- Analyse **Eva**- Evaluate **Crea** –Create
Fact – Factual **Conc**- Conceptual **Proc**- Procedural **Meta**- Metacognitive

Appendix E
(Textbooks Lessons Questions and RBT Analysis)

						Cognitive Process Dimension						Knowledge Dimension			
Unit No.	Lesson No	Learning Outcome	Page No.	Question No.	Question	Rem	Und	App	Ana	Eva	Crea	Fact	Conc	Proc	Meta
1	1. Introduction to Matter	To relate mass, weight, volume, and density to one another.	4				1						1		
			5	U1.1.1.	(Describe) Fill in the blank with the word or phrase that you think correctly completes the following sentences: A(n) ___ can hold a greater volume of water than a mug. A hamster weighs less than a(n)___. A bowling ball is harder to lift than a basketball because ___.	1						1			
			5	U1.1.2.	(Explain) List some similarities and differences between the golf ball on the left and the table tennis on the right in the photo below.		1							1	
			5	U1.1.3.	(Apply) Many Scientific words, such as matter, also have everyday meanings,. Use context clues to write your own definition for each meaning of the word matter.			1						1	
			5	U1.1.4.	(Identify) This list contains the vocabulary terms you'll learn in this lesson. As you read, circle the definition of each term.	1						1			
			6	U1.1.5.	(Explain) How can you tell if something is matter?		1						1		
			6	U1.1.6.	(Identify) Name three examples of matter found in this photo.	1							1		
			7	U1.1.7.	(Explain) Why do astronauts weigh less on the moon than they do on Earth?		1						1		
			8	U1.1.8.	(Infer) Would this balance give the same value for mass if used on the moon? Explain		1						1		
			9	U1.1.9.	(Define) what does volume measure?	1						1			
			9	U1.1.10.	(Infer) Big things can look very small when seen from far away. Describe how you know big things far away aren't really small.		1						1	1	
			11	U1.1.11.	(Calculate) Find the volume of a locker that is 30 cm long, 40 cm wide, and 200 cm high.			1						1	
			12	U1.1.12.	(Calculate) The two images below show a graduated cylinder filled with water before and after a chess piece is placed inside. Use the images to calculate the volume of the chess piece.			1						1	
			13	U1.1.13.	(Explain) What is density?		1						1		
			13	U1.1.14.	(Predict) Circle the item in each pair that is more dense?		1						1		
			14	U1.1.15.	(Calculate) Obsidian is another type of igneous rock. What is the density of a piece of obsidian that has a mass of 239.2 g and a volume of 92 cm cubed?			1						1	
			15	U1.1.16	(Calculate) A rhyolite rock has a volume of 9.5 ml. The density of the rock is 2.6 g/cmcubed. What is the mass of the rock?			1						1	
			16	U1.1.17.	T or F An object's weight is the amount of space it occupies.	1						1			
			16	U1.1.18.	T or F. The mass of an object is equal to its weight.	1						1			
			16	U1.1.19.	T or F. The volume of a solid can be expressed in units of cm cubed.	1						1			
			16	U1.1.20.	T or F. An object that floats in water is less dense than water.	1						1			
			16	U1.1.21.	(Describe) Write a set of instructions that describe how to find the density of an object. Write the instructions so that they work for a regularly shaped object and for an irregularly shaped			1						1	
			17	U1.R1.1.	Fill in the blank with the term that best completes the following sentence. ____is the amount of space that matter in an object occupies.	1						1			
			17	U1.R1.2.	Fill in the blank with the term that best completes the following sentence. ____is anything that has mass and takes up space.	1						1			
			17	U1.R1.3.	Fill in the blank with the term that best completes the following sentence. ____is the amount of matter in an object.	1						1			
			17	U1.R1.4.	Fill in the blank with the term that best completes the following sentence. ____is a measure of the amount of matter in a given amount of space.	1						1			
			17	U1.R1.5.	Fill in the blank with the term that best completes the following sentence. ____is a measure of the gravitational force on an object.	1						1			
			17	U1.R1.6.	(Classify) Is air matter? How can you tell?		1						1		
			17	U1.R1.7.	Explain.		1						1		
			17	U1.R1.8.	(Compare) Explain why a golf ball is heavier than a table tennis ball, even though the balls are the same size.		1						1		
			17	U1.R1.9.	(Calculate) A block of wood has a mass of 120 g and a volume of 200 cm cubed. What is the density of the wood?			1						1	
			17	U1.R1.10.	(Identify) Suppose that 273 g of one of the substances listed above displaces 26 ml of water. What is the substance?	1								1	
			17	U1.R1.11.	(Evaluate) How many ml of water would be displaced by 408 g of lead?					1				1	
			17	U1.R1.12.	(Predict) How can you determine that a coin is not pure silver if you know the mass and volume of the coin.		1						1	1	
			17	U1.R1.13.	(Calculate) A truck whose bed is 2.5 m long, 1.5m wide, abd 1.0 n high is delivering sand for sand-sculpture competition. About how many trips must the truck make to deliver 7 m cubed of			1						1	
					Total number of questions = 34	***14***	***11***	***8***	***0***	***1***	***0***	***12***	***11***	***13***	***0***

Table 23: Textbook # 1 "Matter and Energy" Unit 1 – Lesson 1 RBT Analysis

						Cognitive Process Dimension						Knowledge Dimension			
Unit No.	Lesson No	Learning Outcome	Page No.	Question No.	Question	Rem	Und	App	Ana	Eva	Crea	Fact	Conc	Proc	Meta
1	2. Properties of Matter	To classify and compare substances based on their physical and chemical properties	20				1								
			21	U1.2.1.	(Predict) Check T or F to show whether you think each statement is true or false. A. Liquid water freezes at the same temperature at which ice melts: 0 degree celsius. B. A bowling ball weighs less than a styrofoam ball of the same size. C. An object with a density greater than the density of water will float in water.		1					1			
			21	U1.2.2.	(Describe) If you were asked to describe an orange to someone who had never seen an orange, what would you tell the person?	1						1			
			21	U1.2.3.	(Sythesize) Many English words have their roots in other languages. The root of the word solubility is the latin word solvere, which means "to loosen". Make an educated guess about the meaning of the word solubility.						1				1
			21	U1.2.4.	(Apply) As you learn the definition of each vocabulary term in this lesson, create your own definition or sketch to help you remember the meaning of the term.			1							1
			22	U1.2.5.	(Describe) Does observing a physical property of a substance change the identity of the substance? Explain		1						1		
			23	U1.2.6.	(Observe) Describe the physical properties of objects you see in this photo.			1					1	1	
			23	U1.2.7.	(Apply) Describe a common object by naming its properties. Trade your mystery-object description with a classmate's and try to guess what object he or she has described.			1					1	1	
			24	U1.2.8.	(Explain) The photo above shows oil and vinegar in a pitcher. The top layer is the oil. Describe the density of the vinegar compared to the density of the oil.		1						1		
			24	U1.2.9.	(Predict) If you let all of the liquid evaporate out of the pitcher. Would you be able to see the solid particles of the drink mix? Explain.		1						1		
			25	U1.2.10.	(Identify) Name something made of aluminium and explain why malleability is a useful property.		1					1	1		
			25	U1.2.11.	(Infer) Compare what happens when a geyser erupts to what happens when a tea kettle whistles.		1						1		
			26	U1.2.12.	(Identify) As you read, underline the definition of a chemical property	1						1			
			26	U1.2.13.	(Predict) Why do automobiles rust more easily in wet climates than drier		1						1		
			28	U1.2.14.	(Compare) Describe the difference between a physical property and a chemical property?		1						1		
			28	U1.2.15.	(Distinguish) What type of property is being shown by each nail?				1				1		
			28	U1.2.16	(Predict) Check the correct box to show whether each property of an iron nail is a physical or a chemical property.		1						1		
			29	U1.2.17.	(Identify) List physical and chemical properties used to identify evidence at a crime scene.	1						1	1		
			29	U1.2.18.	(Predict) When examining evidence, why might investigators want to be more careful examining chemical properties than physical properties?		1						1		
			29	U1.2.19.	(Evaluate) By examinining the physical and chemical properties of evidence at a crime scene, Investigators can often be more certain about what a suspicious substance is not than about what it is. Why do you think this is the case?					1			1		1
			30	U1.2.20.	(Infer) Check the box to show which would tell you for sure if you had a sample of real gold.		1					1			
			31	U1.2.21.	(Calculate) A student finds an object with a mass of 64.54 g and a volume of 14 cm cubed. Find the density of the object. Could the object be gold?			1						1	
			32	U1.2.22.	Solubility/ flammability is a physical property.	1						1			
			32	U1.2.23.	The melting point of a substance is the temperature at which the substance changes from a solid to a gas/liquid.	1						1			
			32	U1.2.24.	Reactivity with water/ Magnetism is a chemical property.	1						1			
			32	U1.2.25.	Flammability is the ability of a substance to transfer heat/burn.	1						1			
			32	U1.2.26.	The characteristic properties of a substance do/ do not depend on the size of the sample.	1						1			
			32	U1.2.27.	(Synthesize) You have two solid substances that look the same. What measurements would you take and which tests would you perform to determine whether they actually are the same?						1			1	
			33	U1.R2.1.	Fill in the blank with the term that best completes the following sentence. Flammability is an example of a _____property.	1						1			
			33	U1.R2.2.	Fill in the blank with the term that best completes the following sentence. Electrical conductivity is an example of a _____property.	1						1			
			33	U1.R2.3.	(Identify) What are three physical properties of aluminum foil?	1						1			
			33	U1.R2.4.	(Describe) What effect does observing a substance's physical properties have on the substance?		1						1		
			33	U1.R2.5.	(Explain) Describe how a physical property, such as mass or texture, can change without causing a change in the substance.		1						1		
			33	U1.R2.6.	(Justify) Must new substances be formed when you observe a chemical property? Explain		1						1		
			33	U1.R2.7.	(Infer) You are given samples of the substances shown in the table. The samples are labeled A, B, and C. At room temperature, sample A is a solid, sample B is a liquid, and sample C is a gas. What are the identities of samples A, B, and C? (Hint: Room temperature is about 20 degree celsius)		1						1		
			33	U1.R2.8.	(Conclude) The density of gold is 19.3 g/cm cubed. The density of iron pyrite is 5 g.cm cubed. If a nugget of iron pyrite and a nugget of gold each have a mass of 50 g, what can you conclude about the volume of each nugget?			1					1		
			33	U1.R2.9.	(Predict) Suppose you need to build a raft to cross a fast-moving river. Describe the physical and chemical properties of the raft that would be important to ensure your safety.				1				1		
						11	15	5	2	1	2	14	20	4	3
					Total number of questions = 36										

Table 24: Textbook # 1 "Matter and Energy" Unit 1 – Lesson 2 RBT Analysis

						Cognitive Dimension						Knowledge Dimension			
Unit No.	Lesson No	Learning Outcome	Page No.	Question No.	Question	Rem	Und	App	Ana	Eva	Crea	Fact	Conc	Proc	Meta
1	3. Physical and Chemical Changes	To distinguish between physical and chemical changes of matter.	34						1				1		
			35	U1.3.1.	(Predict) Check T or F to show whether you think each statement is true or false. A. When an ice cube melts, it is still water. B. Matter is lost when a candle is burned. C. When your body digests food, the food is changed into new substances.		1					1			
			35	U1.3.2.	(Describe) Write a word or phrase beginning with each letter of the word CHANGE that describes changes you have observed in everyday objects.		1								1
			35	U1.3.3.	(Apply) Use context clues to write your own definitions for the words interact and indicate			1						1	
			35	U1.3.4.	(Apply) As you learn the definition of each vocabulary term in this lesson, create your own definition or sketch to help you remember the meaning of the term.physical change, chemical change, law of conservation of mass			1					1		
			36	U1.3.5.	(Explain) What happens to a substance during a physical change?		1						1		
			37	U1.3.6.	(Identify) The list below gives several examples of physical changes. Write your own examples of physical changes on the blank lines.	1						1			1
			37	U1.3.7.	(Analyze) How does the yarn in the sweater differ from the wool on the sheep?				1						1
			38	U1.3.8.	(Identify) Use the boxes provided to identify the wood, ashes, and flames involved in the chemical change. Then write a caption describing the chemical changes you see in the photo.		1						1	1	
			39	U1.3.9.	(Explain) How do higher temperatures influence a chemical change?		1						1		
			39	U1.3.10.	(Infer) Think of ways you control temperature to influence chemical changes during typical day. (Hint: Cooking, Art class)		1						1		
			40	U1.3.11.	(Compare) How are physical and chemical changes different?		1						1		
			41	U1.3.12.	(Infer) List the observations you might make as you witness each of the changes below. Then classify each change as a physical change or a chemical change.		1							1	
			42	U1.3.13.	(Identify) What is the law of conservation of mass?	1							1		
			43	U1.3.14.	(Describe) How is the physical change in the robot reversible, and how can you tell that the change follows the law of conservation of mass?		1						1	1	
			43	U1.3.15.	(Infer) What would you observe about the mass in the flask if you did not put the balloon on top? Why?		1						1		
			44	U1.3.16.	Burning/ Dying wool is an example of a physical change.	1							1		
			44	U1.3.17.	The formation of a precipitate signals a physical / chemical change.	1							1		
			44	U1.3.18.	This physical/ chemical change result in the formation of new substances.	1							1		
			44	U1.3.19.	The mass of the toy on the right is the same as/ different from the mass of the toy on the left.	1							1		
			44	U1.3.20.	(Explain) Do changes that cannot be easily reversed, such as burning, observe the law of conservation of mass? Explain.		1						1		
			45	U1.R3.1.	In your own words, define the following terms physical change.	1							1		
			45	U1.R3.2.	In your own words, define the following terms chemical change.	1							1		
			45	U1.R3.3.	In your own words, define the following terms law of conservation of mass	1							1		
			45	U1.R3.4.	(Identify) Give an example of a physical change and an example of a chemical change.	1							1		
			45	U1.R3.5.	(Compare) How is a chemical change different from a physical change?		1						1		
			45	U1.R3.6.	(Apply) Suppose a log's mass is 5 kg. After burning, the mass of the ash is 1 kg. Explain what may have happened to the other 4 kg.			1					1		
			45	U1.R3.7.	(Analyze) As the bright sun shines upon the water the water slowly disappears. The same sunlight gives energy to the surrounding plants to convert water and carbon dioxide into sugar and oxygen gas. Which change is physical and which is chemical?				1				1		
			45	U1.R3.8.	(Compare) Relate the statement "You can't get something for nothing" to the law of the conservation of mass.		1						1		
			45	U1.R3.9.	(Infer) Sharpening a pencil leaves behind pencil shavings. Is sharpening a pencil a physical change or a chemical change? Explain		1						1		
						10	14	3	2		0	2	23	4	
					Total Number of questions= 29										

Table 25: Textbook # 1 "Matter and Energy" Unit 1 – Lesson 3 RBT Analysis

						Cognitive Process Dimension						Knowledge Dimension			
Unit No.	Lesson No	Learning Outcome	Page No.	Question No.	Question	Rem	Und	App	Ana	Eva	Crea	Fact	Conc	Proc	Meta
1	4. Pure Substances and Mixtures	To distinguish between pure substances and mixtures	50						1				1		
			51	U1.4.1.	(Predict) Check T or F to show whether you think each statement is true or false. A. Atoms combine in different ways to make up all of the substances you encounter everyday. B. Saltwater can be separated into salt and water C. A mixture of soil has the same chemical composition throughout		1						1		
			51	U1.4.2.	(Apply) Think of a substance that does not dissolve in water. Draw a sketch below that shows what happens when this substance is added to water			1					1		
			51	U1.4.3.	(Synthesize) Many English words have their roots in other languages. Use the Greek words below to make an educated guess about the meanings of the words homogeneous and heterogeneous.						1				1
			51	U1.4.4.	(Identify) This list contains the key terms you'll learn in this lesson. As you read, circle the definition of each term. (atom, element, compound, mixture, pure substance, hetergeneous, homogeneous)	1							1		
			52	U1.4.5.	(Compare) What do elements, compounds, and mixtures have in common?		1						1		
			52	U1.4.6.	(Predict) If you have ever baked a cake or bread, you know that the ingredients that combine to make it taste different from the baked food, Why do you think that is?		1						1		
			53	U1.4.7.	(Analyze) Why are the spheres representing nitrogen and oxygen different colors?				1				1		
			54	U1.4.8.	(Identify) Fill in the blanks to label the two particle models.	1						1			
			54	U1.4.9.	(Explain) Copper is an element. How do these images of copper illustrate this?		1						1		
			55	U1.4.10.	(Explain) Water is a compound. How do these images of water illustrate this?		1						1		
			55	U1.4.11.	(Identify) What happens when a pure substance undergoes a chemical change?	1							1		
			56	U1.4.12.	(Identify) As you read, underline the ways in which elements are organized on the periodic table.	1						1			
			57	U1.4.13.	(Classify) Read about some of the ways in which compounds can be classified. Then fill in the blanks to complete the photo captions.		1						1		
			58	U1.4.14.	(Describe) This student is going to make and separate a mixture of sand and salt. Complete these captions to describe what is taking place in each photo.		1							1	
			59	U1.4.15.	(Devise) How could you separate a mixture of rocks and sand?		1							1	
			60	U1.4.16.	(Identify) As you read, underline the everyday examples of mixtures on this page.	1						1			
			61	U1.4.17.	(Summarize) Complete the graphic organizer below by filling in the blanks with terms from this lesson. Then add definitions or sketches of each term inside the appropriate box.		1						1		
			62	U1.4.18.	Water is a pure substance/ mixture.	1						1			
			62	U1.4.19.	Water is a(n) element/compound.	1						1			
			62	U1.4.20.	Saltwater and sand can be separated with a magnet/filter.	1						1		1	
			62	U1.4.21.	Saltwater is a homogeneous/ heterogeneous mixture.	1						1			
			62	U1.4.22.	(Predict) Why do you think that the particles of a suspension settle out but the particles of a colloid do not?		1						1		
			63	U1.R4.1.	Fill in the blanks with the term that best completes the following sentences. The basic building blocks of matter are called_____.	1						1			
			63	U1.R4.2.	Fill in the blanks with the term that best completes the following sentences. A(n) _____is a substance that is made up of a single kind of atom.	1						1			
			63	U1.R4.3.	Fill in the blanks with the term that best completes the following sentences. Elements and compounds are two types of _____.	1						1			
			63	U1.R4.4.	Fill in the blanks with the term that best completes the following sentences. A(n) _____is a combination of substances that are combined physically but not chemically.	1						1			
			63	U1.R4.5.	(Identify) What kind of mixture is a solution? A suspension? A colloid?	1							1		
			63	U1.R4.6.	(Apply) Fish give off the compound ammonia which has a pH above 7? To which class of compounds does ammonia belong?			1					1		
			63	U1.R4.7.	(Compare) Fill in the following table with properties of elements and compounds.		1					1			
			63	U1.R4.8.	(Identify) What type of mixture is this salad dressing?	1							1		
			63	U1.R4.9.	(Explain) Could a mixture be made up of only elements and no compounds? Explain		1						1		
			63	U1.R4.10.	(Synthesize) Describe a procedure to separate a mixture of sugar, black pepper, and pebbles.						1	1		1	
						15	12	2	1		2	13	16	4	1
					Total number of questions = 32										

Table 26: Textbook # 1 "Matter and Energy" Unit 1 – Lesson 4 RBT Analysis

						Cognitive Process Dimension						Knowledge Dimension			
Unit No.	Lesson No	Learning Outcome	Page No.	Question No.	Question	Rem	Und	App	Ana	Eva	Crea	Fact	Conc	Proc	Meta
1	5. States of Matter	To model the motion of particles in solids, liquids and gases.	64								1		1		1
			65	U1.5.1.	(Describe) Fill in the blank with a word or phrase that you think correctly completes the following sentences. A. _____is an example of a solid. B. _____ is an example of a gas. C. Unlike solids, gases can _____.		1						1		
			65	U1.5.2.	(Identify) Unscramble the letters below to find substances that are liquids. Write your words on the blank lines.	1		1						1	1
			65	U1.5.3.	(Apply) Use context clues to write your own definitions for the words definite and occupy.			1						1	1
			65	U1.5.4.	(Identify) As you read , place a question mark next to any words that you don't understand . When you finish reading the lesson, go back and review the text that you marked. If the information is still confusing, consult a classmate of a teacher. (solid, liquid, gas)		1						1		
			66	U1.5.5.	(Describe) How are particles in a solid like people sitting in a movie theater?		1						1		
			67	U1.5.6.	(Describe) How are particles in a liquid like people in a movie theater lobby?		1						1		
			67	U1.5.7.	(Describe) How are particles in a gas like people outside of a movie theater?		1						1		
			68	U1.5.8.	(Identify) Underline words or phrases that describe the properties of solids, liquids, and gases.	1						1			
			68	U1.5.9.	(Model) Think about the general shape and behaviour of particles in solids, liquids and gases within a container. What objects could be used as a model of particles?How could you model a container for your particles? Gather the materials and make you modle. How does your model of solid, liquid, and gas particles compare to the real						1		1		
			69	U1.5.10.	(Apply) Identify substances A, B, and C as a solid, a liquid, or a gas by placing a letter in each of the small circles below In the larger circles, draw models of the particles of each substance.			1						1	
			70	U1.5.11.	(Apply) Complete the table below with examples of state changes.			1						1	
			71	U1.5.12.	(Describe) In your own words, describe the glass-blowing process.		1							1	
			71	U1.5.13.	(Investigate) People once thought that old glass windows are thicker at the bottom because the solid glass had flowed to the bottom over time. Research this theory and report your findings.					1			1		1
			71	U1.5.14.	(Investigate) Research the various methods of making glass objects. Present your findings by doing one of the following: make a poster / write a short essay / draw a graphic novel.					1			1		1
			72	U1.5.15.	T or F. Solids can easily chane in volume.										
			72	U1.5.16.	T or F. Liquids take the shape of their container.	1						1			
			72	U1.5.17.	T or F. When the distance between gas particles increases, the volume of the gas increases.	1						1			
			72	U1.5.18.	(Describe) What happens to the kinetic energy of the particles of a substance as the substance changes from a liquid to a gas?		1						1		
			73	U1.R5.1.	Draw aline to connect the following terms to the description of their particle motion. Solid	1						1			
			73	U1.R5.2.	Draw aline to connect the following terms to the description of their particle motion. Liquid	1						1			
			73	U1.R5.3.	Draw aline to connect the following terms to the description of their particle motion. Gas	1						1			
			73	U1.R5.4.	(Define) What is the kinetic theory of matter?	1						1			
			73	U1.R5.5.	(Analyze) What happens to the temperature of a substance while it is changing state? Explain				1				1		1
			73	U1.R5.6.	(Analyze) What could you do to change the volume of a gas?				1				1		1
			73	U1.R5.7.	(Apply) Can a tank of oxygen gas ever be half empty? Explain			1						1	1
			73	U1.R5.8.	(Predict) This jar contains helium gas, What would happen if the lid of this jar was removed?					1				1	
			73	U1.R5.9.	(Explain) How are the helium atoms in the model different from real helium atoms?		1						1		
			73	U1.R5.10.	(Infer) The particles that make up a rock are constantly in motion. However, a rock does not visibly vibrate. Why do you tink this is?		1						1		
						8	9	5	2	3	1	7	13	7	7
					Total number of questions = 28										

Table 27: Textbook # 1 "Matter and Energy" Unit 1 – Lesson 5 RBT Analysis

						Cognitive Process Dimension						Knowledge Dimension			
Unit No.	Lesson No	Learning Outcome	Page No.	Question No.	Question	Rem	Und	App	Ana	Eva	Crea	Fact	Conc	Proc	Meta
1	6. Changes of State	To describe changes of state in terms of the attraction and motion of particles	74				1						1	1	
			75	U1.6.1.	(Identify) Unscramble the letters of each word below to find objects in your classroom that are solids. Write the words on the blank lines.	1						1			1
			75	U1.6.2.	(Describe) Write your own caption for this photo.				1				1		
			75	U1.6.3.	(Apply) Use context clues to write your own definitions for the words converted and constantly.			1						1	
			75	U1.6.4.	(Identify) This list contains the vocabulary terms you'll learn in this lesson. As you read, circle the definition of each term.	1						1			
			76	U1.6.5.	(Identify) As you read, underline the three most familiar states of matter.	1						1			
			76	U1.6.6.	(Apply) Use the graph to determine which point A, B, or C – represents a candle melting. Circle the correct letter.			1					1		
			77	U1.6.7.	(Analyze) Determine whether water particles will have more or less freedom to move at each stage, A, B, C,. Write more freedom or less freedom in each box.				1				1		
			77	U1.6.8.	(Categorize) Identify whether each picture below shows a (1) gain of energy or a (2) loss of energy for the substance. Write the appropriate number in the box at the bottom of each picture.		1						1		1
			78	U1.6.9.	(Predict) In which sample of water do the water particles have more energy: 5 grams (g) of ice cubes at – 10 degree celsius, or 5g of liquid water at 20 degree celsius? How do you know?		1						1		
			78	U1.6.10.	(Identify) In the box below each picture, write the state of the substance shown.	1						1			
			79	U1.6.11.	(Apply) Describe what happens to water particles when ice melts.			1					1		
			79	U1.6.12.	(Infer) Both the freezing temperature and the melting temperature of water are the same (0 degree celsius). Explain why a substance like water freezes and melts at the same temperature.		1						1		
			80	U1.6.13.	(Predict) What would happen to the boiling point of water at 8,000 m above sea level, where air pressure is lower?		1						1		
			80	U1.6.14.	(Identify) In the box below each picture, write the state of the substance shown.	1						1			1
			81	U1.6.15.	(Apply) Indicate whether the change of state in each process causes particles to (A) have more freedom or (B) have less freedom. Write the appropriate letter next to each process.			1					1		
			81	U1.6.16.	(Compare) How are the planes contrail lines similar to clouds?		1						1		
			81	U1.6.17.	(Research) With a partner, find another substance that can sublimate. Describe the conditions under which sublimation occurs.				1				1		1
			83	U1.6.18.	(Compare) Explain how sublimation and deposition are alike and how they are different.		1						1		
			83	U1.6.19.	(Relate) Complete Column 1 and Column 2 to identify opposite processes. In the third column, Indicate whether the process in Column 1 or Column 2 is the result of a gain of energy.		1						1		1
			84	U1.6.20.	(Identify) As you read, underline the ways particles of matter are affected by a change of state.	1							1		
			84	U1.6.21.	. (Apply) Label the state changes that are taking place in both directions of the arrows at stage A, B, and C, Draw the missing model for the gas state.			1					1		
			85	U1.6.22.	(Apply) A flask of water is sealed with a balloon and heated to various temperatures on a hot plate. Fill in the missing information below			1					1	1	
			85	U1.6.23.	(Evaluate) Explain how the system of the flask and the balloon illustrates the conservation of mass					1			1		
			86	U1.6.24.	The change from a solid to a liquid is called _____.	1						1			
			86	U1.6.25.	The change from a solid directly to a gas is called _____.	1						1			
			86	U1.6.26.	Water vapor changes directly to ice by _____.	1						1			
			86	U1.6.27.	_____ is the process in which water vapor changes to a liquid.	1						1			
			86	U1.6.28.	Ice is formed from liquid water during the process of _____.	1						1			
			86	U1.6.29.	Two ways that liquid water can become a gas are by _____.	1						1			
			86	U1.6.30.	The amount of mass _____ during a change of state.	1						1			
			86	U1.6.31.	(Predict) What would happen to the amount of matter on Earth if mass were not conserved during changes of state?		1						1		
			87	U1.R6.1.	Draw aline to connect the following terms to their definitions. Freezing	1							1		
			87	U1.R6.2.	Draw aline to connect the following terms to their definitions. Evaporation	1							1		
			87	U1.R6.3.	Draw aline to connect the following terms to the definitions. Sublimation	1							1		
			87	U1.R6.4.	Draw aline to connect the following terms to their definitions. Melting	1							1		
			87	U1.R6.5.	(Describe) What happens to particles when a substance gains energy and changes		1						1		
			87	U1.R6.6.	(Explain) what happens to the energy that is lost when water freezes?		1						1		
			87	U1.R6.7.	(Compare) How does the movement of particles in a stick of butter differ from the movement of particles in a dish of melted butter?		1						1		
			87	U1.R6.8.	(Identify) As water is cooled, at what temperature do its particles become fixed in place?	1						1			
			87	U1.R6.9.	(Relate) The drawing represents the movement of particles in a substance. What changes of state can this substance undergo?				1				1		1
			87	U1.R6.10.	(Describe) What processes will the substance in the drawing undergo when those changes of state occur? Explain		1						1		
			87	U1.R6.11.	(Compare) How do evaporation and boiling differ?		1						1		
			87	U1.R6.12.	(Apply) The boiling point of a substance in City A is found to be 145 degree celsius. The boiling point of the same substance in City B is 141 degree celsius. Which city, A or B, is at a higher elevation? How do you know?			1					1	1	
						18	13	7	4	1		13	29	3	6
					Total number of questions = 43										

Table 28: Textbook # 1 "Matter and Energy" Unit 1 – Lesson 6 RBT Analysis

						Cognitive Process Dimension						Knowledge Dimension			
Unit No.	Lesson No	Learning Outcome	Page No.	Question Number	Question	Rem	Und	App	Ana	Eva	Crea	Fact	Conc	Proc	Meta
2	1. Introduction To Energy	To describe how energy is conserved through transformation between different forms.	100				1						1		
			101	U2.1.1	(Predict) Check T or F to show wheter you think each statement is true or false. A. Energy can change from one form to another. B. An object can have only one type of energy at a time. C. If an object has energy, it must be moving. D. All energy travels in waves.		1						1		
			101	U2.1.2.	(Describe) Write a caption for this picture that includes the concept of sound energy.				1				1		
			101	U2.1.3.	(Apply) The phrase conservation of energy has an everyday meaning. We speak of trying to conserve, or save, energy for environmental reasons. It also refers to a law of nature. Use context clues to write your own definition for the meaning of the law of conservation of energy.			1					1		1
			101	U2.1.4.	(Apply) As you learn the definition of each vocabulary term in this lesson, create your own definition or sketch to help you remember the meaning of the term. (Energy, kinetic energy, potential energy, mechanical energy, energy transformation, law of conservation of energy)			1				1	1		
			102	U2.1.5.	(Identify) As you read this page and the next, underline the factors that affect an object's kinetic and potential energy.	1						1			
			103	U2.1.6.	(Diagram) Think of another situation that shows kinetic and potential energy. Draw a sketch of and write a description explaining the situation in terms of potential and kinetic energy.						1		1		
			103	U2.1.7.	(Analyze) Do you think that the skater has any gravitational potential energy at point C? Why?				1				1		
			104	U2.1.8.	(Identify) Label the three forms of energy represented in this image.	1						1			
			105	U2.1.9.	(Compare) How does electrical energy differ from electromagnetic energy?		1						1		
			105	U2.1.10.	(Infer) Would you expect to detect electrical energy if you played the pinball game shown in the picture? Explain you answer.		1						1		
			106	U2.1.11.	(Identify) As you read, underline the source of energy in a chemical reaction.	1						1			
			106	U2.1.12.	(Synthesize) Why is the chemical energy of a battery potential energy and not kinetic energy?						1		1		
			107	U2.1.13.	(Identify) What type of energy is monitored by scientists forecasting future space weather?		1						1		
			107	U2.1.14.	(Infer) Why is space weather a bigger concern now than it was in the past.		1						1		
			107	U2.1.15.	(Research) How do scientists forecast space weather? Why?						1		1		1
			108	U2.1.16	(Describe) Give two examples of other devices in which the chemical energy in a battery is transformed into electrical energy.		1						1	1	
			109	U2.1.17	(Relate) How are energy transformations related to the law of conservation of energy?					1			1		
			109	U2.1.18	(Apply) Have you ever thought about how an MP3 player works? What form of energy is used to power an MP3 player? What form of energy do you use from an MP3 player? Can you think of any other forms of energy that may be used inside of an MP3 player?			1					1		1
			109	U2.1.19	(Describe) Give another example of electrical energy being transformed into light.		1					1	1		
			110	U2.1.20	The total energy in a closed system remains the same/ changes as energy changes forms.	1						1			
			110	U2.1.21.	A basketball that is balanced on the rim of a basketball hoop has potential energy/ kinetic energy?	1						1			
			110	U2.1.22	A basketball that is balanced on the rim of a basketball hoop has potential energy/ kinetic energy?	1						1			
			110	U2.1.23	When a candle is burned, some chemcial energy is transformed into nuclear/ heat energy.		1						1		
			110	U2.1.24.	(Apply) Identify and give examples of at least three types of energy you see being used as you look around your classroom.			1				1	1		
			111	U2.R1.1.	Draw a line to connect the following terms to their definitions. Kinetic Energy.	1						1			
			111	U2.R1.2.	Draw a line to connect the following terms to their definitions. Mechanical Energy	1						1			
			111	U2.R1.3.	Draw a line to connect the following terms to their definitions. Potential Energy	1						1			
			111	U2.R1.4.	(Describe) What happens to the kinetic energy of a snowball as it rolls across the lawn and gains mass?		1						1		
			111	U2.R1.5.	(Relate) How is the sun related to nuclear, electromagnetic, and heat energy?		1						1		1
			111	U2.R1.6.	(Apply) When a person uses an iron to remove the wrinkles from a shirt, why does heat travel from the iron to the shirt?			1					1		
			111	U2.R1.7.	(Explain) What determines the amount of chemical energy a substance has?		1						1		
			111	U2.R1.8.	(Identify) Name at least three types of energy associated with the microwave.	1						1			
			111	U2.R1.9.	(Hypothesize) How is electromagnetic energy from the microwave transformed into heat energy?						1		1		1
			111	U2.R1.10.	(Infer) Explain the law of conservation of energy.		1						1		
						10	12	5	2	1	4	13	24	1	5
					Total number of questions = 34										

Table 29: Textbook # 1 "Matter and Energy" Unit 2 – Lesson 1 RBT Analysis

						Cognitive Process Dimension						Knowledge Dimension			
Unit No.	Lesson No	Learning Outcome	Page No.	Question Number	Question	Rem	Und	App	Ana	Eva	Crea	Fact	Conc	Proc	Meta
2	2.Temperature	To relate the temperature of a substance to the kinetic energy of its particles.	112				1						1		
			113	U2.2.1	(Predict) Check T or F to show wheter you think each statement is true or false. A. Solids and liquids are made of particles, but gases are made of air, which is not made of particles B. Kinetic energy is the energy of motion. C. Kinetic energy depends on mass and speed		1					1			
			113	U2.2.2.	(Illustrate) Think about a time when you were very cold. Then draw a picture of a time when you were very hot. Write a caption about the differences between the two situations.						1				
			113	U2.2.3.	(Synthesize) Many English words have their roots in other languages. Use the Greek words below to make an educated guess about meaning of the word thermometer. A context sentence is provided for help. Then, write a sentence using the word correctly.						1				
			113	U2.2.4.	(Identify) This list contains the key terms you'll learn in this lesson. As you read, circle the definition of each term. (Kinetic theory of matter, temperature, degree, thermometer)	1						1			
			115	U2.2.5.	(Describe) In your own words, describe the difference between the movement of particles in liquids and the movement of particles in gases.		1						1		
			115	U2.2.6.	(Illustrate) Locate another solid, liquid, or gas in this photo. Sketch a representation of the particles that make up the solid, liquid, or gas. Make sure to indicate how fast you think the particles might be moving based on temperature. Then write a caption describing the particle movement.						1		1		
			116	U2.2.7.	(Explain) How does a substance's temperature change when the average kinetic energy of its particles increases ? When it decreases		1						1		
			116	U2.2.8.	(Produce) Write a story about someone who travels from one extreme temperature to another make sure to talk about how your character adjusts to the change in temperature. How are the character's daily activities or decisions affected.						1			1	
			117	U2.2.9.	(Identify) What is body temperature in the Celsius scale? In the Fahrenheit scale? In the Kelvin scale?	1						1			
			117	U2.2.10.	(Apply) The water in swimming pools is typically about 80 degree F. Mark this temperature on the Fahrenheit thermometer above . Estimate what temperature this is in the Celsius and kelvin scales.			1						1	
			118	U2.2.11.	The particles in a hot liquid move _____ than the particles in a cold liquid.	1						1			
			118	U2.2.12.	Temperature is measured using a _____.	1						1			
			118	U2.2.13.	(Infer) If a puddle of water is frozen, do particles in the ice have kinetic energy? Explain		1						1		
			119	U2.R2.1.	For each pair of terms, write a sentence using both words that demonstrates the definition of each word. Kinetic theory of matter and temperature	1						1			
			119	U2.R2.2.	For each pair of terms, write a sentence using both words that demonstrates the definition of each word. Thermometer and degree	1						1			
			119	U2.R2.3.	(Relate) Describe the relationship between temperature and kinetic energy?		1						1		
			119	U2.R2.4.	(Apply) Particles in a warmer substance have a ___average kinetic energy than particles in the substance when it is cooler.			1					1		
			119	U2.R2.5.	(Identify) What are the three scales used to measure temperature? What are the units of each scale?	1						1			
			119	U2.R2.6.	(Observe) Which illustration represents the substance at a higher temperature? Explain					1			1		
			119	U2.R2.7.	(Predict) What would happen to the particles in illustration A if the substance were chilled? What would happen if the particles in illustration B were warmed?		1						1		
			119	U2.R2.8.	(Apply) Using your knowledge of the difference between the three different temperature scales, what do you think would happen if a human's body temperature was 98.6 degree Celsius? Why do doctors worry more about a fever for a couple of degrees celsius than a fever for a couple of degrees fahrenheit?			1					1		
						7	6	3		1	4	8	9	2	
					Total number of questions = 21										

Table 30: Textbook # 1 "Matter and Energy" Unit 2 – Lesson 2 RBT Analysis

						Cognitive Process Dimension						Knowledge Dimensi			
Unit No.	Lesson No	Learning Outcome	Page No.	Question Number	Question	Rem	Und	App	Ana	Eva	Crea	Fact	Conc	Proc	Met
2	3.Thermal Energy and Heat	To analyze the relationship between heat, temperature, and thermal energy	122						1				1		
			123	U2.3.1	(Describe) Fill in the blanks with the words that you think correctly complete the following sentences. When you put your hands on a cold object, like a glass of ice water, your hands become____, The glass of water becomes___if you leave your hands on it for a long time. If you leave the galss of ice water out in the sun, the ice will start	1						1			
			123	U2.3.2.	(Describe) Write your own caption of this photo.						1				
			123	U2.3.3.	(Apply) Many Scientific words, such as conductor, also have everyday meanings. Use context clues to write your own definition for each meaning of the word conductor.			1							
			123	U2.3.4.	(Apply) As you learn the definition of each vocabulary term in this lesson, create your own definition or sketch to help you remember the meaning of the term. (thermal energy, conductor, heat, insulator, calorie, convection, conduction, radiation)			1					1		
			124	U2.3.5.	(Explain) What are two factors that determine the thermal energy of a substance?		1						1		
			125	U2.3.6.	(Apply) For each object pair in the table below, circle the object that has more thermal energy. Assume that both objects are at the same temperature.			1					1		
			126	U2.3.7.	(Apply) For each object pair in the table below, draw an arrow in the direction in which energy in the form o fheat would flow.			1						1	
			127	U2.3.8.	(Apply) What is another heat exchange happening in this picture?			1					1		
			127	U2.3.9.	(Relate) What will happen if two objects at different temperatures come into contact?		1						1		
			128	U2.3.10.	(Compare) Have you ever needed to touch a very hot object? What did you use to touch it without burning yourself? Make a list. Have you ever needed to protect yourself from being cold? What sorts of things did you use? Make a list. Now, looking at the two lists, what do the things have in common?		1					1			
			128	U2.3.11.	(Predict) What are two ways to change the state of a substance?		1					1			
			129	U2.3.12.	(Classify) Decide whether each object below is a conductor or an insulator? Then check the correct box.		1					1			
			130	U2.3.13	(Identify) As you read, underline examples of heat transfer	1						1			
			130	U2.3.14.	(Classify) Fill in the blanks in the chart below with examples of conduction, convection, and radiation		1					1			
			131	U2.3.15.	(Identify) Two examples of radiation are shown in the photos above. What is the source of the radiation in the examples?	1						1			
			131	U2.3.16.	(Relate) Research other places throughout the world where solar cookers are being						1		1		
			131	U2.3.17.	(Produce) Explain how solar cookers are useful to society by doing one of the following: Make a solar cooker and demonstrate how it works/ Write a story about a family who uses a solar cooker to stay healhty and safe.						1				
			132	U2.3.18.	If two objects are at the same temperature, the one with more/ fewer/ the same amount of particles will have a higher thermal energy.	1						1			
			132	U2.3.19.	Heat always flows from cold to hot/ hot to cold/ left to right.	1						1			
			132	U2.3.20.	Adding heat to an object causes bonds between particles to form/break/combine/ This is what allows the state change.	1						1			
			132	U2.3.21.	Conduction is the transfer of energy from a warmer object to a cooler object through a gas/ empty space/ direct contact.	1						1			
			132	U2.3.22.	Energy from the sun travels to Earth through conduction/ convection/ radiation.	1						1			
			132	U2.3.23.	(Conclude) Suppose you are outside on a hot day and you move into the shade of a tree. Which form of energy transfer are you avoiding? Explain.		1						1		
			133	U2.R3.1.	In your own words, define the following terms. Heat		1						1		
			133	U2.R3.2.	In your own words, define the following terms. Thermal energy		1						1		
			133	U2.R3.3.	In your own words, define the following terms. Conduction		1						1		
			133	U2.R3.4.	In your own words, define the following terms. Convection		1						1		
			133	U2.R3.5.	In your own words, define the following terms. Radiation		1						1		
			133	U2.R3.6.	(Compare) What is the difference between heat and temperature?		1						1		
			133	U2.R3.7.	(Predict) If two objects at different temperatures are in contact with each other, what happens to their temperatures?		1						1		
			133	U2.R3.8.	(Classify) Which type of energy transfer is occuring at each lettered area?		1						1		
			133	U2.R3.9.	(Synthesize) Describe the relationships among temperature, heat, and thermal energy?						1		1		
			133	U2.R3.10	(Synthesize) Do you think that solids can undergo convection? Explain						1		1		
						8	15	5			5	12	17	1	

Table 31: Textbook # 1 "Matter and Energy" Unit 2 – Lesson 3 RBT Analysis

						Cognitive Process Dimension						Knowledge Dimension			
Unit No.	Lesson No	Learning Outcome	Page No.	Question Number	Question	Rem	Und	App	Ana	Eva	Crea	Fact	Conc	Proc	Meta
2	4. Effects of Energy Transfer	To recognize how the production and use of different types of energy resources can have environmental consequences.	134			1						1			
			135	U2.4.1	(Identify) In the space below, list as many sources of energy as you can think of. Circle the sources you use most often during a typical day.	1						1			
			135	U2.4.2.	(Describe) Write your own caption of this photo of polluted city.		1					1			
			135	U2.4.3.	(Synthesize) You can often define an unknown word if you know the meaning of its word parts. Use the word parts and sentence below to make an educated guess about the meaning of renewable.						1				1
			135	U2.4.4.	(Apply) As you learn the definition of each vocabulary term in this lesson, create your own definition or sketch to help you remember the meaning of the term. (renewable resource, nonrenewable resource fossil fuel)			1					1		
			136	U2.4.5.	(Identify) As you read, underline ways in which humans use energy.	1							1		
			136	U2.4.6.	(Identify) List all of the examples of objects that use energy in this room.	1							1		
			137	U2.4.7.	(Compare) Fill in the Venn diagram to compare and contrast characteristics of renewable and nonrenewable energy sources.		1						1		
			138	U2.4.8.	(Synthesize) What enviornmental effects are shared by all fossil fuels?						1		1		
			138	U2.4.9.	(Analyze) Use the diagrams below to describe how plant and animal remains can become buried and form natural gas or petroleum (oil) after millions of years of heat and pressure.				1					1	
			139	U2.4.10.	(Apply) Study the three photos of the environmental consequences of obtaining, transporting, and using fossil fuels. Write captions for the second and third			1					1		
			140	U2.4.11.	(Identify) As you read the cards on this page and the next two pages, underline whether each source is renewable or nonrenewable.	1						1			
			140	U2.4.12	(Research) Choose one of these alternative energy sources. Research ways in which the energy from your source is distributed to users. Prepare a brochure explaining your energy source.						1		1		1
			141	U2.4.13.	(Summarize) Use the table to list advantages and disadvantages of each alternative energy source.		1					1			
			142	U2.4.14.	(Summarize) Use the table to list advantages and disadvantages of geothermal and biomass energy sources.		1					1			
			142	U2.4.15.	(Justify) Which of the alternative energy sources do you think would have the least impact on the environment? Explain					1			1		
			143	U2.4.16.	(Predict) Develop a prediction about where the effects of acid rain would be the most pronounced.		1						1		
			143	U2.4.17.	(Assemble) Gather more information about acid rain and organize this information in a poster or illustrated report. Present your poster to your class						1		1		
			143	U2.4.18.	(Research) Identify an area that has been affected by acid rain. What effects are clearly visible? How might those effects be reduced?						1		1		
			144	U2.4.19.	_____resources are those that are easily replaced in nature.	1						1			
			144	U2.4.20.	Spills that endanger animals sometimes occur while transporting_____.	1						1			
			144	U2.4.21.	Sources of renewable alternative energy include wind, solar, hydroelectric._____,	1						1			
			144	U2.4.22.	(Debate) What are some arguments for and against the use of alternative energy sources rather than fossil fuels?					1			1		1
			145	U2.R4.1.	Circle the terms that best complete the following sentences. An example of a renewable energy resource is the sun/biomass/coal.	1						1			
			145	U2.R4.2.	Circle the terms that best complete the following sentences. An example of a nonrenewable energy resource is uranium/wind/natural gas.	1						1			
			145	U2.R4.3.	Circle the terms that best complete the following sentences. Fossil fuels include petroleum, coal, and natural gas/biomass/ geothermal.	1						1			
			145	U2.R4.4.	(Explain) How might a renewable energy source become nonrenewable?		1						1	1	
			145	U2.R4.5.	(Differentiate) Compare the enviromental consequences related to obtaining the three major types of fossil fuels.				1				1		
			145	U2.R4.6.	(Summarize) Why are wind, hydroelectric, and geothermal energy resources not suitable for providing energy worldwide?		1						1		
			145	U2.R4.7.	(Analyze) What percentage of the total energy supply was provided by fossil fuels?				1				1		1
			145	U2.R4.8.	(Analyze) Which renewable resource had the highest percentage of use?				1				1		1
			145	U2.R4.9.	(Recommend) Which alternative energy source do you think should be developed in the future? Explain					1					1
			145	U2.R3.10	(Evaluate) What factors will be important in deciding the future use of energy					1					1
						10	7	2	4	4	5	11	17	2	7
					Total number of questions = 32										

Table 32: Textbook # 1 "Matter and Energy" Unit 2 – Lesson 4 RBT Analysis

						Cognitive Process Dimension						Knowledge Dimension			
Unit No.	Lesson No	Learning Outcome	Page No.	Question Number	Question	Rem	Und	App	Ana	Eva	Crea	Fact	Conc	Proc	Meta
3	1. The Atom	To describe how the development of the atomic theory has led to the modern understanding of the atom and its parts.	156				1						1		
			157	U3.1.1	(Identify) Read over the following vocabulary terms. In the spaces provided, place a+ if you know ther term well, a~ if you have heard the term but are not sure what it means, and a?if you are unfamiliar with the term, Then, write a sentence that includes teh word you are most familiar with. (atom, electron, neutron, proton, nucleus)	1									1
			157	U3.1.2.	(Compare) Use the figure below to answer the questions. Check T or F to show whether you think each statement is true or false. A. Electrons move in orbits in the same way planets orbit the sun. B. If this were a model of the atom, the nucleus would be in the same place as the sun.		1						1		
			157	U3.1.3.	(Apply) Use context clues to write your own definition for the words theory and revise.			1					1	1	
			157	U3.1.4.	(Apply) As you learn the definition of each vocabulary term in this lesson, create your own definition or sketch to help you remember the meaning of the term. (atom, neutron, electron, electron cloud, nucleus, atomic number, proton, mass number)			1					1	1	
			158	U3.1.5.	(Describe) Who was Democritus?	1						1			
			159	U3.1.6.	(Analyze) What can you infer about atoms from this image? What can't you infer from the image?				1				1	1	
			160	U3.1.7.	(Identify) As you read, underline the four main ideas of Dalton's theory of the atom.	1						1			
			160	U3.1.8	(Model) Describe how you would show J.J. Thomson's model of the atom using small beads and clay.						1		1		
			161	U3.1.9.	(Analyze) Today's model of the atom looks different from the models that came before it. Why has the model of the atom changed?				1				1		
			162	U3.1.10.	(Identify) As you read this page and the next , underline the sentences that define the three types of particles that make up an atom.	1						1			
			163	U3.1.11.	(Summarize) Complete the following table with information abou the parts of the atom.		1						1		
			164	U3.1.12	(Compare) How are two atoms of the same element alike?		1						1		
			164	U3.1.13.	(Apply) Research how scientists make new types of atoms using particle accelerators. Choose one element hat has been made by scientists. Create a brochure that describes its properties and how it was made.			1						1	
			165	U3.1.14.	(Calculate) Use this model of a helium atom to find its atomic number and mass number.			1						1	
			166	U3.1.15.	T or F. You can use a light microscope to see the atoms in fabric.	1						1			
			166	U3.1.16.	T or F. According to current atomic theory, electrons are in fixed locations.	1						1			
			166	U3.1.17.	T or F. The nucleus contains neutrons and electrons.	1						1			
			166	U3.1.18.	T or F. Every atom of the same element has the same atomic number.	1						1			
			166	U3.1.19.	(Predict) Explain why you think the current model of the atom will or will not change over time.		1						1		
			167	U3.R1.1.	Draw a line to connect the following terms to their definitions. Atom	1							1		
			167	U3.R1.2.	Draw a line to connect the following terms to their definitions. Proton	1							1		
			167	U3.R1.3.	Draw a line to connect the following terms to their definitions. Neutron	1							1		
			167	U3.R1.4.	(Compare) Compare the charges and masses of protons, neutrons, and electrons.		1						1		
			167	U3.R1.5.	(Explain) How can atoms make up all of the substances around you?		1						1		
			167	U3.R1.6.	(Compare) How does the current model of the atom differ from J.J. Thomson's model?		1						1		
			167	U3.R1.7.	(Calculate) What is the atomic number of a sodium atom that has 11 protons and 12 neutrons?			1						1	
			167	U3.R1.8.	(Analyze) The red sphere represents a proton. What is the atomic number of this atom? Explain how you found the atomic number.				1					1	
			167	U3.R1.9.	(Apply) What is the mass number of an isotope of this atom that has 2 neutrons?			1						1	
			167	U3.R1.10	(Analyze) Where are the nucleus and the electrons located in this atom?				1				1		
			167	U3.R1.11.	(Infer) If atoms are made of smaller parts such as electrons, why are atoms considered the basic unit of matter?		1						1		
						11	8	6	4		1	7	17	8	
					Total number of questions = 30										

Table 33: Textbook # 1 "Matter and Energy" Unit 3 – Lesson 1 RBT Analysis

						Cognitive Process Dimension						Knowledge Dimension			
Unit No.	Lesson No	Learning Outcome	Page No.	Question Number	Question	Rem	Und	App	Ana	Eva	Crea	Fact	Conc	Proc	Meta
3	2.The Periodic Table	To describe the relationship between the arrangement of elements on the periodic table and the properties of those elements.	168				1						1		
			169	U3.2.1	(Describe) Write a word or phrase beginning with each letter of the word GOLD that desribes the properties of these gold coins.		1						1		
			169	U3.2.2.	(Describe) As you wil learn in this lesson elements are arranged by their properties on the periodic table What other objects are often arranged by their properties?		1						1		
			169	U3.2.3.	(Apply) Many scientific words, such as table, also have everyday meanings. Use context clues to write your own definition for each meaning of the word table.			1						1	1
			169	U3.2.4.	(Apply) As you learn the definition of each vocabulary term in this lesson, create your own definition or sketch to help you remember the meaning of the term.(periodic table, nonmetal, chemical symbol, metalloid, average atomic mass, group, metal, period)			1					1		
			170	U3.2.5.	(Identify) Observe the appearance of these six elements. Create two or three categories that group the elements by similar properties. Belwo each element, write the name of the category in which the element belongs.		1						1		
			171	U3.2.6.	(Explain) How did Henry Moseley revise Mendeleev's periodic table?		1						1		
			171	U3.2.7.	(Apply) What are you doing this week? Fill in the calendar with activities or plans you have for this week and next. Do any events occur periodically? Explain			1					1		
			173	U3.2.8	(Analyze) According to the periodic table, how many elements are a liquid at room temperature?				1				1		
			173	U3.2.9.	(Analyze) According to the periodic table, how many elements are metalloids?				1				1		
			174	U3.2.10.	(Apply) What is the average atomic mass of aluminium?			1				1			
			175	U3.2.11.	(Identify) Fill in the blanks below with the word metal, nonmetal, or metalloid.	1						1			
			176	U3.2.12	(Explain) Why do elements within a group have similar chemical properties?		1						1		
			177	U3.2.13	(Apply) Imagine that you have just discovered a new element. Explain where this element would appear on the periodic table and why. Describe the element's properties and propse a chemical symble and name for the element			1						1	
			177	U3.2.14.	(Analyze) List three other elements that have 1 valence electron(Hint: refer to the periodic table)				1					1	
			177	U3.2.15.	(Analyze) List three other elements that have 8 valence electron(Hint: refer to the periodic table)				1					1	
			178	U3.2.16.	Elements in the same _____ have similar properties.	1						1			
			178	U3.2.17	Rows on the periodic table are know as _____.	1						1			
			178	U3.2.18.	This is the _____. Atomic number	1						1			
			178	U3.2.19.	This is the _____ chemical symbol	1						1			
			178	U3.2.20.	This is the _____ chemical name	1						1			
			178	U3.2.21.	This is the _____ average atomic mass.	1						1			
			178	U3.2.22.	(Describe) Some elements are highly unstable and break apart within seconds, making them difficult to study. How can the periodic table help scientists infer the properties of these element?		1						1		
			179	U3.R2.1.	Draw a line to connect the following terms to their definitions. Metal	1							1		
			179	U3.R2.2.	Draw a line to connect the following terms to their definitions. Nonmetal	1							1		
			179	U3.R2.3.	Draw a line to connect the following terms to their definitions. Metalloid	1							1		
			179	U3.R2.4.	(Identify) Elements in the same ____ on the periodic table have the same number of valence electrons.	1						1			
			179	U3.R2.5.	(Identify) Properties of elements within a ____ on the periodic table change in a predictable way from one side of the table to the other.	1						1			
			179	U3.R2.6.	(Describe) What is the purpose of the zigzag line on the periodic table?		1						1		
			179	U3.R2.7.	(Apply) Thorium (Th) has an average atomic mass of 232.04 u and an atomic number of 90. In the space below, draw a square from the periodic table to represent thorium.			1						1	
			179	U3.R2.8.	(Infer) What can you infer about copper and silver based on their position relative to each other?		1						1	1	
			179	U3.R2.9.	(Apply) How does the nucleus of a copper atom compare to the nucleus of a nickel			1					1		
			179	U3.R2.10	(Explain) Explain how chemists can state with certainty that no one will discover an element that would appear on the periodic table between Sulfur (S) and chlorine (Cl)		1						1		1
						12	9	7	4			10	17	6	2
					Total number of questions = 32										

Table 34: Textbook # 1 "Matter and Energy" Unit 3 – Lesson 2 RBT Analysis

						Cognitive Process Dimension						Knowledge Dimension			
Unit No.	Lesson No	Learning Outcome	Page No.	Question Number	Question	Rem	Und	App	Ana	Eva	Crea	Fact	Conc	Proc	Meta
3	3.Electrons and Chemical Bonding	To use atomic models to predict whether atoms can form bonds.	180				1						1	1	
			181	U3.3.1	(Predict) Check T or F to show whether you think each statement is true or false. A. The nucleus of an atom does not change when the atom undergoes a chemical reaction. B. An atom does not react with other atoms if it has the same number of protons as it has electrons. C. All of an atom's electrons can interact with the electrons of other atoms to form bonds.		1					1			
			181	U3.3.2.	(Describe) Fill in the blank with the word or phrase that you think correctly completes the following sentences. Use the model of a lithium atom shown above. A. The _____represents the location of the electrons. B. The _____ is represented by the red and silver spheres.		1						1		
			181	U3.3.3.	(Apply) Many scientific words, such as table, also have everyday meanings. Use context clues to write your own definition for each meaning of the word bond.			1						1	1
			181	U3.3.4.	(Identify) As you read, create a reference card for each vocabulary term. On one side of the card, write the term and its meaning. On the other side, draw an image that illustrates or makes a connection to the term. These cards can be used as bookmarks in the text so that you can refer to them while studying.(chemical bond, valence	1							1		
			182	U3.3.5.	(Describe) What are chemical bonds?		1						1		
			182	U3.3.6.	(Identify) Draw arrows that point to the location of the chemical bonds in the water molecule. (Hint: The oxygen atom is red, and the hydrogen atoms are blue).	1						1			
			183	U3.3.7.	(Analyze) Label each hydrogen atom with an "H" and each chlorine atom with a "Cl"				1					1	
			183	U3.3.8	(Apply) How many of each type of atom are there on each side of the arrow?			1					1		
			183	U3.3.9.	(Infer) How can you tell that atoms are not created or destroyed by the chemical		1						1		
			184	U3.3.10.	(Describe) Write a caption for each model describing what it shows.						1		1		1
			185	U3.3.11.	(Identify) As you read, underline the maximum number of electrons that can be in the first energy level of an atom.	1						1			
			185	U3.3.12	(Apply) A fluorine atom has nice electrons, Draw a model to determine how many valence electrons the atom has.			1						1	
			186	U3.3.13.	(Apply) How many valence electrons do nitrogen (N) and phosporus (P) have?			1						1	1
					(Research) Some of the molecules in our bodies can be composed of hundreds, thousands, or even millions of atoms. Research one molecule that is found in our bodies. Identify the atoms that form bonds in the molecule. Then, create a model of this										
			187	U3.3.14.	(Research) Some of the molecules in our bodies can be composed of hundreds, thousands, or even millions of atoms. Research one molecule that is found in our bodies. Identify the atoms that form bonds in the molecule. Then, create a model of this molecule.						1		1	1	
			187	U3.3.15.	(Compare) In the space below each Bohr model, write the number of valence electrons that each atom has.		1						1		
			187	U3.3.16.	(Classify) Circle the atoms that are likely to form chemical bonds with other atoms.		1						1		
			188	U3.3.17	T or F. Atoms are rearranged during a chemical change when bonds break and form.	1						1			
			188	U3.3.18.	T or F. A Bohr model is the best choice to show how atoms are arranged in molecules	1						1			
			188	U3.3.19.	T or F. The atom above is reactive because its outermost energy level is not full.	1						1			
			188	U3.3.20.	(Infer) Why are atoms of lithium, sodium, and potassium almost never found alone in nature?		1						1		
			189	U3.R3.1.	Circle the term that best completes each of the following sentences. A chemical bond joins atoms/ electrons/ together in a water molecule.	1						1			
			189	U3.R3.2.	Circle the term that best completes each of the following sentences. The four valence electrons of a carbon atom are in its innermost/ outermost energy level.	1						1			
			189	U3.R3.3.	(Relate) Which of the following can happen during a chemical change? A. Atoms change into new types of atoms. B. Bonds break, and new bonds form. C. Nuclei of atoms break apart and combine. D. All of the electrons in the atom are lost.		1						1		
			189	U3.R3.4.	(Explain) What are the three ways in which an atom can form bonds with other atoms?		1					1	1		
			189	U3.R3.5.	(Identify) Sulfur (S) is in Group 16 of the periodic table. How many valence electrons does an atom of sulfur have?	1						1			
			189	U3.R3.6.	(Model) Find beryllium (Be) on the periodic table. In the space below, draw a Bohr model of a beryllium atom.						1		1		
			189	U3.R3.7.	(Analyze) How many valence electrons do nitrogen atoms have?				1				1		
			189	U3.R3.8.	(Infer) Explain whether nitrogen atoms will form bonds with other atoms.		1						1		
			189	U3.R3.9.	(Distinguish) How would a Bohr model of a neon atom differ from the model of nitrogen?				1				1		
			189	U3.R3.10	(Apply) Imagine you need to make a model that shows the locations of the parts of a sodium atom. Explain which type of model you would use.			1						1	
						9	10	5	3		3	10	16	6	3
					Total number of questions = 30										

Table 35: Textbook #1 "Matter and Energy" Unit 3 Lesson 3 RBT Analysis

						Cognitive Process Dimension						Knowledge Dimension			
Unit No.	Lesson No	Learning Outcome	Page No.	Question Number	Question	Rem	Und	App	Ana	Eva	Crea	Fact	Conc	Proc	Meta
3	4. Ionic, Covalent, and Metallic Bonding	To describe the interactions between atoms in Ionic, covalent, and metallic bonding.	192				1						1		
			193	U3.4.1	(Predict) Check T or F to show whether you think each statement is true or false. A. Metals are good conductors of electric current. B. An ion is always a negatively charged particle. C. Some atoms bond by sharing electrons. D. Metallic bonds are the strongest type of bond.		1					1			
			193	U3.4.2.	(Describe) Write a short description that explains how the pieces of a puzzle can stay together without the use of glue or tape.		1						1		
			193	U3.4.3.	(Synthesize) You can often define an unknown term if you know the meaning of its word parts. Use the word parts and sentence below to make an educated guess about the meaning of the term covalent bond.						1			1	1
			193	U3.4.4.	(Apply) As you learn the definition of each vocabulary term in this lesson, create your own defintion or sketch to help you remember the meaning of the term. (Ion, molecule, ionic bond, metallic bond, covalent bond)			1					1		
			194	U3.4.5.	(Identify) Explain the difference between a positive and a negative ion.	1						1			
			195	U3.4.6.	(Identify) Which propertly of ionic bonds is illustrated on the right? What other physical properties does this structure affect?	1						1			
			196	U3.4.7.	(Compare) In the table below, list the differences between ionic and covalent bonds.		1					1			
			197	U3.4.8	(Identify) As you read, underline the difference between covalent bonds and the forces holding molecules close to each other.	1							1		
			197	U3.4.9.	(Infer) With a classmate, discuss why oil and vinegar do not mix, How might this example relate to covalent bonding?		1						1		
			198	U3.4.10.	(Identify) As you read, underline the characteristics of electrons in a metallic bond.	1							1		
			198	U3.4.11.	(Explain) How does the electron "sea" help metal bend without breaking?		1							1	
			199	U3.4.12	(Compare) Fill in the Venn diagram to compare and contrast ionic and metallic compounds.		1								1
			200	U3.4.13.	Ionic bonds usually form between a positively charged metal ion and a negatively charged metal/ nonmetal ion.	1							1		
			200	U3.4.14.	In general, covalent compounds have low / high boiling points.	1						1			
			200	U3.4.15.	Metals can/ cannot be reshaped without breaking.	1						1			
			200	U3.4.16.	(Summarize) List the similarities and differences between ionic, covalent, and metallic bonds.		1						1		
			201	U3.R4.1.	Draw a line to connect the following terms to their definitions. Molecule	1						1			
			201	U3.R4.2.	Draw a line to connect the following terms to their definitions. Ion	1						1			
			201	U3.R4.3.	Draw a line to connect the following terms to their definitions. Covalent Bond	1						1			
			201	U3.R4.4.	(Explain) Describe the role electrons in the formation of a covalent bond.		1						1		
			201	U3.R4.5.	(Identify) How is the position of electrons involved in metallic bonding different from the position of electrons that form ionic and covalent bonds?		1						1		
			201	U3.R4.6.	(List) Name the physical properties that many ionic compounds share.	1						1			
			201	U3.R4.7.	(Identify) Which is a better conductor of electric current: a solid ionic compound or a melted ionic compound?	1						1			
			201	U3.R4.8.	(Identify) What is an ion?		1						1		
			201	U3.R4.9.	(Identify) Is the substance in the chart a metal or nonmetal?Explain		1							1	
			201	U3.R4.10	(Infer) Is the substance described in the chart above held together by metallic, covalent, or ionic bonds? Explain.		1						1		
			201	U3.4.11.	(Infer) Why might metallic bonding be weak compared to ionic and covalent bonding?		1						1		
			201	U3.4.12.	(Distinguish) Which type of bond does the phrase "opposites attract" apply to best? Explain				1				1		1
						12	13	1	1		1	11	13	3	3
					Total number of questions = 28										

Table 36: Textbook #1 "Matter and Energy" Unit 3 Lesson 4 RBT Analysis

						Cognitive Process Dimension						Knowledge Dimension			
Unit No.	Lesson No	Learning Outcome	Page No.	Question Number	Question	Rem	Und	App	Ana	Eva	Crea	Fact	Conc	Proc	Meta
4	1.Chemical Reactions	To use balanced chemical equations to model chemical reactions.	212					1					1	1	
			213	U4.1.1	(Identify) Unscramble the letters below to find two types of energy that can be released when chemical reactions occur. Write your words on the blank lines.	1								1	
			213	U4.1.2.	(Describe) Write your own caption to the photo below. Describe what kind of changes have happened to the ship and anchor.				1				1		1
			213	U4.1.3.	(Synthesize) You can often define an unknown term if you know the meaning of its word parts. Use the word parts and sentence below to make an educated guess about the meaning of the term exothermic.						1			1	1
			213	U4.1.4.	(Identify) This list contains the vocabulary terms you'll learn in this lesson. As you read, circle the definition of each term. (Chemical reaction, chemical formula, chemical equation, reactant, product, law of conservation of mass, endothermic reaction, exothermic reaction, law of conservation of energy)	1						1	1		
			214	U4.1.5.	(Identify) In each blank box, identify the evidence that a chemical reaction has taken place.		1						1		
			215	U4.1.6.	(Identify) Circle the subscript in the chemical formula below.	1						1			
			215	U4.1.7.	(Analyze) Atoms of which elements are involved in this reaction?				1				1		
			215	U4.1.8	(Apply) How many atoms of each element are in one molecule of the product?			1						1	
			216	U4.1.9.	(Compare) What is the difference between a coefficient and a subscript?		1						1		
			217	U4.1.10.	(Calculate) Fill in the blanks below to balance this chemical equation. Sketch the products and reactants to show that the number of each type of atom is the same.			1						1	
			217	U4.1.11.	(Apply) Research hydrogen-powered vehicles. Create a poster that describes the advantages and disadvantages of vehicles that use hydrogen as a fuel. Be sure to include a balanced equation to represent the use of hydrogen fuel.			1						1	
			218	U4.1.12	(List) Name three everyday exothermic chemical reactions.	1						1			
			219	U4.1.13.	(Describe) What happens to the energy absorbed during an endothermic reaction?		1						1		
			219	U4.1.14.	(Compare) Complete the Venn diagram to compare endothermic and exothermic reactions.		1						1	1	
			220	U4.1.15.	(Identify) As you read, underline factors that affect reaction rate.	1						1			
			221	U4.1.16.	(Describe) Explain how enzymes affect reactions.		1						1		
			221	U4.1.17	(Research) Lactose intolerance is a condition that occurs when people are unable to digest milk products. Investigate the cause of lactose intolerance. Write a summary of your findings.						1		1		1
			221	U4.1.18.	(Design) Create a project that explains how lactose intolerance affects people and why it occurs present your project as a written report, a poster, or an oral report.						1		1		1
			222	U4.1.19.	One sign of a chemical reaction is the formation of a solid _____.	1						1			
			222	U4.1.20.	A balanced chemical equation shows that chemical reactions follow the law of conservation of _____.	1						1			
			222	U4.1.21.	The total amount of energy before and after a chemical reaction is _____	1						1			
			222	U4.1.22.	A_____is not changed much by a chemical reaction.	1						1			
			222	U4.1.23.	The rate of reaction is_____at higher temperature because particles collide more often.	1						1			
			222	U4.1.24.	(Design) Write a procedure for how you would measure the effect of reactant concentration on the reaction rate.						1			1	
			223	U4.R1.1.	Draw a line to connect the following terms to their definitions. Reactant	1						1			
			223	U4.R1.2.	Draw a line to connect the following terms to their definitions. Product	1						1			
			223	U4.R1.3.	(Describe) What happens to the atoms in the reactants during a chemical		1						1		
			223	U4.R1.4.	(Explain) How does a balanced chemical equation show that mass is never lost or gained in a chemical reaction?		1						1		
			223	U4.R1.5.	(Relate) Describe four ways you could increase the rate of a chemical reaction.			1				1	1		
			223	U4.R1.6.	(Compare) How do exothermic and endothermic reactions differ?		1						1		
			223	U4.R1.7.	(Model) The reactants in the above reaction are hydrogen and nitrogen. The product is ammonia. IN the space below, write a balanced chemical equation that represents the reaction.			1						1	
			223	U4.R1.8.	(Analyze) This reaction releases energy as heat. Explain whether the reaction is exothermic or endothermic and whether it obeys the law of conservation of energy.				1				1		1
			223	U4.R1.9.	(Evaluate) Two colorless solutions are mixed together. Bubbles form as the solution is stirred. Give two possible explanations for this result.					1			1		1
			223	U4.R1.10	(Apply) The chemical formula for glucose is C6H12O6. What are the names of the elements in glucose, and how many atoms of each element are present in a glucose molecule?			1						1	
						12	8	6	3	1	4	12	16	9	6
					Total number of questions = 34										

Table 37: Textbook #1 "Matter and Energy" Unit 4 Lesson 1 RBT Analysis

						Cognitive Process Dimension						Knowledge Dimension			
Unit No.	Lesson No	Learning Outcome	Page No.	Question Number	Question	Rem	Und	App	Ana	Eva	Crea	Fact	Conc	Proc	Meta
4	2. Organic Chemistry	To describe how carbon forms many of the molecules essential to modern materials and living things.	224				1						1		
			225	U4.2.1	(Identify) Unscramble the letters below to find materials that are made from organic compounds. Write your words on the blank lines.				1					1	1
			225	U4.2.2.	(Predict) Make a list of five objects in your classroom. Predict which of these objects are made of organic compounds.		1						1		
			225	U4.2.3.	(Synthesize) Many English words have their roots in other languages. Use the Greek words below to make an educated guess about the meaning of the word						1			1	1
			225	U4.2.4.	(Identify) As you read, place a question mark next to any words that you don't understand. When you finish reading the lesson, go back and review the text that you marked. If the information is still confusing, consult a classmate or a teacher.(organic compound, carbohydrate, hydrocarbon, polymer, organic acid)	1							1		1
			226	U4.2.5.	(Identify) As you read, underline the location of a valence electron in a carbon	1						1			
			226	U4.2.6.	(Identify) Locate and circle the bonds in the molecule below.	1							1		
			227	U4.2.7.	(Identify) Circle the triple bond in the diagram below.	1							1		
			227	U4.2.8	(Analyze) Does this molecule contain any double or triple bonds? Explain your				1				1		
			228	U4.2.9.	(Apply) Write the chemical formula for a compound that contains 5 carbon atoms, 12 hydrogen atoms, and 1 oxygen atom. The symbol for oxygen is O.			1						1	
			229	U4.2.10.	(Identify) As you read, underline the characteristics of the full structural formula and the simplified structural formula.	1						1			
			229	U4.2.11.	(Apply) The simplified structural formula of acetic acid is shown below. Write the full structural formula for this compound.			1						1	
			230	U4.2.12	(Identify) As you read, underline the two main roles of organic molecules in living	1						1			
			230	U4.2.13.	(Identify) List two nonliving and two living things in the photograph that contain carbon compounds.	1						1			
			231	U4.2.14.	(Identify) Each highlighted element below is found in an organic compound. Based on your reading, identify the item that contains each element.					1				1	
			232	U4.2.15.	(Identify) As you read this page and the next, underline the characteristics of each type of organic compounds.	1						1			
			233	U4.2.16.	(Synthesize) Candle wax belongs to a class of organic compounds called lipids. Look up the relationship between lipids and organic acids. Share your findings						1		1		1
			233	U4.2.17	(Apply) Determine whether each structure below represents a hydrocarbon, an organic acid, or a carbohydrate. The first one has been done for you.			1						1	
			234	U4.2.18.	(Identify) As you read, underline examples of organic compounds that contain	1						1			
			234	U4.2.19.	(Apply) The structure below is a portion of a plastic called polyvinyl chloride (PVC). Place square brackets around one of its monomers.			1							
			235	U4.2.20.	(Explain) Why are organic compounds used in electronic displays?		1						1		
			235	U4.2.21.	(Predict) How might the increasing use of OLED technology help reduce energy consumption?		1						1		1
			235	U4.2.22.	(Research) Use the Internet to discover different applications for OLED technology and create a poster display with your findings.						1			1	1
			236	U4.2.23.	A carbon atom forms bonds with its _____electrons.	1						1			
			236	U4.2.24.	Plants and animals use organic compounds for _____ and_____.	1						1			
			236	U4.2.25	The double bond in a carboxyl group is located between a(n) ____ atom and a carbon atom.	1						1			
			236	U4.2.26.	(Synthesize) Explain why carbon is able to form so many different types of		1				1		1		1
			237	U4.R2.1.	Draw aline to connect the following terms to their definitions. Organic Acid	1						1			
			237	U4.R2.2.	Draw aline to connect the following terms to their definitions. Hydrocarbon	1						1			
			237	U4.R2.3.	Draw aline to connect the following terms to their definitions. Polymer	1						1			
			237	U4.R2.4.	Draw aline to connect the following terms to their definitions. Carbohydrate	1						1			
			237	U4.R2.5.	(Explain) Why are the valence electrons of carbon important?		1						1		
			237	U4.R2.6.	(Distinguish) How do hydrocarbons differ in structure from carbohydrates?				1				1		
			237	U4.R2.7.	(Relate) How are monomers related to polymers?		1						1		
			237	U4.R2.8.	(Catergorize) What types of bonds are present in this molecule?		1						1		
			237	U4.R2.9.	(Analyze) What elements are present in this molecule?			1						1	
			237	U4.R2.10	(Solve) What is the chemical formula for this organic compound?										
			237	U4.R2.11.	(Debate) Can aromatic compounds belong to other classes of compounds? Explain your answer.				1				1		1
			237	U4.R2.12.	(Apply) How does a carbon atom's ability to form bonds with other carbon atoms allow it to form large molecules?			1					1		
						16	7	6	4	1	4	13	15	8	8
					Total number of questions = 38										

Table 38: Textbook #1 "Matter and Energy" Unit 4 Lesson 2 RBT Analysis

						Cognitive Process Dimension						Knowledge Dimension			
Unit No.	Lesson No	Learning Outcome	Page No.	Question Number	Question	Rem	Und	App	Ana	Eva	Crea	Fact	Conc	Proc	Meta
4	3. Nuclear Reaction	To distinguish nuclear reactions and compare the types of nuclear reactions	240				1		1				1		
			241	U4.3.1.	(Identify) Fill in the blank with the words or phrases that you think correctly completes the following sentence. Use the model to help you. The nucleus of this atom contains two ___and two____.	1						1			
			241	U4.3.2.	(Relate) List three things that you think of when you hear the word radioactivity.	1						1			
			241	U4.3.3.	(Synthesize) Many English words have their roots in other languages. Use the Greek words below to make an educated guess about the meaning of the words fission and fusion.						1			1	1
			241	U4.3.4.	(Identify) This list contains the vocabulary terms you'll learn in this lesson. As you read, circle the definition of each term. (nuclear reaction, nuclear fission, isotope, nuclear fusion, radioactive decay)	1						1			
			242	U4.3.5.	(Summarize) What happens to the mass of atoms during a nuclear reaction?		1						1		
			243	U4.3.6.	(Compare) As you read, underline what happens during a nuclear reaction that does not happen during a chemical reaction.		1						1		
			243	U4.3.7.	(Model) Draw an isotope of beryllium-9 that has two more particles in the nucleus that the beryllium-7 isotope below. Label the protons and neutrons in your model.						1		1		
			244	U4.3.8	(Identify) As you read this page and the next, underline the products of each type of radioactive decay.	1						1			
			245	U4.3.9.	(Identify) What are two effects of too much exposure to radiation?	1							1		
			245	U4.3.10.	(Apply) Which types of nuclear radiation can pass through a T-shirt?			1							
			246	U4.3.11.	(Apply) Research a way that radioactive decay is used. Create a brochure that explains the application, identifies the isotope that decays, and describes the type of decay.						1		1	1	1
			247	U4.3.12	(Infer) Why is it important that radioactive tracers decay quickly?		1						1		
			247	U4.3.13.	(Research)Investigate another medical technology that uses nuclear radiation to detect or treat cancer.				1				1		1
			247	U4.3.14.	(Distinguish) X-ray images are made by passing x-rays through the body to develop film that is sensitive to x-rays. The x-rays are produced by a machine. In what way are x-ray images different from the images taken using radioactive tracers?				1				1		
			248	U4.3.15.	(Describe) What happens to the uranium nucleus shown above when it is hit by a neutron?		1						1		
			249	U4.3.16.	(Explain) Where does the energy that is released by a fission reaction come from?		1						1		
			249	U4.3.17	(Graph) Make a bar graph of the number of neutrons released by the reactions at each of the three stages of the chain reaction below. Add a bar to show the predicted number of neutrons at the fourth stage if two neutrons from each fission reaction hit another nucleus.			1					1		
			250	U4.3.18.	(Identify) As you read, underline what control rods do.	1							1		
			250	U4.3.19.	(Analyze) Fill in the blanks to show how nuclear energy changes into electrical energy inside a nuclear power plant.				1				1		
			251	U4.2.20.	(Debate) In small teams, debate whether nuclear fission should be used to provide energy.		1						1		
			252	U4.3.21.	(Identify) What are the products of nuclear fusion?	1						1			
			252	U4.3.22.	(Summarize) Use the table to record the number of each type of particle present before and after the fusion reaction of four hydgrogen nuclei.		1						1		
			253	U4.3.23.	(Identify) As you read, underline the reason scientists are trying to produce fusion reactions on Earth.	1						1			
			254	U4.3.24.	Isotopes of an element have different numbers of protons/ neutrons.	1						1			
			254	U4.3.25	The type of radiation with the most penetrating power is alpha particles/ beta particles/ gamma rays.	1						1			
			254	U4.3.26.	The energy released during fission comes from mass/ chemical energy.	1						1			
			254	U4.3.27	The neutrons/ smaller nuclei released during fission can cause additional fission reactions.	1						1			
			254	U4.3.28.	Nuclear fusion is the source of energy in nuclear power plants/ the sun.	1						1			
			254	U4.3.29.	(Analyze) In what ways can a nucleus change during a nuclear reaction?				1				1		
			255	U4.R3.1.	Draw a line to connect the following terms to their definitions. Nuclear reaction	1						1			
			255	U4.R3.2.	Draw a line to connect the following terms to their definitions. Radioactive decay	1						1			
			255	U4.R3.3.	Draw a line to connect the following terms to their definitions. Nuclear Fission	1						1			
			255	U4.R3.4.	Draw a line to connect the following terms to their definitions. Nuclear Fusion	1						1			
			255	U4.R3.5.	(Explain) How is a nuclear reaction different from a chemical reaction?		1						1		
			255	U4.R3.6.	(Describe) What types of atoms release nuclear radiation?		1						1		
			255	U4.R3.7.	(Explain) How are nuclear chain reactions controlled in nuclear power plants?		1						1		
			255	U4.R3.8.	(Analyze) Why are the products of nuclear fusion slightly less massive than the reactants?				1				1		
			255	U4.R3.9.	(Contrast) Give two reasons why fusion could be a better energy source than fission.		1						1		
			255	U4.R3.10	(Conclude) One nucleus contains 31 protons and 40 neutrons. Another nucleus contains 31 protons and 41 neutrons. What can you conclude about the identity of					1				1	
			255	U4.R3.11.	(Infer) Why can the effects of radioactive decay on the body be useful and harmful?		1						1		
			255	U4.R3.12.	(Analyze) What decay process is shown? Explain				1				1		1
						17	12	2	6	1	3	15	23	3	4
					Total number of questions = 41										

Table 39: Textbook #1 "Matter and Energy" Unit 4 Lesson 3 RBT Analysis

						Cognitive Process Dimension						Knowledge Dimension			
Unit No.	Lesson No	Learning Outcome	Page No.	Question Number	Question	Rem	Und	App	Ana	Eva	Crea	Fact	Conc	Proc	Meta
5	1.Solutions	To summarize the characteristics of a solutions	266				1					1	1		
			267	U5.1.1.	(Explain) What happens when you combine a powdered drink mix with water?		1						1		
			267	U5.1.2.	(Describe) Write a caption describing the mixture being made in the jar.		1						1		1
			267	U5.1.3.	(Apply) Many Scientific words, such as solution, also have everyday meanings. Use context clues to write your own definition for each meaning of solution.			1					1		1
			267	U5.1.4.	(Apply) As you learn the definition of each vocabulary term in this lesson, create your own definition or sketch to help you remember the meaning of the term. (Solution, concentration, solute, solubility, solvent)			1					1		
			268	U5.1.5.	(Identify) As you read, underline some common characteristics of solutions.	1						1	1		
			268	U5.1.6.	(Compare) On the note cards below, write down three characteristics of each example of a mixture		1						1		
			269	U5.1.7.	(Categorize) Fill in spaces A, B, C, and D in the table with the appropriate state- liquid, solid, or gas.		1						1		
			270	U5.3.8	(Compare) What is the difference between a dilute solution and a concentrated solution?		1						1		
			270	U5.1.9.	(Research) Identify some common household items that are solutions. Try to categorize each as a dilute or concentrated solution. Create a poster illustrating the items you find.					1			1	1	1
			271	U5.1.10.	(Predict) Draw a picture to illustrate what might happen when more solute is added to a saturated solution.		1						1		
			272	U5.1.11.	(Graph) Plot a line graph using the data at the right to show the relationship between the solubility of Oxygen in water and pressure at 10 degree celsius.			1						1	
			272	U5.1.12	(Describe) Explain the relationship between pressure and solubility.		1						1		
			273	U5.1.13.	(Identify) As you read, underline factors that affect how fast a solid solute dissolves in a liquid solvent.	1						1			
			273	U5.1.14.	(Describe) Write a caption describing each method of dissolving sugar in water.		1						1		
			274	U5.1.15.	A solute dissolves in a(n)_____.	1						1			
			274	U5.1.16.	A solution in which no more solute can dissolve is _____.	1						1			
			274	U5.1.17	At higher temperatures, the solubility of a solid_____,	1						1			
			274	U5.1.18.	(Synthesize) Suppose you want to serve fruit juice mixed with carbonated water at a picnic. Describe what you could do to be sure the drinks keep their fizz for as long as possible. Explain why your method would work.						1		1		1
			275	U5.R1.1.	Draw aline to connect the following terms to their definitions. Solvent	1						1	1		
			275	U5.R1.2.	Draw aline to connect the following terms to their definitions. Solute	1						1	1		
			275	U5.R1.3.	Draw aline to connect the following terms to their definitions. Concentration	1						1	1		
			275	U5.R1.4.	Draw aline to connect the following terms to their definitions. Solubility	1						1	1		
			275	U5.R1.5.	(Identify) In a solution of water and salt, which substance is the solute?	1						1			
			275	U5.R1.6.	(Describe) How does pressure affect the solubility of gases?		1						1		
			275	U5.R1.7.	(Explain) How could you dissolve more solid solute in a saturated solution in a liquid solvent? Explain.		1						1		
			275	U5.R1.8.	(Predict) Which would dissolve sugar faster: hot tea or iced tea? Explain your answer.				1				1		
			275	U5.R1.9.	(Analyze) How does an increase in temperature affect the solubility of each compound in 100g H_2O?				1				1		
			275	U5.R1.10	(Infer) How can you influence the rate at which the solutes dissolve in 100 g H_2O at either temperature?		1						1		
			275	U5.R1.11.	(Predict) Suppose the temperature was lowered at 18 degree celsius. How do you think this would affect the solubility of each solute?		1						1		
						10	12	3	2	1	1	10	23	2	4
					Total number of questions = 29										

Table 40: Textbook #1 "Matter and Energy" Unit 5 Lesson 1 RBT Analysis

						Cognitive Process Dimension						Knowledge Dimension			
Unit No.	Lesson No	Learning Outcome	Page No.	Question Number	Question	Rem	Und	App	Ana	Eva	Crea	Fact	Conc	Proc	Meta
5	2. Acids, Bases, and Salts.	To have an understanding of the physical and chemcial properties of acids, bases, and salts and how these chemicals are commonly used.	276				1						1		
			277	U5.2.1.	(Identify) Unscramble the letters below to find five common items containing acids, bases, or salts. Write your words on the blank lines.	1									1
			277	U5.2.2.	(Describe) Describe the taste of vinegar. Do you think vinegar is acidic or a basic?		1						1		1
			277	U5.2.3.	(Apply) Many Scientific words, such as solution, also have everyday meanings. Use context clues to write your own definition for each meaning of the word neutral.			1							1
			277	U5.2.4.	(Identify) As you read, place a question mark next to any words that you don't understand. When you finish reading the lesson, go back and review the text that you marked. If the information is still confusing, consults a classmate or your teacher. (acid, base, neutralization reaction, salt)	1						1	1		
			278	U5.2.5.	(Identify) What are two common substances that contain an acid?	1						1			
			279	U5.2.6.	(Identify) What ions form when HCl dissolves in water?	1						1	1		
			279	U5.2.7.	(Identify) What ions form when sodium hydroxide dissolves in water.	1						1	1		
			279	U5.2.8	(Label) On each of the labeled cards, write the chemical formula of each ion.			1					1		
			280	U5.2.9.	(Classify) As you read, underline the factor that determines the strength of an acid or base.				1				1		
			280	U5.2.10.	(Explain) Describe what happens when a weak acid dissolves in water.		1						1		
			280	U5.2.11.	(Contrast) How does a strong base behave differently from a weak base?		1						1		
			281	U5.2.12	(Infer) Do you think the acid secreted from the nudibranch is as strong a protection as the hard outer shell that some other slugs have? Explain.		1						1		
			281	U5.2.13.	(Research) Investigate another animal that produces acid to protect itself.					1			1	1	
			281	U5.2.14.	(Compose) Choose one of the species shown on this page Write a short description of a possible encounter with a predator. Explain how this creature used acids or bases to defend itself.						1		1		1
			282	U5.2.15.	(Classify) Label each image as either a physical property or a chemical property of an acid.		1						1		
			283	U5.2.16.	(Explain) What type of indicators can you use to determine the presence of an acid or base in solution?		1						1		
			283	U5.2.17	(Identify) List the physical and chemical properties of acids and bases on the index cards below.	1						1			
			284	U5.2.18.	(Identify) As you read, underline the products that form in a neutralization reaction.	1							1		
			284	U5.2.19.	(Describe) The photo at the right shows an antacid table dissolving in water. Describe what is taking place. What ions do you think are forming?		1						1		1
			285	U5.2.20	(Explain) What determines the identity of the salt that forms in a neutralization reaction?		1						1		
			285	U5.2.21.	(Research) Natural chalk is no longer used to make blackboard and sidewalk chalk. Find out what natural chalk is, where it is found and how it forms. Explain why natural chalk is no longer used for drawing on sidewalks.					1			1		1
			286	U5.2.22.	(Classify) On these two pages, you can read about some common acids, bases , and salts and their uses. Identify each as an acid, a base, or a salt.		1					1	1		
			286	U5.2.23	(Infer) Hydrochloric acid is found in swimming pools and in your stomach. How does it function in each situation?		1						1		
			287	U5.2.24.	(Identify) What properties of a substance can you examine to determine whether it is an acid or a base?	1						1			
			287	U5.2.25.	(Predict) What do you think would happen if you spread regular table salt (sodium chloride) on an icy sidewalk?		1						1		
			288	U5.2.26.	When an acid breaks apart in water, a(n)___ ion is formed.	1						1			
			288	U5.2.27.	Bases form ___ ions in water.	1						1			
			288	U5.2.28.	Strong acids and bases conduct an electric current because	1						1			
			288	U5.2.29.	Acids turn blue litmus paper _____,	1						1			
			288	U5.2.30.	In a neutralization reaction, _____ and a salt are formed.	1						1			
			288	U5.2.31.	_____is used to prevent ice from forming on roads.	1						1			
			288	U5.2.32.	(Evaluate) Explain the following statement: A concentrated acid is not necessarily a strong acid.					1			1		
			289	U5.R2.1.	Draw aline to connect the following terms to their definitions. Acid	1						1			
			289	U5.R2.2.	Draw aline to connect the following terms to their definitions. Base	1						1			
			289	U5.R2.3.	Draw aline to connect the following terms to their definitions. Salt	1						1			
			289	U5.R2.4.	Draw aline to connect the following terms to their definitions. Neutralization Reaction	1						1			
			289	U5.R2.5.	(Identify) Which of the following is a chemical property of a base?	1						1			
			289	U5.R2.6.	(Identify) What particle increases in number when a base is dissolved in water?	1						1			
			289	U5.R2.7.	(Classify) Which of the following is classified as a salt: ammonia or sodium chloride?		1						1		
			289	U5.R2.8.	(Classify) Are many common foods we eat more likely to be acidic or basic?		1						1		
			289	U5.R2.9.	(Contrast) Describe the difference between strong acid and a weak acid.		1						1		
			289	U5.R2.10	(Analyze) A salt is formed when nitric acid (HNO_3) combines with sodium hydroxide ($NaOH$). What ions are present in the salt that forms?				1				1		
			289	U5.R2.11.	(Infer) Pickles are preserved by soaking cucumbers in a vinegar solution. What are some properties of these pickles?					1			1		
			289	U5.R212.	(Infer) How might the vinegar solution help keep pickles from for a long period of time?				1				1		
						20	14	2	3	4	1	19	27	1	6
					Total number of questions = 44										

Table 41: Textbook #1 "Matter and Energy" Unit 5 Lesson 2 RBT Analysis

						Cognitive Process Dimension						Knowledge Dimension			
Unit No.	Lesson No	Learning Outcome	Page No.	Question Number	Question	Rem	Und	App	Ana	Eva	Crea	Fact	Conc	Proc	Meta
5	3. Measuring pH	To describe the pH scale and how it is used to classify a solution as either acidic, basic, or neutral	294				1						1		
			295	U5.3.1.	(Identify) Unscramble the letters below to find five common items containing acids, bases, or salts. Write your words on the blank lines.	1						1			1
			295	U5.3.2.	(Describe) Explain why you think a scientist might test the water quality in a river or stream.		1						1		1
			295	U5.3.3.	(Apply) Use context clues to write your own definition for each meaning of the words precise and estimate.			1							1
			295	U5.3.4.	(Apply) As you learn the definition of the vocabulary term in this lesson, create your own defintition or sketch to help you remember the meaning of the term. (pH)			1					1		1
			296	U5.3.5.	(Identify) As you read, underline the pH values that indicate an acidic solution, a neutral solution, and a basic solution.	1						1			
			296	U5.3.6.	(Calculate) If the pH of a solution changes from pH 8 to pH 3, what is the change in H3O+ concentration?			1						1	
			297	U5.3.7.	(Identify) Write the name of each item in the appropriate column in the table to identify the solution as acidic, neutral, basic.	1							1		
			298	U5.3.8	(Describe) Write a caption to explain each method of measuring pH. Then place a check next to the method you think is the most accurate.		1							1	1
			299	U5.3.9.	(Describe) Explain how hydrangeas may help gardeners decide what else to plant in their garden.		1						1		
			299	U5.3.10.	(Research) How does the pH of soil affect plant growth?					1				1	
			299	U5.3.11.	(Discuss) Gardeners often measure the pH of soil. Discuss why gardeners want to know the pH of soil. How might gardeners use this information?					1			1		1
			300	U5.3.12	(Predict) A decrease in the pH of the soil might affect the ecosystem shown, Choose two species other than the blue heron that could be affected and explain		1						1		1
			301	U5.3.13.	(Describe) How does acid rain form?		1					1	1		
			301	U5.3.14.	(Research) With a partner, research a specific area or environment that has been affected by acid rain. Present your research to the class.					1			1		1
			302	U5.3.15.	(Identify) As you read, underline ways in which pH affects our health.	1						1	1		
			302	U5.3.16.	(Infer) Use information from this lesson to fill in the missing pH level of the anacid in the diagram below.		1						1		
			302	U5.3.17	(Explain) Antacid tablets help restore the stomach to normal pH levels. What property of the antacid allows for this?		1					1	1		
			303	U5.3.18.	(Analyze) Decide whether each condition would result in acidosis or alkalosis, Place a check in the box to show your diagonsis.				1				1		
			304	U5.3.19.	The pH of a solution depends on the concentration of ____ions.	1						1			
			304	U5.3.20	The pH of soil and streams can decrease because of _____rain.	1						1			
			304	U5.3.21.	A solution with a pH less than 7 is _____.	1						1			
			304	U5.3.22.	A solution with a pH greater than 7 is _____.	1						1			
			304	U5.3.23	A blood pH of greater than 7.45 leads to the condition called _____.	1						1			
			304	U5.3.24.	(Support) Use an example to support the following statement: living things may be unable to survive if their environment is not kept within a suitable pH range.				1				1		
			305	U5.R3.1.	In your own words, define the following term. pH			1					1		
			305	U5.R3.2.	(Describe) What might cause stomach pH to become more acidic than normal?		1						1		
			305	U5.R3.3.	(Compare) How is the concentration of H3O+ ions and OH- ions different in an acid solution and a basic solution?		1						1		
			305	U5.R3.4.	(Decide) Myra wants to measure the pH of a sample of drinking water as accurately as possible. What method should she use?					1			1		1
			305	U5.R3.5.	(Conclude) A student uses universal pH paper to find the pH of three solutions. Solution A has a pH of 5, solution B has a pH of 11, and solution C has a pH of 7. Identify which solution is acidic, which solution is neutral, and which solution is					1			1	1	1
			305	U5.R3.6.	(Evaluate) Devon says that acid in your tomach will make you unhealthy. Do you agree or disagree? Explain.					1			1		1
			305	U5.R3.7.	(Analyze) When a volvano erupts, sulfur oxides are released into the atmosphere. How does this volcanic eruption affect precipitation?				1				1		
			305	U5.R3.8.	(Apply) If the volcanic eruption lowers the pH of the water in a nearby lake, how might this lowered pH harm living things in the lake?			1					1		
						9	9	5	3	6	0	10	21	4	11
					Total number of questions = 32										

Table 42: Textbook #1 "Matter and Energy" Unit 5 Lesson 3 RBT Analysis

						Cognitive Process Dimension						Knowledge Dimension			
Unit No.	Lesson No	Learnining Outcome	Page No.	Question No.	Question	Rem	Und	App	Ana	Eva	Crea	Fact	Conc	Proc	Meta
1. Life Over Time	1. Introduction To Living Things	To describe the necessities of life and the characteristics that all living things share.	4				1					1			
			5	U1.1.1.	(Compare) both of these pictures show living things. How are these living things different?		1					1			
			5	U1.1.2.	(List)Many of the things that people need to stay alive are not found in space List the things that the International Space Station must have to keep astrounauts alive?	1						1			
			5	U1.1.3.	(Synthesize) Many English words have their roots in other languages. Use the Greek words below to make an educated guess about the meaning of the word homeostasis?						1		1		1
			5	U1.1.4.	(Identify) This list contains the vocabulary terms you'll learn in this lesson As you read, underline the definition of each term.	1							1		
			6	U1.1.5.	(Categorize) Identify each organism in the picture as unicellular or multicellular.		1						1	1	
			6	U1.1.6.	(Analyze) Why are these sunflowers all facing in the same direction?				1				1		1
			6	U1.1.7.	(Infer) Fill in the response that a dog might have to each stimulus listed in the table		1						1		
			8	U1.1.8.	(Identify) As you read underline the ways in which organisms reproduce.	1						1			
			8	U1.1.9.	(Identify) Use the check boxes to identify which offspring are identical to the parent or parents and which offspring are not identical.				1				1		1
			9	U1.1.10.	(Describe) List three activities that you have done today that require energy.		1						1		
			9	U1.1.11.	(Describe) How does a frog grow and develop? Write a caption for each picture to describe each stage in a frog's life.		1						1		
			10	U1.1.12.	(Identify) As you read, underline the four necessities of life	1						1			
			10	U1.1.13.	(Describe) How do the young eagles in the picture get each necessity of life?		1						1		
			11	U1.1.14.	(Describe) Look for these four organisms in the picture. How does each organism get its food?				1						1
			12	U1.1.15.	Sunlight is an example of (A) homeostasis / stimulus	1						1			
			12	U1.1.16.	Binary Fission is an example of asexual/ sexual reproduction	1						1			
			12	U1.1.17	Plants are producers/consumers.	1						1			
			12	U1.1.18.	Decomposers return organisms/ nutrients to the environment.	1						1			
			12	U1.1.19.	(Hypothesize) How do some producers and consumers each rely on light from the					1					1
			13	U1R1.1.	In your own terms, define the following term:homeostasis		1						1		
			13	U1R1.2.	In your own terms, define the following term: asexual reproduction.		1						1		
			13	U1R1.3.	In your own terms, define the following terms: cell		1						1		
			13	U1R1.4.	(Explain) What is the relationship between a stimulus and a response?		1						1		
			13	U1R1.5.	(Describe) What happens to DNA during sexual reproduction?		1						1		
			13	U1R1.6.	(Contrast) What are the differences between producers, consumers, and decomposers?		1						1		
			13	U1R1.7.	(Describe) Use the pictures to answer the question below: what is happening to the birds in the picture above?				1						1
			13	U1R1.8.	(Explain) Use the pictures to answer the question below: How do nutrients and energy allow the changes shown in the picture to happen				1				1		
			13	U1R1.9.	(Compare) How is a fish similar to an oak tree?		1						1		1
			13	U1R1.10.	(Making Inferences) Could life as we know it exist on Earth if air contained only oxygen? Explain				1				1		1
						8	13		6	1	1	8	18	1	8
					Total number of Questions = 29										

Table 43: Textbook #2 "The Diversity of Living Things" Unit 1 Lesson 1 RBT Analysis

						Cognitive Process Dimension						Knowledge Dimension			
Unit No.	Lesson No	Learnining Outcome	Page No.	Question No.	Question	Rem	Und	App	Ana	Eva	Crea	Fact	Conc	Proc	Meta
1	2. Theory of Evolution by Natural Selection	To describe the role of genetic and environment factors in the theory of evolution by natural selection	14				1						1		
			15	U1.2.1.	(Predict) Check T or F to show whether you think each statement is true or false a. fur color can help prevent an animal from being eaten. B. The amount of available food can affect an organism's survival. C. Your parents' characteristics are not passed to you. d. A species can go extinct if its habitat is destroyed.		1					1			
			15	U1.2.2.	(Infer) How do you think this bird and this flower are related? Explain your answer		1						1		1
			15	U1.2.3.	(Synthesize) You can often define an unknown word by clues provided in the sentence. Use the sentence below to make an educated guess about the meaning of the word artificial: Example Sentence: Many people prefer real sugar to artificial sweeteners made by humans.						1				1
			15	U1.2.4.	(Apply) As you learn the definition of each vocabulary term in this lesson, create your own definition or sketch to help you remember the meaning of the term.			1					1		
			16	U1.2.5.	(Explore) Trace Darwin's route on the map, and choose one of the following stops on his journey: Galapagos Islands, Andes Mountains, Australia, Do research to find out what plants and animals live there . Then write an entry in Darwin's log to describe what he might have seen.			1						1	1
			17	U1.2.6.	(Infer) How do you think the pointed beak of this woodpecker finch helps it to get food?				1				1		1
			18	U1.2.7.	(List) Darwin studied artificial selection in the pigeons that he bred. List three other domestic animals that have many different breeds.	1						1			
			19	U1.2.8.	(Identify) As you read, underline the names of other important thinkers who influenced Darwin's ideas.	1						1			
			19	U1.2.9.	(Apply) Explain why the size of your muscles is partly an acquired trait and partly dependent on DNA.			1					1		
			19	U1.2.10.	(Summarize) What can you conclude from the two red growth lines on this graph?			1					1	1	
			20	U1.2.11.	(Infer) A fish may have hundreds of offspring at a time, and only a small number will survive. Which characteristics of fish might allow them to survive?		1							1	
			21	U1.2.12.	(Summarize) How did large jaws and teeth become typical traits of jaguars?		1						1		1
			21	U1.2.13.	(Explain) In the table below, explain how each part of natural selection works. A. overproduction b. genetic variation c. selection d. adaptation		1						1		
			22	U1.2.14.	(Identify) Underline examples of adaptations	1						1			
			22	U1.2.15.	Write a caption to describe how this butterfly's long mouth part helps it to survive.					1			1		1
			23	U1.2.16.	(Summarize) How has ice cover near the North Pole changed in the last few decades?		1						1		
			23	U1.2.17.	(Infer) How do you think this environmental change will affect species that live in the surrounding area?		1						1		
			24	U1.2.18.	Darwin's theory of natural selection was influenced by his own observations and the work of other scientists. Through natural/artificial selection, breeders choose the traits that are passed on to the next generation.	1						1			
			24	U1.2.19.	The theory of evolution by natural selection states that organisms with advantageous traits produce more offspring. Natural selection can act only on acquired traits/ inherited variation.	1						1			
			24	U1.2.20.	Many extinctions have occurred over the course of Earth's history. Because of environmental change, dinosaurs eventually became mutated/ extinct.	1						1			
			25	U1R2.1.	Use the term from the lesson to complete the sentences below: The four parts of natural selection are overproduction, _____, selection, and adaptation,	1						1			
			25	U1R2.2.	_____is the process by which populations change over time	1						1			
			25	U1R2.3.	The hollow bones of birds, which keep birds lightweight for flying, is an example of a(n)___	1						1			
			25	U1R2.4.	(Summarize) Describe Darwin's observations on the Galapagos islands during his voyage on the HMS Beagle		1								1
			25	U1R2.5.	(Explain) How does environmental change affect the survival of a species?		1						1		
			25	U1R2.6.	(Compare) Why are only inherited traits, not acquired ones, involved in the process of natural selection?		1						1		
			25	U1R2.7.	(Describe) What is the relationship between mutation, natural selection, and adaptation?		1						1		
			25	U1R2.8.	(Apply) How is each of these lizards adapted to its environment?			1					1		1
			25	U1R2.9.	(Infer) What might happen to a population of rabbits in a forest if a new predator moved to the forest?		1						1		
						9	12	5	1	1	1	10	15	3	8
					Total number of questions = 29										

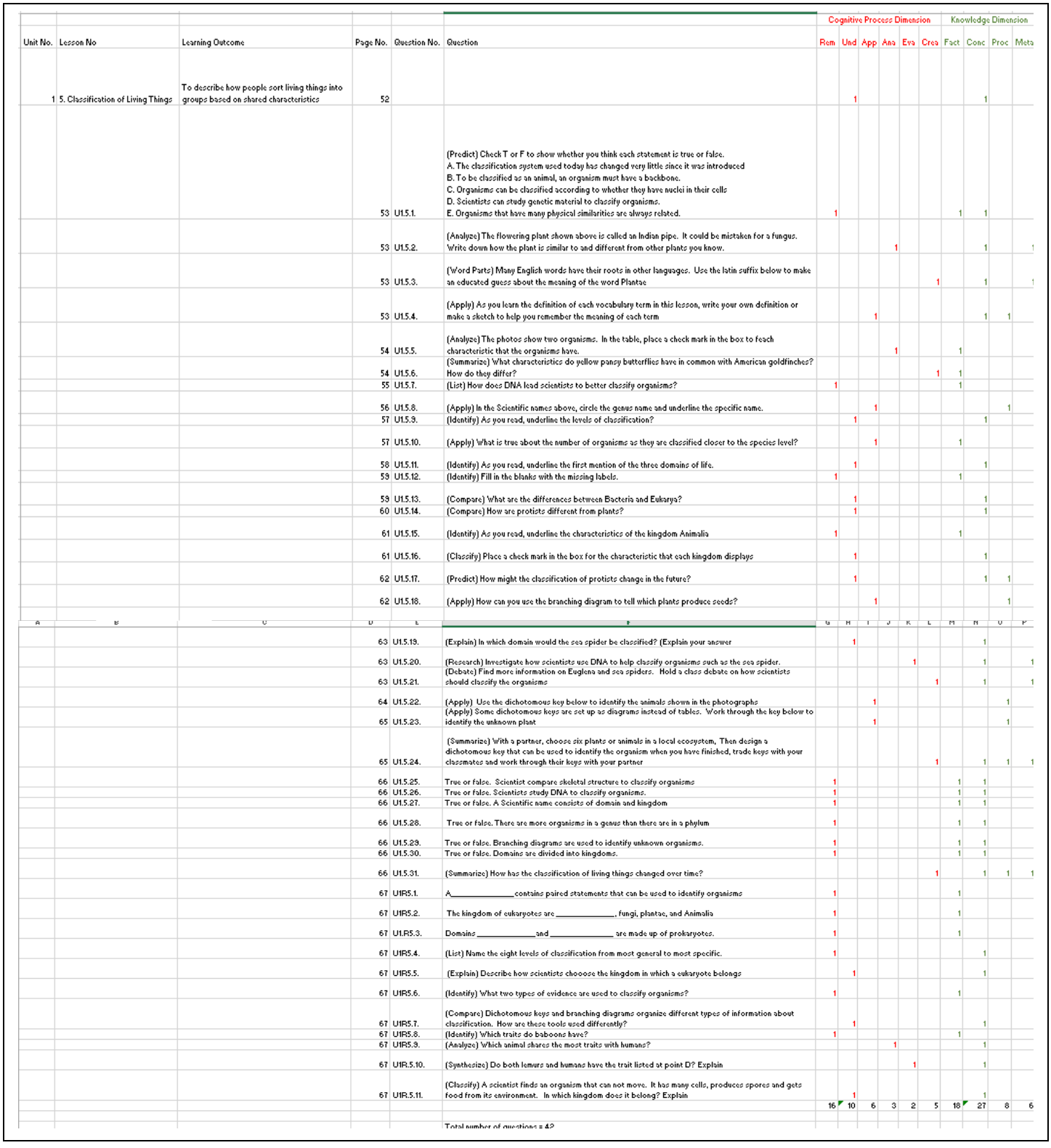
Table 44: Textbook #2 "The Diversity of Living Things" Unit 1 Lesson 2 RBT Analysis

						Cognitive Process Dimension						Knowledge Dimension			
Unit No.	Lesson No	Learning Outcome	Page No.	Question No.	Question	Rem	Und	App	Ana	Eva	Crea	Fact	Conc	Proc	Meta
1	3. Evidence of Evolution	To describe the evidence that supports the theory of evolution by natural selection	28				1						1		
			29	U1.3.1.	(Predict) Check T or F to show whether you think each statement is true or false. A. Fossils provide evidence of organisms that lived in the past b. The wing of a bat has simlar bones to those in a human arm. C. DNA can tell us how closely related two organisms are. D. Whales are descended from land-dwelling mammals.	1						1			
			29	U1.3.2.	(Infer) This is a Petokey stone, which is made up of tiny coral fossils. What can you infer if you find a coral fossil on land?		1						1		
			29	U1.3.3.	(Synthesize) You can often define an unknown word if you understand the parts of the word. Use the words belwo to make an educated guess about the meaning of the word fossil record.						1				1
			29	U1.3.4.	(Apply) As you learn the definition of each vocabulary term in this lesson, create your own definition or sketch to help you remember the meaning of the term			1					1		
			30	U1.3.5.	(Examine) What features of the organisms are preserved in amber?				1				1		1
			31	U1.3.6.	(Identify) As you read, underline the steps that describe how a cast fossil forms	1						1			
			31	U1.3.7.	(Identify) Describe the environment in which this organism lives.	1						1			
			31	U1.3.8.	(Infer) How is this organism like both a fish and a four-legged vertebrate, such as an amphibian?				1						1
			32	U1.3.9.	(List) What is a common ancestor?	1							1		
			32	U1.3.10.	(Relate) Do you see any similarities between the bones of the bat and cat limbs and the bones of the human arm? If so, use the colors of the bat and cat bones to color similar bones in the human arm.				1						1
			33	U1.3.11.	(Infer) The number of amino acids in human cytochome c differs between humans and the species at left. Which two species do you infer are the least closely related to humans?			1					1	1	
			35	U1.3.12.	(Identify) Circle the pairs of nitrogen bases (G, T, C, A) that differ between the hippopotamus and humpback whale DNA.				1			1			
			35	U1.3.13.	(Infer) How do you think these bones are involved in a whale's movement?		1						1		
			35	U1.3.14.	(Analyze) Examine the four skeletons. Indicate which species appears to be best adapted for swimming underwater for a long time. Which characters allow the animal to behave this way?				1				1		
			36	U1.3.15.	Complete the summary and circle the correct word. Fossile evidence shows that life on Earth has changed overtime. The remains of once-living organisms are called fossils/ancestors.	1						1			
			36	U1.3.16.	Evolutionary theory is also supported by structural, genetic, and developmental evidence, Similarities/ Differences in internal structures support evidence of common ancestry.	1						1			
			36	U1.3.17.	Scientists use evidence from many fields of living organisms. The tiny leg bones/ large dorsal fins of modern whales are an example of unused structures.	1						1			
			36	U1.3.18.	(Summarize) How does the fossil record provide evidence of the diversity of life?		1						1		1
			37	U1R3.1.	Which word means "the remains or imprints of once-living organisms found in layers of rock?"	1						1			
			37	U1R3.2.	Which word means "the history of life in the geologic past as indicated by the imprints or remains of living things?"	1						1			
			37	U1R3.3.	(Identify) What are two types of evidence that suggest that evolution has occurred?	1						1			
			37	U1R3.4.	(Explain) How do fossils provide evidence that evolution has taken place?		1						1		
			37	U1R3.5.	(Apply) What is the significance of the Similar number and arrangement of bones in a human arm and a bat wing?			1					1		1
			37	U1R3.6.	(Imagine) If you were a scientist examining the DNA sequence of two unknown organisms that you hypothesize share a common ancestor, what evidence would you expect to find?					1			1		
			37	U1R3.7.	(Identify) What do the data suggest about how related turtles are to humans compared to tuna and chimpanzees?				1				1		
			37	U1R3.8.	(Infer) If there are no differences between the amino acid sequences in the cytochome c protein of humans and chimpanzees, why aren't we the same species?					1			1		
			37	U1R3.9.	(Apply) Explain why the pattern of differences that exists from earlier to later fossils in the fossil record supports the idea that evolution has taken place on Earth.			1					1		
						10	4	4	6	2	1	10	14	1	6
					Total number of questions = 27										

Table 45: Textbook #2 "The Diversity of Living Things" Unit 1 Lesson 3 RBT Analysis

						Cognitive Process Dimension						Knowledge Dimension			
Unit No.	Lesson No	Learning Outcome	Page No.	Question No.	Question	Rem	Und	App	Ana	Eva	Crea	Fact	Conc	Proc	Meta
1. Life Over Time	4. The History of life on Earth	To describe the evolution of life on Earth over time, using the geologic time scale	38				1						1		
			39	U1.4.1.	(Predict) Check T or F to show whether you think each statement is true or false. A. a mass extinction occurs when a large number of species go extinct during a relatively short amount of time. B. The largest division of the geologic time scale is the era.		1					1	1		
			39	U1.4.2.	(Draw) Imagine you find a fossil of a fish. Which parts of the fish could you see in the fossil? Draw what you think you would see below.						1		1		
			39	U1.4.3.	(Apply) Use Context clues to write your own definition for the words fossil record and extinction.			1					1		
			39	U1.4.4.	(Identify) As you read, place a question mark next to any words that you don't understand. When you finish reading the lesson, go back and review the text that you marked If the information is still confusing, consult a classmate or a teacher.		1						1		
			40	U1.4.5.	(Infer) What does relative dating tell you about fossil A?		1						1		
			40	U1.4.6.	(Solve) What does absolute dating tell you about fossil			1					1	1	
			41	U1.4.7.	(Describe) What changes do you see in the limb structure of the three animals above?		1						1		
			41	U1.4.8.	(Describe) How can the extinction of an organism be inferred from evidence in the fossil record?		1						1		
			42	U1.4.9.	(Identify) Underline one reason why it is hard for scientists to study the early history of Earth .		1					1			
			42	U1.4.10.	(Identify) When did the Paleozoic era begin and end?	1						1			
			43	U1.4.11.	(List) Which three periods make up the Mesozoic era?	1						1			
			44	U1.4.12.	(Summarize) How are cyano bacteria related to increases in oxygen in the atmosphere?						1		1	1	
			45	U1.4.13.	(Compose) Select one of the organisms that lived during the Paleozoic era and find out more about it Make a poster with the information about the organism.						1			1	
			45	U1.4.14.	(Describe) Based on this drawing, describe the landscape that existed during the Carboniferous period of the Paleozoic era.		1						1		1
			46	U1.4.15.	(Identify) As you read, underline the names of animals that lived in the Mesozoic era.	1						1			
			46	U1.4.16.	the chain of events that, according to a main hypothesis, resulted in a mass extinction at the end of the Mesozoic era.						1		1	1	1
			47	U1.4.17.	(Hypothesize) How might the mass extinction that occurred at the end of the Mesozoic era relate to the dominance of mammals in the Cenozoic era?					1			1		
			48	U1.4.18.	To complete the summary circle the correct word. The fossil record provides evidence of ancient life. Absolute/ relative dating estimates the age of a fossil in years.	1						1			
			48	U1.4.19.	eras, periods, and epochs. Epochs/ Eras are characterized by the type of organism that dominated Earth at the time	1						1			
			48	U1.4.20.	the Paleozoic era, the Mesozoic era, and the Cenozoiz era. Primates evolved during the mesozoic era/ cenozoic era.	1						1			
			48	U1.4.21.	(Synthesize) Starting with precambrian time, briefly describe how life on Earth has changed over Earth's long						1		1	1	1
			49	U1R4.1.	Matching the following terms to their definitions – fossil	1						1			
			49	U1R.4.2.	Matching the following terms to their definitions– geoglogic time scale	1						1			
			49	U1R.4.3.	Matching the following terms to their definitions– fossil record	1						1			
			49	U1R.4.4.	Matching the following terms to their definitions–	1						1			
			49	U1R.4.5.	(List) What four major divisions make up the history of life on Earth in the geologic time scale?	1						1			
			49	U1R. 4.6.	(Explain) What is one distinguishing feature of each of the four major divisions listed in your previous answer.		1					1			
			49	U1R. 4.7.	(Contrast) How do the atmospheric conditions near the beginning of Precambrian time contrast with the atmospheric conditions that are present now? Which organism is largely responsible for this change?				1			1		1	
			49	U1R.4.8.	(Explain) The fossils shown are of a marine organism. In which of the three rock layers would you expect to find fossils of an organism that went extinct before the marine organism evolved? Explain your answer.				1			1	1	1	
						11	8	2	2	1	5	16	14	7	8
					Total number of questions = 29										

Table 46: Textbook #2 "The Diversity of Living Things" Unit 1 Lesson 4 RBT Analysis



						Cognitive Process Dimension						Knowledge Dimension			
Unit No.	Lesson No	Learning Outcome	Page No.	Question No.	Question	Rem	Und	App	Ana	Eva	Crea	Fact	Conc	Proc	Meta
1	5. Classification of Living Things	To describe how people sort living things into groups based on shared characteristics	52				1						1		
			53	U1.5.1.	(Predict) Check T or F to show whether you think each statement is true or false. A. The classification system used today has changed very little since it was introduced B. To be classified as an animal, an organism must have a backbone. C. Organisms can be classified according to whether they have nuclei in their cells D. Scientists can study genetic material to classify organisms. E. Organisms that have many physical similarities are always related.	1						1	1		
			53	U1.5.2.	(Analyze) The flowering plant shown above is called an Indian pipe. It could be mistaken for a fungus. Write down how the plant is similar to and different from other plants you know.				1				1		1
			53	U1.5.3.	(Word Parts) Many English words have their roots in other languages. Use the latin suffix below to make an educated guess about the meaning of the word Plantae						1		1		1
			53	U1.5.4.	(Apply) As you learn the definition of each vocabulary term in this lesson, write your own definition or make a sketch to help you remember the meaning of each term			1					1	1	
			54	U1.5.5.	(Analyze) The photos show two organisms. In the table, place a check mark in the box to feach characteristic that the organisms have.				1			1			
			54	U1.5.6.	(Summarize) What characteristics do yellow pansy butterflies have in common with American goldfinches? How do they differ?						1	1			
			55	U1.5.7.	(List) How does DNA lead scientists to better classify organisms?	1						1			
			56	U1.5.8.	(Apply) In the Scientific names above, circle the genus name and underline the specific name.			1						1	
			57	U1.5.9.	(Identify) As you read, underline the levels of classification?		1						1		
			57	U1.5.10.	(Apply) What is true about the number of organisms as they are classified closer to the species level?			1				1			
			58	U1.5.11.	(Identify) As you read, underline the first mention of the three domains of life.		1						1		
			59	U1.5.12.	(Identify) Fill in the blanks with the missing labels.	1						1			
			59	U1.5.13.	(Compare) What are the differences between Bacteria and Eukarya?		1						1		
			60	U1.5.14.	(Compare) How are protists different from plants?		1						1		
			61	U1.5.15.	(Identify) As you read, underline the characteristics of the kingdom Animalia	1						1			
			61	U1.5.16.	(Classify) Place a check mark in the box for the characteristic that each kingdom displays		1						1		
			62	U1.5.17.	(Predict) How might the classification of protists change in the future?		1						1	1	
			62	U1.5.18.	(Apply) How can you use the branching diagram to tell which plants produce seeds?			1						1	
A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
			63	U1.5.19.	(Explain) In which domain would the sea spider be classified? (Explain your answer		1						1		
			63	U1.5.20.	(Research) Investigate how scientists use DNA to help classify organisms such as the sea spider.					1			1		1
			63	U1.5.21.	(Debate) Find more information on Euglena and sea spiders. Hold a class debate on how scientists should classify the organisms						1		1		1
			64	U1.5.22.	(Apply) Use the dichotomous key below to identify the animals shown in the photographs			1						1	
			65	U1.5.23.	(Apply) Some dichotomous keys are set up as diagrams instead of tables. Work through the key below to identify the unknown plant			1						1	
			65	U1.5.24.	(Summarize) With a partner, choose six plants or animals in a local ecosystem. Then design a dichotomous key that can be used to identify the organism when you have finished, trade keys with your classmates and work through their keys with your partner						1		1	1	1
			66	U1.5.25.	True or false. Scientist compare skeletal structure to classify organisms	1						1	1		
			66	U1.5.26.	True or false. Scientists study DNA to classify organisms.	1						1	1		
			66	U1.5.27.	True or false. A Scientific name consists of domain and kingdom	1						1	1		
			66	U1.5.28.	True or false. There are more organisms in a genus than there are in a phylum	1						1	1		
			66	U1.5.29.	True or false. Branching diagrams are used to identify unknown organisms.	1						1	1		
			66	U1.5.30.	True or false. Domains are divided into kingdoms.	1						1	1		
			66	U1.5.31.	(Summarize) How has the classification of living things changed over time?						1		1	1	1
			67	U1R5.1.	A_____contains paired statements that can be used to identify organisms	1						1			
			67	U1R5.2.	The kingdom of eukaryotes are _____, fungi, plantae, and Animalia	1						1			
			67	U1.R5.3.	Domains _____and _____ are made up of prokaryotes.	1						1			
			67	U1R5.4.	(List) Name the eight levels of classification from most general to most specific.	1							1		
			67	U1R5.5.	(Explain) Describe how scientists chooose the kingdom in which a eukaryote belongs		1						1		
			67	U1R5.6.	(Identify) What two types of evidence are used to classify organisms?	1						1			
			67	U1R5.7.	(Compare) Dichotomous keys and branching diagrams organize different types of information about classification. How are these tools used differently?		1						1		
			67	U1R5.8.	(Identify) Which traits do baboons have?	1						1			
			67	U1R5.9.	(Analyze) Which animal shares the most traits with humans?				1				1		
			67	U1R.5.10.	(Synthesize) Do both lemurs and humans have the trait listed at point D? Explain					1			1		
			67	U1R.5.11.	(Classify) A scientist finds an organism that can not move. It has many cells, produces spores and gets food from its environment. In which kingdom does it belong? Explain		1						1		
						16	10	6	3	2	5	18	27	8	6
					Total number of questions = 42										

Table 47: Textbook #2 "The Diversity of Living Things" Unit 1 Lesson 5 RBT Analysis

						Cognitive Process Dimension						Knowledge Dimension			
Unit No	Lesson No	Learning Outcome	Page No.	Question No.	Question	Rem	Und	App	Ana	Eva	Crea	Fact	Conc	Proc	Meta
2	1. Archaea, Bacteria, and Viruses	To describe the characteristicss of archaea bacteria, and viruses.	78				1					1			
	1. Archaea, Bacteria, and Viruses	To explain how they reproduce or replicate	78				1						1		
			79	U2.1.1.	(Predict) Check T or F to show whether you think each statement is true or false. A. Some bacteria are helpful. B. Viruses are living things. C. A single bacterium can produce many offspring at one time.		1					1			1
			79	U2.1.2.	(Predict) Using the photo on the right and what you know of bacteria. How do you think bacteria and archaea are similar?					1			1		1
			79	U2.1.3.	(Apply) Many Scientific words, such as host, also have everyday meaning. Use context clues to write your own definition for each meaning of the word host.			1						1	1
			79	U2.1.4.	(Identify) This list contains the vocabulary terms you'll learn in this lesson. As you read circle the definition of each term	1						1			
			80	U2.1.5.	(Identify) As you read, underline the characteristics of prokaryotes.	1						1			
			80	U2.1.6.	On the lines below, describe the characteristics of prokaryotic cells and eukaryotic cells.		1					1			
			81	U2.1.7.	(Identify) As you read, underline unusual places where archaea can live.	1						1			
			81	U2.1.8.	(Explain) What evidence suggests that archaea are more closely related to eukaryotes than bacteria are?		1						1		
			82	U2.1.9.	(Illustrate) Draw an example of each of the three bacteria shapes described above.			1						1	1
			83	U2.1.10.	(Relate) What is the advantage for bacteria that form endospores?					1			1		1
			83	U2.1.11.	(Predict) This pond is full of decaying leaves and wood as well as living aquatic plants and animals. In what parts of the pond do you think bacteria might live?				1				1		1
			84	U2.1.12.	(Identify) As you read, underline the steps that occur when bacterium reproduces using binary fission.	1								1	
			84	U2.1.13.	A bacterium undergoes binary fission. After thirty minutes, both new cells are ready to divide again. If this generation divides, and so does the following generation, how many total bacteria will there be? You may want to draw a diagram to check you answer.					1			1		
			85	U2.1.14.	(Diagram) Fill in the missing labels in this flow chart to complete the description of conjugation.						1		1		
			86	U2.1.15.	(Identify) List three reasons viruses are not living things.	1							1		
			87	U2.1.16.	(Describe) How did the 1918 - 1919 flu differ from other strains of the flu?		1						1		
			87	U2.1.17	(Research) In 2009, H1N1 Flu caused many cases of the flue around the world. Research how H1N1 flu differs from the 1918 - 1919 flu.					1			1	1	1
			87	U2.1.18.	(Predict) How would a flu pandemic be different today than in 1918? In what ways it be easier or harder to fight a new flu virus now?		1								1
			88	U2.1.19.	(Explain) Why can't plants catch a cold?		1						1		
			89	U2.1.20.	(Identify) Fill in the blank labels with the terms virus, host cell, and new viruses as you study the image to understand lytic cycle.	1							1		
			89	U2.1.21.	(Apply) With a classmate, discuss why some scientists say that viruses replicate instead of reproduce.			1					1		
			90	U2.1.22.	To complete the summary circle the correct word. Archae are prokaryotes with variable cell walls made up of unique molecules. Archaea are more/ less similar to eukaryotes than bacteria are.		1						1		
			90	U2.1.23.	Bacteria are prokaryotes that can have a round, rod, spiral shape. Binary fission is asexual reproduction, because the offspring are copies of/ different from the original cell		1						1		
			90	U2.1.24.	Viruses are nonliving particles made of a protein coat and genetic material. Viruses are not alive because they do not release energy/ have DNA or RNA.		1						1		
			91	U2R1.1.	A(n)_____ is made of genetic material and a protein coat.	1						1			
			91	U2R1.2.	_____is when one cell reproduces by dividing in half to become two cells.	1						1			
			91	U2R1.3.	A virus needs a(n)_____ to reproduce.	1						1			
			91	U2R1.4.	(Compare) How do prokaryotes and eukaryotes differ?		1						1		
			91	U2R1.5.	(Describe) What are the characterisitics of archaea?		1						1		
			91	U2R1.6.	(Identify) In the lytic cycle, the host cell a. destroys the virus, b. becomes the virus, c. is destroyed, d. undergoes cell division				1				1		1
			91	U2R1.7.	(Explain) How do the cell walls of archae and bacteria differ?		1						1		
			91	U2R1.8.	(Explain) Describe the process illustrated in the diagram above. How many individuals would exist if the process continued for one more generation?		1								1
			91	U2R1.9.	(Apply) Unlike some archae, most bacteria die when their environment reaches extremely hight temperature. How can people kill harmful bacteria that might live in some human foods?			1							1
						9	13	4	2	4	1	8	13	4	11
					Total number of questions = 33										

Table 48: Textbook #2 "The Diversity of Living Things" Unit 2 Lesson 1 RBT Analysis

						Cognitive Process Dimension						Knowledge Dimension			
Unit No.	Lesson No	Learning Outcome	Page No.	Question No	Question	Rem	Und	App	Ana	Eva	Crea	Fact	Conc	Proc	Meta
2	2. Protists and Fungi	To describe the characteristicss of protists and fungi	92				1					1			
	2. Protists and Fungi	To explain how they reproduce or replicate	92				1						1		
			93	U2.2.1.	(Predict) Check T or F to show whether you think each statement is true or false. A. Mushrooms belong to the kingdom plantae B. Algae use sunlight to make food through photosynthesis C. Spores are important in fixing atmospheric nitrogen		1						1		
			93	U2.2.2.	(Describe) The photo below shows a protist you might be familiar with – seaweed. Write a caption for the photo that describes this protist		1							1	1
			93	U2.2.3.	(Synthesize) Many English words have their roots in other languages. Use the Greek words below to make an educated guess about the meaning of the words spores and hyphae.						1				1
			93	U2.2.4.	(Identify) This list contains the vocabulary terms you'll learn in this lesson. As you read circle the definition of each term	1						1			
			94	U2.2.5.	(Compare) The two organisms shown below look very different. Why do scientists classify both as protists.		1						1		
			95	U2.2.6.	(Draw) Each protist shown below is missing the structures it uses for movement. Draw the missing parts for each individual.						1			1	1
			95	U2.2.7.	(Identify) How can structures for movement help protists to survive?		1						1		
			96	U2.2.8.	(Identify) Onthis page and the next, underline the benefits of asexual reproduction and the benefits of sexual reproduction.	1						1			
			96	U2.2.9.	(Compare) Both protists and bacteria can reproduce asexually using binary fission. Research to find out how protist fission differs from bacterial		1						1		
			97	U2.2.10.	(Draw) Use the terms diploid, haploid, and adult to fill in the blanks describing how ULVA reproduces with alternating generations of diploid						1		1		1
			98	U2.2.11.	(Identify) On this page, and the next, underline how each kind of protist gets its food.	1						1			
			99	U2.2.12.	(Infer) Because plant-like protists make their own food from sunlight, in what kind of environment would they not be able to survive? Why?		1						1		
			99	U2.2.13.	(Summarize) For each kind of protist on the chart below, list three characteristics.		1					1			
			100	U2.2.14.	(Apply) Fungi come in all shapes and sizes. Draw an organism that is a mushroom with all the parts shown in the image at left but that is shaped according to your imagination. Label each part of the mushroom.			1						1	
			101	U2.2.15.	(Identify) Describe the role of spores in both asexual and sexual fungus reproduction		1					1			
			101	U2.2.16.	(Infer) Why is it important for spores to spread easily to other locations?		1					1			
			102	U2.2.17.	(Identify) On this page and the next, underline the characteristics that define each kind of fungus.	1									
			103	U2.2.18.	(Infer) Suppose that the number of kinds of lichens at a city park is decreasing each year. What might explain this disappearance?		1						1		
			104	U2.2.19.	To complete this summary, fill in the blank with the correct word or phrase. Protists are eukaryotes that don't fit in other classifications groups. A _____ is a haploid reproductive cell used in sexual reproduction.	1						1			
			104	U2.2.20.	Protists can be grouped as fungus-like, plant-like, and animal-like protists. _____-like protists can produce their own food from the sun's	1						1			
			104	U2.2.21.	Fungi absorb nutrients and have chitinous cell walls. Fungi are ____ because they have a nucleus and other membrane-bound organelles.	1							1		
			104	U2.2.22.	Fungi can partner with other organisms. _____ can indicate levels of air pollution.	1							1		
			104	U2.2.23.	(Describe) This lesson groups protists informally by the way they get food. Think of another way to categorize the different kinds of protists and describe your system below.		1						1		
			105	U2R2.1.	Draw a line to connect the following terms to their definitions. Fungi	1						1			
			105	U2R2.2.	Draw a line to connect the following terms to their definitions. Protists	1						1			
			105	U2R2.3.	Draw a line to connect the following terms to their definitions. Spore	1						1			
			105	U2R2.4.	Draw a line to connect the following terms to their definitions. Gamete	1						1			
			105	U2R2.5.	(Compare) Why are protists discussed in groups such as animal-like, plant-like, and fungus-like protists?		1						1		
			105	U2R2.6.	(List) Write the three major types of fungi and an example of each.	1						1			
			105	U2R2.7.	(Identify) What are two ways that protists can reproduce asexually?	1						1			
			105	U2R2.8.	(Describe) What are two ways in which fungi reproduce?		1						1		
			105	U2R2.9.	(Hypothesize) Do you think this protist can make its own food? Explain						1				1
			105	U2R2.10.	(Synthesize) In humans, infections by fungi and protists are usually maore difficult to treat than bacterial infections. Suggest an explanation that is based on cell structure.						1				1
			105	U2R2.11.	(Apply) Suppose that when crops developed a fungal infection, a farmer decided to spray the soil with a fungicide. Just after spraying, the plants looked healthier, but soon they showed signs of mineral deficiency. What might explain this response.				1				1	1	
						14	13	1	1		5	14	13	4	6
					Total number of questions = 34										

Table 49: Textbook #2 "The Diversity of Living Things" Unit 2 Lesson 2 RBT Analysis

						Cognitive Process Dimension						Knowledge Dimension			
Unit No.	Lesson No	Learning Outcome	Page No.	Question Source	Question	Rem	Und	App	Ana	Eva	Crea	Fact	Conc	Proc	Meta
2	3.Introduction To Plants	To list the characteristics that all plants share	106			1						1			
2	3. Introduction To Plants	To explain how plants are classified into major plant divisions	106				1						1		
			107	U2.3.1.	(Predict) Check T or F to show whether you think each statement is true or false. A.All plants have a special transport system that delivers water and nutrients B. The majority of plants have roots, stems, and leaves. C. Conifer trees, such as pine trees, produce flowers. d. Plants are multicelluar eukaryotes.	1						1			
			107	U2.3.2.	(Categorize) Write a caption for this magnified cross section of a buttercup plant stem		1					1			
			107	U2.3.3.	(Synthesize) You can ofen define an unknown word if you know the meaning of its word parts. Use the word parts and sentences below to make an educated guess about the meaning of the words gymnosperm and angiosperm						1				1
			107	U2.3.4.	(Identify) As you learn the definition of each vocabulary term in this lesson, create your own definition or sketch to help you remember the meaning of the	1						1			
			108	U2.3.5.	(Apply) Imagine a plant is running for president of the garden club. Write a campaign speech stating its unique characteristics.			1							1
			109	U2.3.6.	(Identify) Name the function of chlorophyll in plants.	1						1			
			109	U2.3.7.	(Identify) In which part of the cell is chlorophyll found?	1						1			
			110	U2.3.8.	(Explain) Why are nonvascular plants so small?		1						1		
			111	U2.3.9.	(List) As you read, underline the importance of a plant's vascular system.	1						1			
			111	U2.3.10.	(Compare) In the table below, compare the functions of the three parts of the		1					1			
			112	U2.3.11.	(Identify) As you read, underline the structure in nonvascular plants that is like a	1						1			
			112	U2.3.12.	(Inquiry) Study the photo of the moss. What evidence suggests that mosses produce their own food?				1						1
			113	U2.3.13.	(Compare) In the graphic organizer below, compare seedless nonvascular plants to seedless vascular plants. How are they similar and different?		1						1		1
			114	U2.3.14.	(Identify) As you read, underline the characteristics of gymnosperms.	1						1			
			114	U2.3.15.	(Identify) Which type of gymnosperm does not reproduce with cones?	1						1			
			115	U2.3.16	(Label) Fill in the structure of each of the flower parts described below.	1						1			
			116	U2.3.17	(Compare) Compare vascular and nonvascular plants., seedless and see vascular plants, and nonflowering and flowering plants.		1						1		
			117	U2.3.18	(Summarize) How are the compounds derived from the foxglove plant and the white willow tree used in medicine?		1						1		
			117	U2.3.19.	(Research) Find out how another plant is used in modern medicine.					1					1
			117	U2.3.20.	(Propose) How can we protect medicinal plants in rainforests?					1					1
			118	U2.3.21.	Write two facts about non vascular plants.Summary points		1					1			
			118	U2.3.22.	Write two facts about seedless vascular plants. Summary points.		1					1			
			118	U2.3.23.	Write two facts about gymnosperm.Summary points.		1					1			
			118	U2.3.24.	Write two facts about angiosperm. Summary points.		1					1			
			118	U2.3.25.	(Infer) What characteristics of flowering plants have helped them to be		1						1		
			119	U2R3.1.	Fill in the blank with the term that best completes the following sentences. A(n) __ is a plant organ that consists of an embryo, tissues, and a protective coating.	1						1			
			119	U2R3.2.	Most plants are called _____ because they can make their own food using photosynthesis.	1						1			
			119	U2R3.1.	Vascular plants that have seeds surrounded by fruit are called _____	1						1			
			119	U2R3.4.	(Identify) What characteristics do all plants share?	1						1			
			119	U2R3.5.	(Summarize) What is the importance of having a vascular system?		1						1		
			119	U2R3.6.	(Identify) List the function of each of the following parts of the flower: stamen, pistil, ovary, and sepal.	1						1			
			119	U2R3.7.	(Identify) Which letter corresponds to the structure that absorbs water and	1						1			
			119	U2R3.8.	(Label) Which letter corresponds to the part of the plant that is primarily used for photosynthesis?	1						1			
			119	U2R3.9.	(Infer) Is this an example of a vascular plant? How do you know?		1								1
			119	U2R3.10.	(Conclude) A scientist discovers a new plant that has vascular tissue and produce seeds. It has brightly colored, scented flowers. What type of plant did the scientist discover? How might this plant be pollinated, and what would lead you to draw that conclusion?				1						1
						16	13	1	2	2	1	22	6		8
					Total number of questions = 35										

Table 50: Textbook #2 "The Diversity of Living Things" Unit 2 Lesson 3 RBT Analysis

						Cognitive Process Dimension						Knowledge Dimension			
Unit No.	Lesson No	Learning Outcome	Page No.	Question Source	Question	Rem	Und	App	Ana	Eva	Crea	Fact	Conc	Proc	Meta
2	4. Plant Processes	To describe the processes through which plants obtain energy, reproduce, and respond to their environments.	120				1						1		
			121	U2.4.1.	(Identify) Read over the following vocabulary terms. In the spaces provided, place a + if you know the term well, a - if you have heard the term but are not sure what it means, and a? If you are unfamiliar with the term. Then write a sentence that includes one of the words you are most familiar with. Cellular respiration/transpiration/tropism/pollination	1						1			
			121	U2.4.2.	(Describe) Finish the caption for this photo. The vine responds to the wire by__		1					1			
			121	U2.4.3.	(Synthesize) You can ofen define an unknown word if you know the meaning of its word parts. Use the word parts and sentences below to make an educated guess about the meaning of the word photosynthesis						1				1
			121	U2.4.4.	(Identify) As you learn the definition of each vocabulary term in this lesson, create your own definition or sketch to help you remember the meaning of the term. (cellular respiration, stimulus, pollination, transpiration, tropism, stamen, pistil, dormant)	1							1		
			122	U2.4.5.	(Describe) Fill in the captions to describe how plants obtain energy from sunlight.		1						1		
			123	U2.4.6.	(Relate) How is cellular respiration the reverse of photosynthesis		1						1		
			124	U2.4.7.	(Contrast) Use the diagram to explain how spores differ from seeds.		1							1	1
			125	U2.4.8.	(Diagram) Fill in the Venn diagram to compare and contrast the way seedless and seed plants reproduce.			1						1	1
			126	U2.4.9.	(Identify) Circle the two labels of gametophyte structures in the illustration.	1							1		
			127	U2.4.10.	(Label) Under each example of asexual reproduction, write the type of structure used for this purpose.		1								1
			127	U2.4.11.	(Apply) Write a play that compares and contrasts the results of sexual and asexual reproduction in plants .			1							1
			128	U2.4.12.	(Infer) Why are plant stomata usually open during the day?		1						1		
			129	U2.4.13.	(Identify) As you read, underline the effect of phototropism.	1							1		
			129	U2.4.14.	(Label) Draw an X next to the side of the stems with shorter cells.	1						1			
			129	U2.4.15.	(Hypothesize) Write a hypothesis related to gravitropism that an astronaut could test in space.						1		1		1
			130	U2.4.16.	(Summarize) Use the filled in boxes as clues to help you complete the table with information from the lesson. Some terms will appear more than once.		1						1		
			130	U2.4.17.	(Design) Tulip bulbs are planted in the fall because they must go dormant in order to bloom the next spring. They require temperatures below 7◦ C (45 F). Design an experiment to find out how long tulip bulbs must remain in the cold dormant state before blooming.						1		1		1
			131	U2.4.18.	(Relate) All of th plants shown here are seed plants. Which phase of the life cycle do you see?		1						1		
			131	U2.4.19.	(Research) Learn the growing season of five fruits or vegetables that are grown in you state.					1					1
			131	U2.4.20.	(Apply) Plan a menu for a meal that uses three of the fruits and vegetables that you learned about that become ripe in the same season.			1						1	1
			132	U2.4.21.	Photosynthesis takes place in chloroplasts/ mitochondria, which contain chlorophyll	1						1			
			132	U2.4.22.	Photosynthesis/ Cellular respiration releases the energy stored in food and produces carbon dioxide and	1						1			
			132	U2.4.23.	Flowering plants produce seeds/ spores and fruit following fertilization.	1						1			
			132	U2.4.24.	Some plants use plantlets, tubers, or runners to reproduce sexually/ asexually	1						1			
			132	U2.4.25.	Growth, wilting, and dormancy are examples of plant responses/stimuli.	1						1			
			132	U2.4.26.	(Explain) What are two ways in which photosynthesis is importance?		1						1		
			133	U2R4.1.	Fill in the blank with the term that best completes the following sentences. __ is the transfer of pollen from the male reproductive structures to the female structures of seed plants.	1						1			
			133	U2R4.2.	The process by which plants release water vapor into the air through stomata is called _____	1						1			
			133	U2R4.3.	A __ is the female reproductive structure of flowers.	1						1			
			133	U2R4.4.	Seeds are _____ when conditions are unfavorable for growth.	1						1			
			133	U2R4.5.	(Identify) Explain what a plant produces in each of the two parts of its life cycle.		1						1		
			133	U2R4.6.	(List) Provide three examples of asexual plant structures.	1						1			
			133	U2R4.7.	(Predict) In which parts of a plant would you expect phototropism to occur? Explain				1				1		
			133	U2R4.8.	(Explain) Describe the roles of chloroplasts and chlorophyll in photosynthesis		1						1		
			133	U2R4.9.	(Analyze) What external stimuli produced the results shown in the graph above?				1				1		
			133	U2R4.10.	(Conclude) Based on the graph, what process has slowed down? Explain how you know this					1			1		
			133	U2R4.11.	(Synthesize) Can an organism carry out cellular respiration without photosynthesis? How about photosynthesis without cellular respiration? Explain						1				1
						15	11	3	2	2	4	13	16	3	10
					Total number of questions = 37										

Table 51: Textbook #2 "The Diversity of Living Things" Unit 2 Lesson 4 RBT Analysis

						Cognitive Process Dimension						Knowledge Dimension			
Unit No.	Lesson No	Learning Outcome	Page No.	Question Source	Question	Rem	Und	App	Ana	Eva	Crea	Fact	Conc	Proc	Meta
2	5. Introduction To animals	To explain what characteristics define animals.	138			1						1			
2		To describe some different kinds of animals.	138				1					1			
			139	U2.5.1.	(Predict) Check T or F to show whether you think each statement is true or false. A. Animals are producers because they can make their own food. B. An invertebrate is an animal that does not have a backbone. C. Birds are more closely related to mammals than to reptiles.	1						1			
			139	U2.5.2.	(Compare) What do the two kinds of animals shown here have in common?		1								1
			139	U2.5.3.	(Synthesize) You can ofen define an unknown word if you know the meaning of its word parts. Use the word parts and sentences below to make an educated guess about the meaning of the words exoskeleton and endoskeleton.						1				1
			139	U2.5.4.	(Identify) As you learn the definition of each vocabulary term in this lesson, create your own definition or sketch to help you remember the meaning of the term. (consumer, vertebrate, invertebrate, endoskeleton, exoskeleton)	1							1		
			140	U2.5.5.	(Infer) These photos show different kinds of animal cells. Write down three other specialized cells that you think would be found in animal bodies.		1					1			
			141	U2.5.6.	(Identify) As you read, underline the different kinds of food animals eat.	1						1			
			141	U2.5.7.	(Infer) How might an organism that relies on the environment to maintain body temperature do so?		1						1		
			142	U2.5.8.	(Identify) Name the outer covering of each animal on the lines provided.	1						1			
			143	U2.5.9.	(Compare) As you read, underline the characteristics of invertebrates and vertebrates		1					1			
			143	U2.5.10.	(Apply) You may be unfamiliar with the lancelet shown here, but since lancelets are animals, what six things do you know must be true about them?			1					1		
			144	U2.5.11.	(Identify) As you read the captions, underline the kind of environment where each group of invertebrates lives.	1						1			
			144	U2.5.12.	(Infer) Why might stinging tentacles be advantageous for slow-moving predators, such as some cnidarians?		1					1			
			145	U2.5.13.	(Apply) On your way home from school, write a list of all the invertebrate animals you see. Then do research to try to classify each one.			1				1			
			146	U2.5.14.	(Identify) As you read the captions, underline how vertebrates reproduce.	1						1			
			146	U2.5.15.	(Relate) What is the difference between an invertebrate chordate and a vertebrate chordate?		1						1		
			147	U2.5.16	(Compare) What are some physical characteristics that scientists use to classify these vertebrates?		1					1			
			148	U2.5.17	An organism that gets energy by eating other organisms is a (n)_____	1						1			
			148	U2.5.18	An invertebrate that hunts prey with stinging tentacles is a(n)_____	1						1			
			148	U2.5.19.	An animal with two identical sides has _____symmetry.	1						1			
			148	U2.5.20.	A skeleton that is inside the body and attaches to muscles is called a(n)_____	1						1			
			148	U2.5.21.	(Classify) Think of five different animals and make a list of the characteristics they share.	1						1			
			149	U2R5.1.	Fill in the blank with the term that best completes the following sentences. __are organisms with a backbone.	1						1			
			149	U2R5.2.	Tunicates and lancelets are classified as _____chordates.	1						1			
			149	U2R5.3.	The hard external covering of some invertebrates is calles an _____	1						1			
			149	U2R5.4.	(Identify) List the six characteristics that animals share.	1						1			
			149	U2R5.5.	(Explain) How do tunicates and lancelets differ from other chordates?		1						1		
			149	U2R5.6.	(Compare)What is the major difference between invertebrates and vertebrates?		1						1		
			149	U2R5.7.	(Identify) What are two unique characteristics shared by all birds?	1						1			
			149	U2R5.8.	(Analyze) Which groups shown on the tree include invertebrates? Explain				1						1
			149	U2R5.9.	(Infer) Do any of the groups shown on this tree include vertebrates? Explain		1								1
			149	U2.R5.10.	(Conclude) Assess what kinds of traits make invertebrates such a diverse group of animals					1					1
						16	10	2	1	1	1	20	6		5
					Total number of questions =31										

Table 52: Textbook #2 "The Diversity of Living Things" Unit 2 Lesson 5 RBT Analysis

						Cognitive Process Dimension						Knowledge Dimension			
Unit No.	Lesson No	Learning Outcome	Page No.	Question Source	Question	Rem	Und	App	Ana	Eva	Crea	Fact	Conc	Proc	Meta
2	6. Animal Behaviour	To describe some behaviors that help animals to survive and reproduce	150				1						1		
			151	U2.6.1.	(Identify) Unscramble the letters below to find four behaviours that help animals survive and reproduce. Write your words on the blank lines.				1						1
			151	U2.6.2.	(Describe) Write your own caption to this photo.						1				1
			151	U2.6.3.	(Synthesize) You can ofen define an unknown word if you know the meaning of its word parts. Use the word parts and sentences below to make an educated guess about the meaning of the words hibernation and estivation						1				1
			151	U2.6.4.	(Apply) As you learn the definition of each vocabulary term in this lesson, create your own definition or sketch to help you remember the meaning of the term. (stimulus, migration, innate behaviour, hibernation, learned behaviour, estivation, territory, soical behaviour)			1							1
			152	U2.6.5.	(Identify) What are the two categories of stimuli that can cause a change in behaviour?	1						1	1		
			152	U2.6.6.	(Infer) Consider the colorful individual below. How might color vision help mantis shrimp survive?		1								1
			152	U2.6.7.	(Compare) Do some research on an animal that can sense external stimuli that people cannot sense, such as electric pulses (electric fish), magnetic fields (homing pigeons), infrared radiation (snakes), or UV light (bees). Write a report describing how these animals repond to these external stimuli with behaviour		1						1		1
			153	U2.6.8.	(Identify) Which human behaviours are innate, and which are learned? List some examples below.	1						1			
			154	U2.6.9.	(Identify) What are two strategies that predators use to capture prey?	1						1			
			155	U2.6.10.	(Identify) What are three behaviors that animals use to avoid danger?	1						1			
			155	U2.6.11.	(Infer) Not many animals can change color to camouflage themselves against a background. What is another behavior that animals could use to be camouflaged against a background?		1						1		
			156	U2.6.12.	(Apply) How do you think the young in the photo let the parents know that they need food?			1					1		
			157	U2.6.13.	(Identify) As you read, underline the key terms that describe important seasonal animal behaviors.	1						1			
			157	U2.6.14.	(Infer) What do people do to make it through seasonal conditions such as cold winters or hot summers?		1					1			
			158	U2.6.15.	(Compare) List one advantage and one disadvantage of living in a group.		1					1			
			158	U2.6.16.	(Infer) Meerkats make different alarm calls for different types of predators. How do you think this could help meerkats survive?		1						1		
			159	U2.6.17.	(Compare) How are social hierarchies different from set social structures		1						1		
			160	U2.6.18.	What are learned and innate behaviours?	1						1			
			160	U2.6.19.	What are three examples of social behaviors in animal?	1						1			
			160	U2.6.20.	What is biological clock?	1						1			
			160	U2.6.21.	(Synthesize) Describe an anial behavior that you have seen recently where you live or on TV. Identify the stimulus that caused the behavioral response, and explain how that behavior might help the animal survive.						1				1
			161	U2R6.1.	Draw aline to connect the following terms to their definitions. Territory	1						1			
			161	U2R6.2.	Draw aline to connect the following terms to their definitions. Innate	1						1			
			161	U2R6.3.	Draw aline to connect the following terms to their definitions. Estivation	1						1			
			161	U2R6.4.	(Identify) What is the difference between internal stimuli and external stimuli?	1							1		
			161	U2R6.5.	(Describe) Choose one animal and describe how it marks its territory		1								1
			161	U2R6.6.	(Explain) How do animals use pheromones?		1								1
			161	U2R6.7.	(Compare) What are the advantages and disadvantages of living in a group?		1						1		
			161	U2R6.8.	(Analyze) Which of the following behaviors could be represented by the arrows: migration, hibernation, or estivation?				1				1		1
			161	U2R6.9.	(Infer) How would the birds traveling along this path know when to move from place to place?		1						1		1
			161	U2R6.10.	(Relate) What behaviors do humans use to find food, parent their offspring, and court each other?		1						1		
			161	U2R6.11.	(Apply) Explain how looking bigger by spreading its wings might help a bird avoid predation.			1					1		
						12	12	3	2	0	3	13	12		11
					Total number of questions = 32										

Table 53: Textbook #2 "The Diversity of Living Things" Unit 2 Lesson 6 RBT Analysis

						Cognitive Process Dimension						Knowledge Dimension			
Unit No.	Lesson No	Learning Outcome	Page No.	Question number	Question	Rem	Und	App	Ana	Eva	Crea	Fact	Conc	Proc	Meta
1	1. Structure of the Universe	To describe the structure of the universe, including the scale of distances in the universe.	4				1					1	1		
			5	U1.1.1.	(Predict) Check T or F to show whether you think each statement is true or false. A. You live on Earth. B. Earth Orbits a star called the moon. C. Earth and the sun have the same composition. D. The sun is just one of many stars in the Milky Way galaxy. E. Distances in the universe are extremely large.		1					1			
			5	U1.1.2.	(Draw) When you look into the night sky, you are seeing only a very small part of the universe. Use the space below to draw what you see in the night sky.						1		1		1
			5	U1.1.3.	(Synthesize) Many English words have their roots in other languges. Use the Latin words below to make an educated guess about the meaning of the word universe.						1		1		1
			5	U1.1.4.	(Apply) This list contains the key terms that you'll learn in this lesson. As you read, circle the definition of each term. (Solar system, galaxy, planet, light-year, star, universe)			1				1	1		
			6	U1.1.5.	(Identify) As you read the text, underline those characteristics of Earth that make it a special place.	1						1			
			7	U1.1.6.	(Analyze) What is the relationship between the sizes of the planets and their distances from the sun?				1				1		
			7	U1.1.7.	(Identify) As you read the text, underline the different bodies that make up the solar system.	1						1			
			8	U1.1.8.	(Apply) Conduct research about one of the following aspects of stars: composition, layers, energy production, size. Present your findings to the class in the form of an oral presentation or a poster presentation.			1					1		1
			8	U1.1.9.	(Compare) How does the composition of a star differ from the composition of a planet?		1					1	1		
			9	U1.1.10.	(Describe) In the boxes below, write in you answers to each of the questions. You live on Earth. What is Earth's place in the universe? Earth is part of the solar system. What bodies make up our solar system? The solar system is located within a spiral arm of the Milky Way galaxy. What is a galaxy?		1						1		
			10	U1.1.11.	(Explain) The Andromeda galaxy is located approximately 2.5 million light-years from Earth. Why is the light that reaches Earth 2.5 million years old?		1						1		
			11	U1.1.12.	(Apply) In the text, the universe is described as being composed of galaxies and voids. Design and build a model that shows the structure of the universe as you imagine it to be.			1						1	1
			11	U1.1.13.	(Describe) What is the general structure of the universe?		1						1		
			12	U1.1.14.	What is Earth's place in the Universe?	1						1			
			12	U1.1.15.	What makes up our solar system?	1						1			
			12	U1.1.16	What is a star?	1						1			
			12	U1.1.17.	What are galaxies made up of?	1						1			
			12	U1.1.18.	(Describe) Beginning with Earth, summarize the structure of the universe.		1						1		
			13	U1.R1.1.	Fill in the blank with the term that best completes the following sentences. A___ is a large collection of stars, gas, and dust that is held together by gravity.	1						1			
			13	U1.R1.2.	Fill in the blank with the term that best completes the following sentence. Space and all matter and energy in it is called the _____.	1						1			
			13	U1.R1.3.	Fill in the blank with the term that best completes the following sentence. A____ consists of a star and all of the bodies in orbit around it.	1									
			13	U1.R1.4.	(Identify) What is a large celestial body that is composed of gas and emits light?	1						1			
			13	U1.R1.5.	(Identify) What is a spherical body that orbits the sun?	1						1			
			13	U1.R1.6.	(Explain) Why can the structure of the universe be compared to soap bubbles?		1						1		
			13	U1.R1.7.	(Define) Define light year, and explain how and why light-years are used to measure distances in the universe.		1						1		
			13	U1.R1.8.	(Apply) Given current spacecraft technology, which of the objects in the table do you think it would be possible for you to travel in your lifetime?			1						1	
			13	U1.R1.9.	(Determine) A planet in our solar system is located far from the sun. Describe the size and composition of this planet.				1				1		1
			13	U1.R1.10.	(Deduce) What do you think that astronomers mean when they use the term obervable universe? (Hint: Think of the time it takes for light from very distant objects to reach Earth.)					1					1
						11	8	4	2	1	2	13	13	2	6
					Total number of questions = 28										

Table 54: Textbook #3 "Space Science" Unit 1 Lesson 1 RBT Analysis

						Cognitive Process Dimension						Knowledge Dimension			
Unit No.	Lesson No	Learning Outcome	Page No.	Question No.	Question	Rem	Und	App	Ana	Eva	Crea	Fact	Conc	Proc	Meta
1	2. Stars	To describe stars and their physical properties.	16				1						1		
			17	U1.2.1.	(Predict) Check T or F to show whether you think each statement is true or false. A. The sun is a star. B. Stars are made mostly of nitrogen and oxygen. C. If two stars have the same apparent magnitude, they are the same distance from Earth. D. Red stars have higher surface temperatures thatn blue stars. E. Some stars are about as small as Earth.		1					1	1		
			17	U1.2.2.	(Describe) In the images below, the stars Betelgeuse (left) and Rigel (right) are shown. Both stars are located in the constellation Orion. Describe any differences between these two stars that you see in this pair of images.		1						1	1	1
			17	U1.2.3.	(Sythesize) Many English words have their roots in other languages. Use the Latin word below to make an educated guess about the meaning of the word luminosity.						1				1
			17	U1.2.4.	(Apply) As you read, place a question mark next to any words that you don't understand. When you finish reading the lesson, go back and review the text that you marked. If the information is still confusing, consult a classmate or a teacher.			1					1	1	
			18	U1.2.5.	(Identify) As you read the text, underline any physical properties of stars that are discussed.	1						1			
			18	U1.2.6.	(Describe) Write in the correct answer for each question.	1						1			
			19	U1.2.7.	(Compare) Fill in the Venn diagram to compare and contrast the physical properties of the sun with the physical properties of other stars.		1						1	1	
			20	U1.2.8.	(Define) As you read the text, underline the definition of apparent magnitude.	1						1			
			20	U1.2.9.	(Analyze) How does the light from a flashlight that is shone from two different distances model the apparent magnitude of two stars with the same absolute				1				1		
			21	U1.2.10.	(Explain) Why does a star such as Beteleuse, which is located far from Earth, have a much greater absolute magnitude than apparent magnitude?		1						1		
			22	U1.2.11.	(Explain) Explain how the colors of stars that have different surface temperatures are similar to the colors of a steel bar that is heated to different temperatures.		1						1		
			22	U1.2.12.	(Formulate) Come up with a creative way to remember the colors of stars, from coolest to hottest.						1				1
			23	U1.2.13.	(Apply) From Earth, the sun appears to be a very large star. In reality, the sun is quite small when compared to stars such as Rigel and Antares. At the scale shown on this page, why would it be impossible to illustrate stars that are smaller than the sun?			1					1		
			24	U1.2.14.	_____is the measure of a star's brightness as seen from Earth.	1						1			
			24	U1.2.15.	___is the measure of how bright a star would be if it were located at a standard distance from Earth.	1						1			
			24	U1.2.16	What is the standard unit that astronomers use to measure the size of stars?	1						1			
			24	U1.2.17.	What is the color and surface temperature of the star in the illustration below?	1						1			
			24	U1.2.18.	What is the color and surface termperature of the star in the illustration below?	1						1			
			24	U1.2.19.	(Contrast) How does the sun compare to other stars in terms of surface temperature, apparent magnitude, absolute magnitude, and size?		1						1		
			25	U1.R2.1.	In your own words, define the following terms. Star	1						1	1		
			25	U1.R2.2.	In your own words, define the following terms. Luminosity	1						1	1		
			25	U1.R2.3.	In your own words, define the following terms. Apparent Magnitude	1						1	1		
			25	U1.R2.4.	(List) What are some of the physical properties of stars?	1						1	1		
			25	U1.R2.5.	(Analyze) Why is the absolute magnitude of some stars greater than their apparent magnitude?				1				1		
			25	U1.R2.6.	(Compare) How does the size of the sun compare to the sizes of other stars?		1						1		
			25	U1.R2.7.	(Apply) Mizar is a star system that is composed of two pairs of stars, Mizar A and Mizar B, or four stars in total. What do astronomers call a system that is composed of more than two stars?			1					1		
			25	U1.R2.8.	(Apply) Which stars have the highest surface temperatures, red stars or blue stars?			1						1	
			25	U1.R2.9.	(Apply) The sun has a surface temperature of 5,527 degree celsius. What is the color of the sun?			1						1	
			25	U1.R2.10.	(Calculate) A star has a size of 0.1 solar radius. How many times larger is the sun than this star?			1						1	
						12	7	6	2	0	2	13	16	6	3
					Total number of questions = 29										

Table 55: Textbook #3 "Space Science" Unit 1 Lesson 2 RBT Analysis

						Cognitive Process Dimension						Knowledge Dimension			
Unit No.	Lesson No	Learning Outcome	Page No.	Question No.	Question	Rem	Und	App	Ana	Eva	Crea	Fact	Conc	Proc	Meta
1	3.The Life Cycle of Stars	To describe the stages of the life cycles of stars.	26				1					1	1		
			27	U1.3.1.	(Predict) Check T or F to show whether you think each statement is true or false. A. Our sun is among the most massive stars in our galaxy. B. A neutron star is an extremely dense ball of neutrons. C. Astronomers use the H-R diagram to predict when comets will travel close to Earth. D. Stars develop from white dwarfs.		1					1			
			27	U1.3.2.	(Explain) Humans pass through a series of stages called a life cycle. Stars go through a series of stages, too. What stage of the human life cycle are you currently in? What stage of the star life cycle do you think the sun is in?		1						1		1
			27	U1.3.3.	(Synthesize) You can often define an unknown word if you know the meaning of its word parts. Use the words and sentence below to make an educated guess about the meaning of the word supernova.						1				1
			27	U1.3.4.	(Identify) As you read, create a reference card for each vocabulary term. On one side of the card, write ther term and its meaning. On the other side, draw an image that illustrates or makes a connection to the term. These cards can be used as bookmarks in the text so that you can refer to them while studying.	1								1	1
			28	U1.3.5.	(Identify) What is happening in the circled part of this nebula?	1							1		
			29	U1.3.6.	(Identify) What process begins when a star is born?	1							1		
			29	U1.3.7.	(Examine) Look at the start of the first reaction. Compare this to the end of the last reaction. What type of nuclei are found at both ends of the reaction?		1						1		
			30	U1.3.8.	(Identify) When does a low-mass star become a giant?		1						1		
			30	U1.3.9.	(Research) If our sun grows to 10 times its current size at the end of its life cycle, how big will it be? Will Mercury be engulfed? Venus? Earth? What if our sun grows to 100 times its current size?					1			1	1	1
			31	U1.3.10.	(Describe) Using the image below, describe the process by which a giant becomes a white dwarf.		1						1		
			32	U1.3.11.	(Explain) What causes a supernova?		1						1		
			33	U1.3.12.	(Relate) Use the scale to find the diameter of this neutron star in miles.		1						1		
			33	U1.3.13.	(Explain) What is a pulsar?		1						1		
			34	U1.3.14.	(Identify) Where on the H-R diagram are the brightest stars located?	1							1		
			34	U1.3.15.	(Identify) Where on the H-R diagram are the coolest stars located?	1							1		
			35	U1.3.16.	(Identify) What is the region of the H-R diagram where stars spend most of their lives called?	1							1		
			35	U1.3.17.	temperature and brightness as it moves from position A to B and then to C on the H-R diagram?		1						1		
			36	U1.3.18.	T or F. Carbon and helium combine during nuclear fusion to form hydrogen.	1						1			
			36	U1.3.19.	T or F. The relative brightness and temperature of a star change overtime.	1						1			
			36	U1.3.20.	T or F. High-mass stars spend more time in the main sequence than do low-mass	1						1			
			36	U1.3.21.	(Synthesize) Relate the life stages of a star to the process of nuclear fusion.						1		1	1	1
			37	U1.R3.1.	Draw a line to connect the following terms to their definitions. Nebula	1						1			
			37	U1.R3.2.	Draw a line to connect the following terms to their definitions. Main Sequence	1						1			
			37	U1.R3.3.	Draw a line to connect the following terms to their definitions. Neutron Star	1						1			
			37	U1.R3.4.	Draw a line to connect the following terms to their definitions. Supernova	1						1			
			37	U1.R3.5.	(Identify) What force causes a star to form from a nebula?	1						1			
			37	U1.R3.6.	(Explain) What triggers nuclear fusion in stars?		1						1		
			37	U1.R3.7.	(Contrast) Describe how the life cycle of a low-mass star differs from the life cycle of a high-mass star.		1						1		
			37	U1.R3.8.	(Explain) Why is the H-R diagram useful in plotting the life cycles of stars?		1						1		
			37	U1.R3.9.	(Analyze) What changes within the star (A) lead to the red giant (B)?			1					1	1	
			37	U1.R3.10.	(Explain) Why will the color of the sun change from yellow to red when it becomes a giant?		1						1		
			37	U1.R3.11.	(Relate) Black holes cannot be seen. However, scientists think that black holes exist because of their effect on surrounding matter. Describe another force or phenomenon that cannot be seen directly. Give examples of the effects of this force on everyday object.					1			1		
						14	13	1		2	2	9	21	4	5
					Total number of questions = 32										

Table 56: Textbook #3 "Space Science" Unit 1 Lesson 3 RBT Analysis

						Cognitive Process Dimension						Knowledge Dimension			
Unit No.	Lesson No	Learning Outcome	Page No.	Question Number	Question	Rem	Und	App	Ana	Eva	Crea	Fact	Conc	Proc	Meta
2	1. Historical Models of the Solar System	To compare various historical models of the solar system.	48				1						1		
			49	U2.1.1	(Predict) Check T or F to show wheter you think each statement is true or false. A. The sun and planets circle Earth. B. Most early astrononmers placed the sun at the center of the solar system. C. The planets orbit the sun in ellipses. D. The telescope helped to improve our understanding of the solar system.		1					1			
			49	U2.1.2.	(Evaluate) What, if anything, is wrong with the model of the solar system shown below?					1			1		1
			49	U2.1.3.	(Synthesis) You can often define an unknown word if you know the meaning of its word parts. Use the word parts and sentence belwo to make an educated guess about the meaning of the word heliocentric.						1				1
			49	U2.1.4.	(Apply) As you learn the definition of each vocabulary term in this lesson, create your own definition or sketch to help you remember the meaning of the term. (Solar system, geocentric, heliocentric, parallax)			1				1	1		
			50	U2.1.5.	(Identify) As you read, underline the definitions of geocentric and heliocentric.	1						1			
			50	U2.1.6.	(Research) Use different sources to research a geocentric model of the solar system from either anient Greece, ancient China, or Babylon. Write a short description of the model you choose.						1		1		1
			51	U2.1.7.	(Predict) If a star appears at position 1 during the summer, during which season will it appear at position 2?		1						1		
			52	U2.1.8.	(Describe) Use the diagram at the right to describe Ptolemy's geocentric model of the solar system.		1						1		
			52	U2.1.9.	(Defend) As a class activity, defend Ptolemy's geocentric model of the solar system. Remember that during Ptolemy's time people were limited to what they could see with the naked eye.						1		1		1
			53	U2.1.10.	(Compare) How does Copernicus's model of the solar system differ from Ptolemy's model of the solar system?		1						1		
			54	U2.1.11.	(Identify) Underline text that summarizes kepler's three laws.	1						1			
			54	U2.1.12.	(Analyze) How did Kepler's first law support the idea of a heliocentric solar system?				1				1		
			55	U2.1.13.	(Identify) What were Galileo's most important contributions to astronomy?	1						1			
			55	U2.1.14.	(Research) Galileo invented or improved upon many instruments and technologies, such as the compound microscope, the thermometer, and the geometric compass. Research one of Galileo's technological contributions.						1				1
			55	U2.1.15.	(Create) Describe one of Galileo's experiments concerning the motion of bodies by doing one of the following: Make a poster, recreate the experiment, draw a graphic novel of Galileo conducting an experiment.						1			1	1
			56	U2.1.16	Label the solar system bodies as they appear in the geocentric model.	1						1			
			56	U2.1.17	Which astronomers are associated with this model of the solar system?	1						1			
			56	U2.1.18	Label the solar system bodies as they appear in the heliocentric model.	1						1			
			56	U2.1.19	Which astronomers are associated with this model of the solar system?	1						1			
			56	U2.1.20	(Compare) How does the geocentric model of the solar system differ from the heliocentric model of the solar system?		1						1		
			57	U2.R1.1.	Fill in the blank with the term that best completes the following sentences. The __is the sun and all of the planets and other bodies that travel around it.		1					1			
			57	U2.R1.2.	Fill in the blank with the term that best completes the following sentences. Until the time of Copernicus, most scientists thought the __model of the solar system was correct.		1					1			
			57	U2.R1.3.	Fill in the blank with the term that best completes the following sentences. An apparent shift in the position of an object when viewed from different locations is called _____.		1					1			
			57	U2.R1.4.	(Identify) Who first observed the phases of venus?	1						1			
			57	U2.R1.5.	(Identify) Who attempted to measure the relative distances to the moon and the sun?	1						1			
			57	U2.R1.6.	(Identify) Who replaced circles with ellipses in a heliocentric model of the universe?	1						1			
			57	U2.R1.7.	(Identify) Whose geocentric model of the solar system was accepted for 1,400 years?	1						1			
			111	U2.R1.8.	(Identify) Whose heliocentric model is seen as the first step in the development of modern models of the solar system?	1						1			
			111	U2.R1.9.	(Appraise) How did data gathered using Galileo's early telescope support the heliocentric model?					1			1		
			111	U2.R1.10.	(Explain) How did Aristotle's inability to detect parallax lead him to propose a geocentric model of the solar system?		1						1		
						12	9	1	1	2	5	17	11	1	6
					Total number of questions = 30										

Table 57: Textbook #3 "Space Science" Unit 2 Lesson 1 RBT Analysis

						Cognitive Process Dimension						Knowledge Dimension			
Unit No.	Lesson No	Learning Outcome	Page No.	Question Number	Question	Rem	Und	App	Ana	Eva	Crea	Fact	Conc	Proc	Meta
2	2.Gravity and the Solar System	To explain the role that gravity played in the formation of the solar system and in determining the motion of the planets.	60				1						1		
			61	U2.2.1	(Predict) Check T or F to show wheter you think each statement is true or false. A. Gravity keeps the planets in orbit around the sun. B. The planets follow circular paths around the sun. C. Sir Isaac Newton was the first scientist to describe how the force of gravity behaved. D. The sun formed in the center of the solar system. E. The terrestrial planets and the gas giant planets formed from the same material.		1					1	1		
			61	U2.2.2.	(Draw) In the space below, draw what you think the solar system looked like before the planets formed.						1		1		1
			61	U2.2.3.	(Synthesize) You can often define an unknown word if you know the meaning of its word parts, Use the word parts and sentence below to make an educated guess about the meaning of the protostellar.						1				1
			61	U2.2.4.	(Apply) This list contains the key terms you'll learn in this section. As you read, circle the definition of each term. (gravity, centripetal force, orbit, solar nebula, aphelion, planetesimal, perhelion)			1				1	1		
			62	U2.2.5.	(Identify) Underline the definition of and the effects of gravity.		1						1		
			63	U2.2.6.	(Compare) How is a circle different from an ellipse?		1						1		
			63	U2.2.7.	(Contrast) What is the difference between Copernicus's and Kepler's description of planetary orbits?		1						1		
			64	U2.2.8.	(Analyze) At which point does a planet move most slowly in its orbit, at aphelion or perihelion?				1				1		
			64	U2.2.9.	(Summarize) In the table below, summarize each of Kepler's three laws in your own words.		1						1		
			65	U2.2.10.	(Calculate) Compare the example below to the sample problems. What would the force of gravity be in the example below? Explain your answer			1					1	1	
			66	U2.2.11.	(Explain) In the illustration at the top of the page what does the hand represent, the ball represent, and the string represent? (Hint: Think of the sun, a planet, and the force of gravity.)		1						1		
			67	U2.2.12.	(Define) What is the solar nebula?	1						1	1		
			68	U2.2.13.	(Identify) How did the sun form?		1						1		
			68	U2.2.14.	(Describe) Use the terms planetesimal and protoplanetary disk to describe the illustration above.		1						1		
			69	U2.2.15.	(Explain) How can objects as small as dust grains become the building blocks of planets?		1						1		
			70	U2.2.16.	(Analyze) Where did planets made mostly of gas and Ice form within the protoplanetary disk?				1				1		
			71	U2.2.17.	(Describe) In the spaces on the left, describe Steps 2 and 4 in the formation of the solar system. In the spaces on the right, draw the last two steps in the formation of the solar system.		1						1		
			72	U2.2.18.	The strength of the force of gravity depends on the product of the _____of two objects. Therefore, as the masses of two objects increase, the force that the objects exert on one another_____.	1						1			
			72	U2.2.19.	Gravitional force is inversely proportional to the square of the ____between two objects. Therefore, as the distance between two objects increases, the force of gravity between them ____.	1						1			
			72	U2.2.20.	The sun exerts a ____, indicated by line B, on a planet so that at point C it is moving around the sun in orbit instead of moving off in a as shown at line A.	1						1			
			72	U2.2.21	(Explain) In your own words, explain Newton's law of universal gravitation.		1						1		
			73	U2.R2.1.	Fill in the blank with the term that best completes the following sentences. Small bodies from which the planets formed are called_____.	1						1			
			73	U2.R2.2.	Fill in the blank with the term that best completes the following sentences. The path that a body follows as it travels around another body in space is its_____.	1						1			
			73	U2.R2.3.	Fill in the blank with the term that best completes the following sentences. The ____ is the cloud of gas and dust from which our solar system formed.	1						1			
			73	U2.R2.4.	(Define) In your own words, define the word gravity.		1						1		
			73	U2.R2.5.	(Describe) How did the sun form?		1						1		
			73	U2.R2.6.	(Describe) How did planetesimals form?		1						1		
			73	U2.R2.7.	(Identify) What law is illustrated in this diagram?				1					1	
			73	U2.R2.8.	(Analyze) How does gravity keep the planets in orbit around the sun?				1				1		
			73	U2.R2.9.	(Explain) How do temperature differences in the protoplanetary disk explain the arrangement of the planets in the solar system?		1						1		
						7	15	2	4		2	9	22	2	2
					Total number of questions = 30										

Table 58: Textbook #3 "Space Science" Unit 2 Lesson 2 RBT Analysis

						Cognitive Process Dimension						Knowledge Dimension			
Unit No.	Lesson No	Learning Outcome	Page No.	Question Number	Question	Rem	Und	App	Ana	Eva	Crea	Fact	Conc	Proc	Meta
2	3.The Sun	To describe the structure and rotation of the sun, energy production and energy transport in the sun, and solar activity on the sun.	74				1						1		
			75	U2.3.1	(Predict) Check T or F to show whether you think each statement is true or false. A. The sun is composed mostly of hydrogen and helium. B. Energy is produced in the sun's core. C. The process by which energy is produced in the sun is known as nuclear fission. D. Energy is transferred to the surface of the sun by the processes of radiation and conduction. E. A dark area of the sun's surface that is cooler than the surrounding areas is called a sunspot.		1						1		
			75	U2.3.2.	(Explain) In your own words, explain the meaning of the word sunlight.		1						1		
			75	U2.3.3.	(Synthesize) You can often define an unknown word if you know the meaning of its word parts. Use the word parts and sentence below to make an educated guess about the meaning of the photosphere.						1				1
			75	U2.3.4.	(Apply) This list contains the key terms you'll learn in this section. As you read , circle the definition of each term. (nuclear fusion, solar flare, sunspot, prominence)			1					1		
			76	U2.3.5.	(Identify) As you read the text, underline different discoveries that scientists have made about the sun.	1						1			
			76	U2.3.6.	(Calculate) The diameter of Earth is 12,756 km. How many times greater is the sun's diameter than the diameter of Earth?			1						1	
			77	U2.3.7.	(Analyze) Why is the structure of the sun different from the structure of Earth?				1				1		
			78	U2.3.8.	(Discussion) Einstein's equation E=mc2 is probably the most famous equation in the world. With your classmates , discuss the kinds of technologies that rely on the conversion of matter to energy.						1		1	1	1
			78	U2.3.9.	(Identify) Fill in the circles to label the particles in the diagrams.	1						1			
			79	U2.3.10.	(Identify) As you aread the text, underline the steps in the nuclear fusion process in the sun.	1							1		
			81	U2.3.11.	(Compare) How is energy transferred from the sun's core to the sun's surface in the radiative zone and in the convective zone?		1						1		
			81	U2.3.12.	(Define) In your own words, define the term differential rotation.		1						1		
			82	U2.3.13.	(Analyze) The sunspot range is the difference between the maximum number of sunspots and the minimum number of sunspots for a certain period of time. To find this range, subtract the minimum number of sunspots from the maximum number of sunspots. What is the range of sunspot activity between 1700 and 1800?				1					1	
			83	U2.3.14.	(Compare) Use the Venn diagram below to compare solar flares and prominences.		1							1	
			84	U2.3.15.	Identify the six layers of the sun, beginning with the innermost layer.	1						1	1		
			84	U2.3.16.	By what process is the sun's energy transported in layer A?/ By what process is the sun's energy transproted in layer B?		1						1		
			84	U2.3.17.	(Describe) In your own words, describe the process of energy production by nuclear fusion in the sun.		1						1		
			85	U2.R3.1.	Fill in the blank with the term that best completes the following sentences. The process by which two or more low-mass atomic nuclei fuse to form another, heavier nucleus is called _____.	1						1			
			85	U2.R3.2.	Fill in the blank with the term that best completes the following sentences. A _____ is a dark area on the surface of the sun that is cooler than the surrounding areas.	1						1			
			85	U2.R3.3.	Fill in the blank with the term that best completes the following sentences. A _____is a loop of relatively cool gas that extends above the photosphere.	1						1			
			85	U2.R3.4.	(Identify) What is the layer of the sun from which energy escapes into space?	1						1			
			85	U2.R3.5.	(Identify) What is the layer of the sun in which energy is produced?	1						1			
			85	U2.R3.6.	(Identify) What is the layer of the sun through which energy is transferred away from the core by radiation?	1						1			
			85	U2.R3.7.	(Identify) What is the composition of the sun?	1						1			
			85	U2.R3.8.	(Explain) What is the sunspot cycle?		1						1		
			85	U2.R3.9.	(Determine) How many days does it take for the sun to spin once on its axis at location A? How many days does it take for the sun to spin once on its axis at location B?			1						1	
			85	U2.R3.10	(Compare) How is the rotation of the sun different from the rotation of Earth?		1						1		
			85	U2.3.11.	(Explain) In your own words, explain how energy is transproted from the core to the surface of the sun by radiation and by convection.		1						1		
						11	10	3	2		2	10	14	5	2
					Total number of questions = 28										

Table 59: Textbook #3 "Space Science" Unit 2 Lesson 3 RBT Analysis

						Cognitive Process Dimension						Knowledge Dimension			
Unit No.	Lesson No	Learning Outcome	Page No.	Question Number	Question	Rem	Und	App	Ana	Eva	Crea	Fact	Conc	Proc	Meta
2	4. The terrestrial Planets	To describe some of the properties of the terrestrial planets and how the properties of Mercury, Venus, and Mars differ from the properties of Earth	86				1						1		
			87	U2.4.1	(Define) Circle the term that best completes the following sentences. A. Venus/Earth/Mars is the largest terrestrial planet. B. Mercury/Venus/Mars has clouds that rain sulfuric acid on the planet. C. Huge dust storms sweep across the surface of Mercury/Venus /Mars. D. Venus/Earth/Mars is the most geologically active of the terrestrial planets. E. Mercury/Venus/Earth has the thinnest atmosphere of the terrestrial planets.	1						1			
			87	U2.4.2.	(Identify) What are properties of Earth that make it a special place in the solar system?	1						1			
			87	U2.4.3.	(Synthesize) Many English words have their roots in other languages. Use the latin words below to make an educated guess about the meaning of the word astronomy.						1				1
			87	U2.4.4.	(Apply) As you learn the definition of each vocabulary term in this lesson, create your own definition or sketch to help you remember the meaning of the term. (terrestrial planet, astronomical unit)			1				1	1		
			88	U2.4.5.	(Identify) As you read, underline important characteristics of the planet Mercury.	1						1			
			89	U2.4.6.	(Plan) You are an astronaut who will be exploring Mercury. What equipment would you take to Mercury to help you survive?					1					1
			89	U2.4.7.	(Estimate) In the figure, you can see that Mercury's core makes up a large percentage of the planet. What percentage of the diameter of Mercury is inside the core? A. 26%, b. 50%, c. 74%				1				1	1	
			90	U2.4.8.	(Identify) Underline the defintions of the terms prograde rotation and retrograde rotation that appear in the text.	1							1		
			91	U2.4.9.	(Contrast) How is the landscape of Venus different from the landscape of Earth?		1						1		
			91	U2.4.10.	(Identify) As you read the text, underline those factors that make Venus an unlikely place for life to exist.	1						1			
			92	U2.4.11.	(Identify) As you read the text, underline the characteristics that make Earth special.	1						1			
			93	U2.4.12	(Identify) In the image, circle any signs of life that you see.	1						1			
			94	U2.4.13.	(Debate) Research the surface features of the northern and southern hemisphere of Mars. Decide which hemisphere you would rather explore. With your class, debate the merits of exploring one hemisphere versus the other.						1		1		1
			95	U2.4.14.	(Explain) What are two possible reasons why the atmosphere on Mars is so thin?		1						1		
			95	U2.4.15.	(Compare) Compare and contrast the physical properties of Mars to the physical properties of Earth.		1						1		
			96	U2.4.16.	(Describe) How do the features in the image at the right indicate that liquid water once flowed on Mars?				1				1		
			97	U2.4.17.	(Infer) What advantages would a robotic explorer, such as Spirit or Opportunity, have over a manned mission to Mars?		1						1		
			97	U2.4.18.	(Hypothesize) What kind of evidence would the Mars Exploration Rovers be looking for that indicated that water once flowed on Mars?						1		1		
			98	U2.4.19.	Why do temperatures on Mercury vary so much?		1						1		
			98	U2.4.20.	Why is Venus's surface temperature so high?		1						1		
			98	U2.4.21.	What factors support life on Earth?	1							1		
			98	U2.4.22.	What makes up the surface of Mars?	1							1		
			98	U2.4.23.	(Compare) How are important properties of Mercury, Venus, and Mars different from important properties of Earth?		1						1		
			99	U2.R4.1.	Fill in the blanks with the terms that best complete the following sentences. The __are the dense planets nearest the sun.	1						1			
			99	U2.R4.2.	Fill in the blanks with the terms that best complete the following sentences. An __is equal to the distance between the sun and Earth.	1						1			
			99	U2.R4.3.	(Identify) Which planet has the highest surface temperature in the solar system?	1						1			
			99	U2.R4.4.	(Identify) Which planet has very large dust storms?	1						1			
			99	U2.R4.5.	(Identify) Which planet is the most heavily cratered of the terrestrial planets?	1						1			
			99	U2.R4.6.	(Identify) Which planet has the highest surface gravity of the terrestrial planets?	1						1			
			99	U2.R4.7.	(Explain) What is the difference between prograde rotation and retrograde rotation?		1						1		
			99	U2.R4.8.	(Describe) What characteristics of Venus's atmosphere make the planet so harsh?		1						1		
			99	U2.R4.9.	(Analyze) Which planet rotates most slowly about its axis?				1				1		
			99	U2.R3.10	(Analyze) Which planet revolves around the sun in less time than it rotates around its axis?				1				1		
			99	U2.R3.11.	(Analyze) Which planet revolves around the sun in the shortest amount of time?				1				1		
			99	U2.R3.12.	(Explain) Why are the temperatures on each of the other terrestrial planets more extreme than the temperatures on Earth?		1						1		
						15	10	1	5	1	3	13	21	1	3
					Total number of questions = 35										

Table 60: Textbook #3 "Space Science" Unit 2 Lesson 4 RBT Analysis

						Cognitive Process Dimension						Knowledge Dimension			
Unit No.	Lesson No	Learning Outcome	Page No.	Question Number	Question	Rem	Und	App	Ana	Eva	Crea	Fact	Conc	Proc	Meta
2	5.The Gas Giant Planets	To describe some of the properties of the gas giant planets and how these properties differ from the physical properties of Earth.	102				1						1		
			103	U2.5.1	(Predict) Circle the term that best completes the following sentences. A. Jupiter/Saturn/Uranus is the largest planet in the solar system. B. Jupiter/Uranus/Neptune has the strongest winds in the solar system. C. Saturn/Uranus/Neptune has the largest ring system of the gas giant planets. D. Jupiter/Saturn/Neptune has more moons than any other plaent in the solar system. E. Jupiter/Uranus/Neptunre is tilted on its side as it orbits the Sun.		1					1			
			103	U2.5.2.	(Identify) What are the objects that circle Saturn? What do you think they are made of?		1								
			103	U2.5.3.	(Apply) Many scientific words, such as gas, also have everyday meanings. Use context clues to write your own definition for each meaning of the word gas.			1						1	1
			103	U2.5.4.	(Apply) This list contains the key terms you'll learn in this section. As you read, circle the definition of each term. (Gas giant, planetary ring)			1					1		
			104	U2.5.5.	(Identify) As you read, underline important physical properties of the planet jupiter.	1						1			
			105	U2.5.6.	(Apply) Io, Europa, Callisto, and Ganymede are known as the Galilean moons. The astronomer Galileo discovered these moons using one of the first telescopes. Why do you think that Galilean moons were the first objects to be discovered with a telescope?			1					1		
			105	U2.5.7.	(Model) Select one of the following topics about weather on jupiter to research: belts and zones; jet streams; storms. Present your findings to the rest of the class in the form of a model. Your model may be handcrafted, or may be an art piece, or may be a computer presentation.						1		1		1
			106	U2.5.8.	(Identify) As you read the text, underline important physical properties about the planet Saturn.	1						1			
			107	U2.5.9.	(Explain) In your own words, write a caption for this illustration of Saturn's moon Enceladus.		1						1		1
			107	U2.5.10.	(Describe) Complete this table by writing a description of each structure in Saturn's ring system.		1						1		
			108	U2.5.11.	(Identify) As you read the text, underline important physical properties of the planet Uranus.	1						1			
			109	U2.5.12	(Predict) Earth has an axial tilt of 23.5 degree, whereas Uranus has an axial tilt of almost 98 degree. If Earth had the same axial tilt as Uranus, how would the conditions be different at Earth's North and South Poles?		1						1		
			109	U2.5.13.	(Research) Astronomers are discovering planets orbiting stars in other solar systems? Find out what kinds of planets astronomers are discovering in these solar systems.					1			1		
			110	U2.5.14.	(Predict) The wind speeds recorded in Neptune's Great Dark Spot reached 2,000 km/h. Predict what kind of destruction might result on Earth if wind speeds in hurricanes approached 2,000 km/h.		1						1		
			111	U2.5.15.	(Conclude) Complete the cause-and-effect chart by answering the questions below.			1					1		
			112	U2.5.16.	What causes cloud bands to form on Jupiter?		1						1		
			112	U2.5.17.	What are Saturn's rings made up of?	1						1			
			112	U2.5.18.	What is the tilt of Uranus's axis of rotation?		1						1		
			112	U2.5.19.	What gives Neptune its bluish color?		1						1		
			112	U2.5.20.	(Apply) Compare the properties of the gas giant planets as a group with properties of Earth.			1					1		
			113	U2.R5.1.	Fill in the blanks with the terms that best complete the following sentences. A large planet that has a deep, massive atmosphere is called a_____.	1						1			
			113	U2.R5.2.	Fill in the blanks with the terms that best complete the following sentences. A_____is a disk of matter that circles a planet and consists of numerous particles in orbit that range in size from a few millimeters to several hundred meters.	1						1			
			113	U2.R5.3.	(Identify) Which planet has a density that is less than that of water?	1						1			
			113	U2.R5.4.	(Identify) Which planet has the strongest winds in the solar system?	1						1			
			113	U2.R5.5.	(Identify) Which planet is tilted on its side as it orbits the sun?	1						1			
			113	U2.R5.6.	(Identify) Which planet has the largest planet in the solar system?	1						1			
			113	U2.R5.7.	(Compare) How does the composition of Earth's atmosphere differ from the composition of the atmosphere differ from the composition of the atomspheres of the gas giant planets?		1						1		
			113	U2.R5.8.	(Compare) How do the periods of rotation and revolution for the gas giant planets differ from those of Earth?		1						1		
			113	U2.R5.9.	(Identify) Which planet is shown in the diagram? How do you know?	1									
			113	U2.R5.10	(Analyze) How does the axial tilt of this planet affect its seasons?				1				1		
			113	U2.R5.11.	(Analyze) Why do you think the wind speeds on the gas giant planets are so much greater than the wind speeds on Earth?				1				1		
			113	U2.R5.12.	(Compare) List Earth and the gas giant planets in order from the hottest to the coldest planet. How does the temperature of each planet relate to its distance from the sun?		1						1		
						11	12	5	2	1	1	11	18	1	3
					Total number of questions = 32										

Table 61: Textbook #3 "Space Science" Unit 2 Lesson 5 RBT Analysis

						Cognitive Process Dimension						Knowledge Dimension			
Unit No.	Lesson No	Learning Outcome	Page No.	Question Number	Question	Rem	Und	App	Ana	Eva	Crea	Fact	Conc	Proc	Meta
2	6. Small Bodies in the Solar System	To compare and contrast the properties of small bodies in the solar system.	114				1						1		
			115	U2.6.1	(Predict) Circle the term that best completes the following sentences. A. Pluto is a planet. B. The kulper Belt is located beyond the orbit of Neptune. C. Comets are made of ice, rock, and dust. D. All asteroids have the same composition. E. Most meteoroids that enter Earth's atmosphere burn up completely.		1					1			
			115	U2.6.2.	(Identify) Can you identify the object that is streaking through the sky in the photograph? What do you think makes this object glow?	1							1	1	
			115	U2.6.3.	(Apply) Many scientific words, such as belt, also have everyday meanings. Use context clues to write your own definition for each meaning of the word belt.			1					1		
			115	U2.6.4.	(Apply) As you learn the definition of each vocabulary term in this lesson, create your own definition or sketch to help you remember the meaning of the term. (dwarf planet, asteroid, Kuiper Belt, meteoroid, kuiper Belt object, meteor, comet, meteorite, Oort cloud)			1					1		
			116	U2.6.5.	(Identify) As you read the text, underline the names of different kinds of small bodies that are found in the solar system.	1						1			
			117	U2.6.6.	(Describe) Describe two properties of dwarf planets.		1						1		
			117	U2.6.7.	(Anaylze) Where in the solar system are most the dwarf planets located?				1				1		
			118	U2.6.8.	(Analyze) What do points A and B on the diagram tell you about the orbits of some KBOs?				1				1		
			119	U2.6.9.	(Explain) Why is Pluto no longer considered a planet?		1					1			
			119	U2.6.10.	(Research) Astronomer Clyde Tombaugh discovered Pluto in 1930. Research why Tombaugh was searching beyond Neptune for "Planet X" and how he discovered Pluto.					1			1		1
			119	U2.6.11.	(Debate) Research the 2006 IAU decision to redefine Pluto as a "dwarf planet" Combine this research with you research on Pluto. With your classmates , debate whether Pluto should be considered a "dwarf planet" or return to being called the ninth planet in the solar system.						1		1		1
			120	U2.6.12	(Identify) As you read the text, underline the different parts of a comet and their properties.	1						1			
			120	U2.6.13.	(Identify) Use the write-on lines in the diagram to identify the structures of a comet.	1						1			
			121	U2.6.14.	(Anaylze) A short-period comet is shown above. How do the tails of the comet and the coma relate to loss of matter and the comet's life span?				1				1		
			122	U2.6.15.	(Identify) As you read the text, underline those places in the solar system where asteroids are located.	1						1			
			122	U2.6.16.	(Analyze) Where is the asteroid belt located?				1				1		
			123	U2.6.17.	(Describe) Eros is a near-Earth asteroid that tumbles through space. Imagine that you are the first human to explore Eros. Write a postcard that describes what you found on Eros. Then research the asteroid and find out how close your description came to really.		1						1		
			124	U2.6.18.	(Identify) Use the write-on lines below to identify the three objects that are shown.	1						1			
			125	U2.6.19.	(Describe) In the boxes below, describe the composition and origin of each group of meteorite. Also, indicate how common each group of meteorite is.		1						1		
			126	U2.6.20.	Enter the correct letter or letters that indicate a location for each small body in the Solar system.	1						1			
			126	U2.6.21	Check true or false to answer the questions below. A. Comets originate in the asteroid belt and the Kuiper Belt. B. Three groups of asteroids are stony, iron, and stony-iron. C. Most meteoroids that enter Earth's atmosphere burn up.	1						1			
			126	U2.6.22.	(Compare) Make a table in which you compare and contrast comets and asteroids in terms of composition, location in the solar system, and size.		1						1		
			127	U2.R6.1.	Fill in the blanks with the terms that best complete the following sentences. The _____is a spherical region that surrounds the solar system and extends almost halfway to the nearest star.	1						1			
			127	U2.R6.2.	Fill in the blanks with the terms that best complete the following sentences. A region of the solar system that extends from the orbit of Neptune to about twice the orbit of Neptune is the _____.	1						1			
			127	U2.R6.3.	Fill in the blanks with the terms that best complete the following sentences. Most__are located between the orbits of Mars and Jupiter.	1						1			
			127	U2.R6.4.	Fill in the blank with the term that best completes the following sentences. A meteroid that reaches Earth's surface without burning up is a_____.	1						1			
			127	U2.R6.5.	(Identify) What is a minor body that orbits outside the orbit of Neptune?	1						1			
			127	U2.R6.6.	(Identify) Which is a small body that follows a highly elliptical orbit around the sun?	1						1			
			127	U2.R6.7.	(Identify) What is the largest of the small bodies that are found in the solar system?	1						1			
			127	U2.R6.8.	(Identify) What is the glowing trail that results when a meteoroid burns up in Earth's atmosphere?	1						1			
			127	U2.R6.9.	(Apply) Which of the comets in the table are short period comets?			1						1	
			127	U2.R6.10	(Apply) Which of the comets in the table most likely originated in the Oort cloud?			1						1	
			127	U2.R6.11.	(Infer) Why do you think that the speeds of comets increase as they near the sun?		1						1		
			127	U2.R6.12.	(Predict) Why do you think that some asteroids tumble end over end through space while other asteroids rotate around their axis?		1						1		
						16	8	4	4	1	1	17	15	3	2
					Total number of questions = 34										

Table 62: Textbook #3 "Space Science" Unit 2 Lesson 6 RBT Analysis

						Cognitive Process Dimension						Knowledge Dimension			
Unit No.	Lesson No	Learning Outcome	Page No.	Question Number	Question	Rem	Und	App	Ana	Eva	Crea	Fact	Conc	Proc	Meta
3	1. Earth's Days, Years, and Seasons	To relate Earth's days, years, and seasons to Earth's movement in space.	140			1	1					1	1		
			141	U3.1.1	(Predict) Check T or F to show whether you think each statement is true or false. A. A day is about 12 hours long. B. A year is about 365 days long. C. When it is summer in the Northern Hemisphere, it is		1					1			
			141	U3.1.2.	(Apply) Write your own caption for this photo of leaves in the space below.			1							1
			141	U3.1.3.	(Synthesize) The term rotation can be tricky to remember because it is used somewhat differently in science that it is in everyday life. In baseball, a pitching rotation lists the order of a team's starting pitchers. The order starts over after the last pitcher on the list has played. On the lines below, write down any other examples you can think of that use the term rotation.						1				1
			141	U3.1.4.	(Apply) As you learn the definition of each vocabulary term in this lesson, create your own definition or sketch to help you remember the meaning of the term. (rotation, season, day, equinox, revolution, solstice, year)			1				1	1		
			142	U3.1.5.	(Identify) As you read, underline the places on Earth's surface at which the ends of Earth's axis would be.	1						1			
			143	U3.1.6.	(Infer) How is a leap year, in which a day is added to every fourth year, related to the time it takes Earth to revolve around the sun?		1						1		
			143	U3.1.7.	(Apply) Imagine the Earth's current position is at point A below. Write the label B to show Earth's position 6 months from now in the same diagram.			1					1		
			144	U3.1.8	(Apply) Which location on the illustration of Earth below receives more direct rays from the sun? A/B/They receive equal amounts			1					1	1	
			144	U3.1.9.	(Identify) Which location is cooler?_____	1						1			
			145	U3.1.10.	(Synthesize) Why isn't the area in the photo very warm even though the sun is up all night long?						1		1		
			146	U3.1.11.	(Apply) In what month does winter begin in the Southern Hemisphere?			1					1		
			147	U3.1.12	(Infer) During which solstice would the sun be at its highest point in the sky in the Northern Hemisphere?		1						1		
			147	U3.1.13.	(Infer) In which parts of the world is an equinox most different from other days of the year?		1					1	1		
			148	U3.1.14.	It takes Earth 24 seconds/hours to make one rotation on its axis.	1						1			
			148	U3.1.15.	It takes Earth 365 hours/ days to revolve around the sun.	1						1			
			148	U3.1.16.	Earth's temperatures and hours of daylight stay the most constant at the equator /poles.	1						1			
			148	U3.1.17.	When it is summer in the Northern Hemisphere, it is summer/ winter in the Southern Hemisphere.	1						1			
			148	U3.1.18.	(Predict How would conditions on Earth change if Earth stopped rotating on its axis?		1						1		
			149	U3.R1.1.	In the space provided below, describe how each set of words ae related. Revolution, year		1						1		
			149	U3.R1.2.	In the space provided below, describe how each set of words ae related. Rotation, day		1						1		
			149	U3.R1.3.	In the space provided below, describe how each set of words ae related. Season, equinox, solstice		1						1		
			149	U3.R1.4.	(Identify) About how many days are in an Earth year? And how many hours in an Earth day?	1						1			
			149	U3.R1.5.	(Describe) How does the tilt of Earth's axis affect how the sun's rays strike Earth?		1						1		
			149	U3.R1.6.	(Synthesize) How does the tilt of Earth's axis affect the number of daylight hours and the temperature of a location on Earth?						1		1		
			149	U3.R1.7.	(Identify) What season in the Northern Hemisphere experiencing in the image above?	1						1			
			149	U3.R1.8.	(Explain) How do the tilt of Earth's axis and Earth's movements around the sun cause seasons?		1						1		
			149	U3.R1.9.	(Describe) If the Earth moves to point A in the image above, what season will the Northern Hemisphere experience?		1						1		
						8	11	5			3	11	16	1	2
					Total number of questions 27										

Table 63: Textbook #3 "Space Science" Unit 3 Lesson 1 RBT Analysis

						Cognitive Process Dimension						Knowledge Dimension			
Unit No.	Lesson No	Learning Outcome	Page No.	Question Number	Question	Rem	Und	App	Ana	Eva	Crea	Fact	Conc	Proc	Meta
3	2.Moon Phases and Eclipses	To describe the effects the sun and the moon have on Earth, including gravitational attraction, moon, phases, and eclipses.	152				1						1		
			153	U3.2.1	(Identify) Fill in the blanks with the word or phrase you think correctly completes the following sentences. We can see the moon because it ___the light from the sun. The moon's _____ affects the oceans' tides on Earth. The impact craters on the moon were created by collisions with _____, meteorites and asteriods.	1						1			
			153	U3.2.2.	(Describe) Write your own caption for this photo in the space below.		1								1
			153	U3.2.3.	(Synthesize) You can often define an unknown word if you know the meaning of its word parts use the word parts and sentenve below to make an educated guess about the meaning of the word penumbra.						1				1
			153	U3.2.4.	(Apply) As you learn the definition of each vocabulary term in this lesson, create your own definition or sketch to help you remember the meaning of the term. (satellite, eclipse, gravity, umbra, lunar phases, penumbra)			1				1	1		
			154	U3.2.5.	(Identify) As you read, underline the reason that the moon stays in orbit around Earth.	1						1	1		
			155	U3.2.6.	(Analyze) Draw the correct position of the pin when the moon is in the position shown in the top right corner of this figure.				1				1		
			155	U3.2.7.	(Analyze) How would the moon appear to an observer on Earth if the moon did not rotate?				1				1		
			156	U3.2.8	(Describe) Why does the moon's appearance change?		1						1		
			156	U3.2.9.	(Apply) Look at the night sky and keep a moon journal for a series of nights. What phase is the moon in now?			1					1	1	
			157	U3.2.10.	(Analyze) What shape does the moon appear to be when it is closer to the sun than Earth is?				1				1		
			158	U3.2.11.	(Identify) Fill in the boxes with the type of eclipse that would occur if the moon were in the areas being pointed to.	1						1			
			159	U3.2.12	(Explain) Why is it relatively rare to observe a solar eclipse?		1						1		
			159	U3.2.13.	(Describe) Explain what happens during a solar eclipse.		1						1		
			160	U3.2.14.	The moon takes about one day/month/year to orbit Earth.	1						1			
			160	U3.2.15.	When the moon is in Earth's umbra, a total solar/lunar eclipse is occuring.	1						1			
			160	U3.2.16.	The fraction of the moon that receives sunlight always/never changes.	1						1			
			160	U3.2.17	(Describe) What causes the lunar phases that we see from Earth?		1						1		
			161	U3.R2.1.	In your own words, define the following terms. Gravity	1						1			
			161	U3.R2.2.	In your own words, define the following terms. Satellite	1						1			
			161	U3.R2.3.	In your own words, define the following terms. Umbra	1						1			
			161	U3.R2.4.	(Describe) What are two phases of a waxing moon, and how do they appear?		1						1		
			161	U3.R2.5.	(Identify) Explain why the moon can be seen from Earth.		1						1		
			161	U3.R2.6.	(Describe) what is the relationship between Earth, the sun, and the moon in space?		1						1		
			161	U3.R2.7.	(Identify) What type of eclipse is shown in the diagram?	1							1		
			161	U3.R2.8.	(Describe) Where is the moon in its orbit at the time of a solar eclipse?		1						1		
			161	U3.R2.9.	(Infer) What phase is the moon in when there is a total solar eclipse?		1						1		
			161	U3.R2.10	(Predict) Which shape of the moon will you never see during the daytime, after sunrise and before sunset? (Hint: Consider the directions of the sun and the moon from Earth.)		1						1		
			161	U3.R2.11.	(Synthesize) If you were an astronaut in the middle of the near side of the moon during a full moon, how would the ground around you look? How would Earth, high in your sky look? Describe what is in sunlight and what is in darkness.						1		1		
						10	11	2	3	0	2	10	18	1	2
					Total number of questions = 28										

Table 64: Textbook #3 "Space Science" Unit 3 Lesson 2 RBT Analysis

						Cognitive Process Dimension						Knowledge Dimension			
Unit No.	Lesson No	Learning Outcome	Page No.	Question Number	Question	Rem	Und	App	Ana	Eva	Crea	Fact	Conc	Proc	Meta
3	3. Earth's Tides	To explain what tides are and what causes them in Earth's oceans and to describe variations in the tides.	166				1						1		
			167	U3.3.1	(Describe) Fill in the blank with the word that you think correctly completes the following sentences. The moon of the ___around Earth is related to tides. The daily rotation of ___ is also related to tides. During a ___tide, the water level is higher than the average sea level. During a_____tide, the water level is lower than the average sea level.		1					1			
			167	U3.3.2.	(Label) Draw an arrow to show where you think high tide might be.				1				1		
			167	U3.3.3.	(Synthesize) The word spring has different meaning. Use the meanings of the word spring and the sentence below to make an educated guess about the meaning of the term spring tides.						1				1
			167	U3.3.4.	(Apply0 As you learn the definition of each vocabulary term in this lesson, create your own definition or sketch to help you remember the meaning of the term. (tide, spring tide, tidal range, and neap tides)			1				1	1		
			168	U3.3.5.	(Identify) Underline the sentence that identifies which object is mainly responsible for tides on Earth.	1							1		
			169	U3.3.6.	(Identify) Label the areas where high tides form and the area where the low tide forms.	1							1		
			169	U3.3.7.	(Predict) What happens to the bear when high tide comes in?		1						1		
			170	U3.3.8	(Identify) As you read, underline the two kinds of tidal range.	1						1			
			170	U3.3.9.	(Inquire) Explain why spring tides happen twice a month.		1						1		
			171	U3.3.10.	(Compare) Fill in the Venn diagram to compare and contrast spring tides and neap tides.		1							1	
			172	U3.3.11.	(Inquire) Draw a diagram of Earth to show what Earth's tides would be like if the moon revolved around Earth at the same speed that Earth rotates						1		1		
			172	U3.3.12	(Predict) In the table, predict the approximate times of high tide and low for clearwater, Florida.		1						1		
			173	U3.3.13.	(Identify) Describe how living conditions change for two tidal organisms.		1						1		
			173	U3.3.14.	(Research and Record) List the names of two organisms that live in the high tide zone or the low tide zone along a coastline of your choice.					1			1		
			173	U3.3.15.	(Describe) Imagine a day in the life of an organism you researched in question 14 by doing one of the following: make a poster/ record an audio story/ write a play/ make a cartoon.		1						1		1
			174	U3.3.16.	The type of tide shown here is _____.	1						1			
			174	U3.3.17	Tides on Earth are caused mainly by the _____.	1						1			
			174	U3.3.18.	During a spring tide, the sun, moon, and Earth are in a/an_____	1						1			
			174	U3.3.19.	During a neap tide, the sun, moon, and Earth form a/an_____	1						1			
			174	U3.3.20.	(Describe) State how the moon causes tides		1						1		
			175	U3.R3.1.	Answer the following questions in your own words. Use tide and tidal range in the same sentence.						1		1		
			175	U3.R3.2.	Write an original definition for neap tide and for spring tide.	1						1	1		
			175	U3.R3.3.	(Describe) Explain what tides are. Include high tide and low tide in your answer.		1						1		
			175	U3.R3.4.	(Explain) State what causes tides on Earth.		1						1		
			175	U3.R3.5.	(Identify) Write the alignment of the moon, the sun and Earth that causes a spring tide.	1						1			
			175	U3.R3.6.	(Describe) Explain why tides happen 50 min later each day.		1						1		
			175	U3.R3.7.	(Analyze) What type of tidal range will Earth have when the moon is in this position?				1				1		
			175	U3.R3.8.	(Apply) How many days pass between the minimum and the maximum of the tidal range in any given area? Explain your answer.			1					1		
			175	U3.R3.9.	(Apply) How would the tides on Earth be different if the moon revolved around Earth in 15 days instead of 30 days?			1					1		
						9	11	3	2	1	3	9	20	1	2
					Total number of questions = 29										

Table 65: Textbook #3 "Space Science" Unit 3 Lesson 3 RBT Analysis

						Cognitive Process Dimension						Knowledge Dimension			
Unit No.	Lesson No	Learning Outcome	Page No.	Question Number	Question	Rem	Und	App	Ana	Eva	Crea	Fact	Conc	Proc	Meta
4	1. Images From Space	To describe ways of collecting information from space and analyze how different wavelengths of the electromagnetic spectrum provide different information	186				1						1		
			187	U4.1.1	(Predict) Check T or F to show whether you think each statement is true or false. Visible light is a type of electromagnetic radiation. Artificial satellites can produce images of Earth only. Earth's atmosphere blocks all ultraviolet radiation from space. Optical telescopes are used to study objects in the universe.		1					1	1		
			187	U4.1.2.	(Identify) Look at the picture below. Write a caption that explains what the picture shows.						1		1		1
			187	U4.1.3.	(Synthesize) You can often define an unknown term if you know the meaning of its word parts. Use the word parts and sentence below to make an educated guess about the meaning of the						1				1
			187	U4.1.4.	(Apply) As you learn the definition of each vocabulary term in this lesson, create your own definition or sketch to help you remember the meaning of the term. (wavelength, electromagnetic spectrum, spectrum)			1				1	1		
			188	U4.1.5.	(Identify) As you read, underline the name of each part of the electromagnetic spectrum.	1						1			
			188	U4.1.6.	(Analyze) Write the parts of the electromagnetic spectrum in order from lowest frequency to highest frequency.				1				1	1	
			189	U4.1.7.	(Complete) Electromagnetic ___that has a shorter wavelength has a ____frequency.	1						1			
			190	U4.1.8	(Identify) As you read, underline five ways that people can use elecromagnetic radiation.	1						1			
			190	U4.1.9.	(Explain) Describe an example of how nonvisible radiation can be used.		1						1		
			191	U4.1.10.	(Analyze) Why are x-ray telescopes and gamma-ray telescopes in space?				1				1		
			192	U4.1.11.	(Identify) As you read, underline two types of optical telescopes.	1						1			
			192	U4.1.12	(Identify) As you read, underline one example of electromagnetic radiation that non-optical telescopes detect.	1						1			
			193	U4.1.13.	(Apply) Choose a wavelength from the electromagnetic spectrum other than visible light or x-rays. Imagine that you could look at an image of your hand produced using that wavelength. Then draw a picture of what you think your hand would look like.			1					1	1	
			193	U4.1.14.	(Analyze) Compare the mirror in the reflecting telescope with the radio telescope. In what way is radio telescope like a reflecting telescope?				1				1		
			194	U4.1.15.	(Identify) As you read, underline three examples of satellite orbits.	1						1			
			195	U4.1.16.	(Analyze) Describe one change in urbanization between 1973 and 2006 that you see with these two images.				1				1		
			195	U4.1.17	(Research) Lactose intolerance is a condition that occurs when people are unable to digest milk products. Investigate the cause of lactose intolerance. Write a summary of your findings.					1			1		1
			196	U4.1.18.	(Analyze) Compare one image of the Andromeda galaxy on the opposite page with the image in visible light on this page.				1				1		
			198	U4.1.19.	Two parts of the electromagnetic spectrum between visible light and gamma rays are _____.	1						1			
			198	U4.1.20.	Optical telescopes detect _____	1						1			
			198	U4.1.21.	These two images of Saturn are different because they were made using different wavelengths of _____.	1						1			
			198	U4.1.22.	(Explain) Describe how images from space of Earth and other objects are useful.		1						1		1
			199	U4.R1.1.	Fill in the blank with the term that best completes the following sentences. The distance between two adjacent crests of a wave is called its_____.	1						1			
			199	U4.R1.2.	Fill in the blank with the term that best completes the following sentences. The ____ is all the wavelength of electromagnetic radiation.	1						1			
			199	U4.R1.3.	Fill in the blank with the term that best completes the following sentences. A __is a continuous range of a single feature, such as wavelength.	1						1			
			199	U4.R1.4.	(Explain) State why telescopes that detect non-optical radiation are useful for studying objects in space. Give an example.		1						1		
			199	U4.R1.5.	(Identify) List three examples of telescopes that detect different types of electromagnetic	1						1			
			199	U4.R1.6.	(Explain) Describe how wavelength, frequency, and energy are related.		1						1		
			199	U4.R1.7.	(Explain) Describe one type of electromagnetic radiation that can cause harm to human.		1						1		
			199	U4.R1.8.	(Analyze) Some infrared radiation reaches Earth, and some does not. Which part does reach Earth - longer wavelengh infrared or shorter wavelength infrared?				1				1		
			199	U4.R1.9.	(Analyze) List two other types of electromagnetic radiation that reach Earth's surface.				1				1		
			199	U4.R1.10	(Apply) Describe how remote-sensing satellites can help people stay safe from massive fires.			1					1		
						13	6	3	7	1	2	15	18	2	4
					Total number of questions = 32										

Table 66: Textbook #3 "Space Science" Unit 4 Lesson 1 RBT Analysis

						Cognitive Process Dimension						Knowledge Dimension			
Unit No.	Lesson No	Learning Outcome	Page No.	Question Number	Question	Rem	Und	App	Ana	Eva	Crea	Fact	Conc	Proc	Meta
4	2. Technology for Space Exploration	To analyze the ways people explore space, and assess the role of technology in these efforts.	202						1	1			1		
			203	U4.2.1	(Predict) Check T or F to show whether you think each statement is true or false. Astronauts can travel to distant planets in the solar system. The space shuttle orbits the moon. Artificial satellites in space can help you find locations on Earth. Rovers explore the surfaces of planets and moons.		1					1			
			203	U4.2.2.	(Describe) Write your own caption to this photo.						1		1		1
			203	U4.2.3.	(Apply) Use context clues to write your own definition for the words analyze and transmit.			1						1	1
			203	U4.2.4.	(Identify) As you read, place a question mark next to any words that you don't understand. When you finish reading the lesson, go back and review the text that you marked. If the information is still confusing, consult a classmate or a teacher.(Space shuttle, lander, probe, rover, orbiter, artificial satellite)	1						1	1		
			204	U4.2.5.	(Explain) What is the purpose of SRBs?		1						1		
			204	U4.2.6.	(Identify) As you read, underline challenges humans face when travelling in space.	1						1			
			205	U4.2.7.	(Identify) What are some technologies humans use to survive outside in space?	1						1			
			206	U4.2.8	(Relate) What is one advantage of placing a telescope in space?		1						1		
			207	U4.2.9.	(Compare) How are probes and landers alike? How are they different?		1						1		
			207	U4.2.10.	(Describe) What information can scientists obtain from orbiters		1						1		
			208	U4.2.11.	(Identify) As you read, underline examples of four different kinds of satellites.	1							1		
			208	U4.2.12.	(Identify) List two different features on Earth's surface not given as an example here that might be studied from space.	1							1		
			209	U4.2.13.	(Analyze) Identify changes in the land surface along the Mississippi River delta using the photos.				1				1		
			210	U4.2.14.	(Research) Investigate a satellite map that shows surface features for your town or city. What kinds of data does this map contain?					1			1		1
			211	U4.2.15.	(Identify) List two similarities between deep- sea exploration and space	1						1			
			211	U4.2.16.	(Synthesize) Candle wax belongs to a class of organic compounds called lipids. Look up the relationship between lipids and organic acids. Share your findings						1		1		
			211	U4.2.17	(Apply) Determine whether each structure below represents a hydrocarbon, an organic acid, or a carbohydrate. The first one has been done for you.			1				1			
			212	U4.2.18.	(Identify) As you read, number the sequence of steps required to get a television signal to your television set.	1						1			
			212	U4.2.19.	(Explain) State one reason satellites are useful for communication.		1						1		
			213	U4.2.20.	(Apply) Write a caption for the image shown here.			1					1		1
			214	U4.2.21.	To escape from Earth's gravity, the space shuttle uses liquid fuel and _____.	1						1			
			214	U4.2.22.	Satellites provide images for military purposes, remote sensing, communications, navigation, and _____	1						1			
			214	U4.2.23.	To obtain clearer images, space telescopes orbit above _____	1						1			
			214	U4.2.24.	Examples of uncrewed spacecraft include probes, orbiters, landers, and __	1						1			
			214	U4.2.25	(Provide) Give examples of the kind of information scientists can obtain from each type of uncrewed spacecraft.	1						1			
			215	U4.R2.1.	Circle the term that best completes the following. A rocket/space shuttle is reusable crewed spacecraft.	1						1			
			215	U4.R2.2.	A(n) lander/ orbiter/ is a kind of artificial satellite.	1						1			
			215	U4.R2.3.	A(n) orbiter/ rover often has mechanical arms to gather rock samples.	1						1			
			215	U4.R2.4.	A(n) orbiter/ probe is more suited to the long-term study of a planet or moon.	1						1			
			215	U4.R2.5.	A rocket/ space shuttle had detachable capsules that contained the crew.	1						1			
			215	U4.R2.6.	(List) Give an example of how satellites are used for communication.	1						1			
			215	U4.R2.7.	(Explain) Why is most space exploration accomplished with spacecraft that do not have crews on board?		1						1		
			215	U4.R2.8.	(Apply) How could you benefit from using a GPS unit in your daily life?			1					1		
			215	U4.R2.9.	(Explain) What is one advantage for using an orbiter to study objects in space?		1						1		
			215	U4.R2.10	(Identify) Which spacesuit feature provides oxygen to an astronaut?	1						1	1		
			215	U4.R2.11.	(Infer) How is the spacesuit designed to protect the astronaut outside of a					1			1		
			215	U4.R2.12.	(Infer) Why do you think it's important to map a planet's surface before planning a lander mission?		1						1		
			215	U4.R3.13.	(Conclude) Could a lander be used to study the surface of Saturn? Explain.					1			1		
						19	9	4	1	3	2	19	20	1	4
					Total number of questions = 38										

Table 67: Textbook #3 "Space Science" Unit 4 Lesson 2 RBT Analysis

						Cognitive Process Dimension						Knowledge Dimension			
Unit No.	Lesson No	Learning Outcome	Page No.	Question Number	Question	Rem	Und	App	Ana	Eva	Crea	Fact	Conc	Proc	Meta
4	3. History of Space Exploration	To understand some of the achievements of space exploration.	218				1						1		
			219	U4.3.1.	(Describe) Write a word beginning with each letter of the acronym NASA that describes space exploration						1				1
			219	U4.3.2.	(Describe) Write your own caption to this photo.						1				1
			219	U4.3.3.	(Apply) Use context clues to write your own definition for the word challenge.			1						1	1
			219	U4.3.4.	(Identify) As you read, place a question mark next to any words that you don't understand. When you finish reading the lesson, go back and review the text that you marked. If the information is still confusing, consult a classmate or a teacher. (NASA)	1								1	
			220	U4.3.5.	(Identify) As you read, underline the four words that make up the acronym NASA.	1						1			
			220	U4.3.6.	(Infer) Why might people continue to pursue space exploration in the future?		1						1		
			221	U4.3.7.	(Interpret) How has space exploration changed over time?					1			1		
			222	U4.3.8	(Compare) How are suborbital and orbital space exploration alike and different?		1						1		
			223	U4.3.9.	(Infer) Why was landing on the moon such an important moment in American history?		1						1		
			223	U4.3.10.	(Interpret) What are some requirements for astronauts in order to explore the moon?					1			1		1
			224	U4.3.11.	(Assess) As you read, underline different uses of space shuttle technology.				1				1		
			225	U4.3.12	(Infer) How might working in space be different from working on Earth?		1						1		1
			225	U4.3.13.	(Compare) How is space exploration using space shuttles similar to and different from space exploration using space stations?		1						1		
			226	U4.3.14.	(Identify) As you read, underline the uses of space probes.	1						1			
			226	U4.3.15.	(Assess) How have space probes extended our knowledge of the solar system?				1				1		
			227	U4.3.16.	(Research) Investigate a particular space probe or orbiter and its mission. What did it discover?					1			1		1
			228	U4.3.17	(List) As you read, underline the advantages of using landers and rovers in the exploration of a planet's surface.	1						1			
			228	U4.3.18.	(Assess) How have we learned about Mars from landers and rovers?				1				1		
			229	U4.3.19.	(Infer) How do satellites transmit data to Earth?		1						1		
			230	U4.2.20.	T/F. The first crewed orbital spaceflight mission took place aboard NASA's project Gemini in 1961.	1						1			
			230	U4.3.21.	T/F. Space probes can travel on the surface of a planet.	1						1			
			230	U4.3.22.	T/F. Space stations are a place where humans can live their daily lives, such as eating, sleeping, and working.	1						1			
			230	U4.3.23.	(Compare) What are some advantages and disadvantages of crewed and uncrewed missions?		1						1		
			231	U4.R3.1.	Fill in the blank with the term that best completes the following sentences. A/An ___ is a human-made object that is placed in orbit around a body in space.	1						1			
			231	U4.R3.2.	_____is a government agency that runs the space program in the United States.	1						1			
			231	U4.R3.3.	A vehicle that is designed to move about and collect data from the surface of a planet is called a _____.	1						1			
			231	U4.R3.4.	(List) Identify four ways in which people can directly explore space.	1						1			
			231	U4.R3.5.	(Identify) What are five ways in which people can explore and study space without physically going there?	1						1			
			231	U4.R3.6.	(Summarize) Describe three achievements in space exploration that involved the United States.		1					1	1		
			231	U4.R3.7.	(Infer) Is this an image of an orbiter or a rover? How do you know?				1				1	1	1
			231	U4.R3.8.	(Relate) How is preparing for a space mission similar to planning for a camping trip? How is it different?		1						1		
			231	U4.R3.9.	(Assess) What type of technology would you want to use to study the gas giant plants?				1				1		1
						12	9	1	5	3	2	12	17	3	8
					Total number of questions = 32										

Table 68: Textbook #3 "Space Science" Unit 4 Lesson 3 RBT Analysis

Appendix F
(Observation Questions RBT Analysis)

	Grade 6	Date: Wednesday September 18th, 2013. Time Started: 8:20 Time Ended: 9:00									
	Learning Objectives	To understand the density of different liquids									
	Questions Asked	Cognitive Process Dimension						Knowledge Domain			
		Rem	Und	App	Ana	Eva	Crea	Fact	Conc	Proc	Meta
O1.1	Who Can tell me what is matter?		1						1		
O1.2	What are two things we can relate to matter?		1						1		
O1.3	What is SI unit for mass?	1						1			
O1.4	We relate matter to what?		1						1		
O1.5	What is SI unit to weight?	1						1			
O1.6	If we go to moon what will change?				1				1		1
O1.7	Explain why on moon only you weight will change?					1			1		1
O1.8	How much is the weight of the earth's gravitational force?	1						1			
O1.9	How do we find the volume?			1						1	1
O1.10	How do we find the volume of marble?			1						1	1
O1.11	What do we measure with graduated cylinder?		1						1		
O1.12	Can I measure ml for a solid object?				1				1		
O1.13	What do I do to measure marble volume?			1						1	
O1.14	How do I convert from ml to cubic cm?			1						1	
O1.15	Why do I have to change to cubic cm when measuring solids , not ml?		1		1				1	1	
O1.16	After all students mixed all liquids, Do you notice something strange when observing the different liquids? Why are they different?				1						1
O1.17	What do you mean by density?		1						1		
O1.18	Why do have different layers as you can see?				1						1
O1.19	What can you relate these differences in the layers to?					1			1		1
O1.20	If liquids are heavy, would things stay up or down?		1						1		
O1.21	From textbook Q12 pg. 12 Calculate The two images below show a graduated cylinder filled with water before and after a chess piece is placed inside. Use the images to calculate the volume of the chess piece.			1						1	1
O1.22	How did you derive the answer? Why do you minus?		1	1						1	1
O1.23	Why 6 ml is not used, why do we have to convert to cubic cm?		1						1		
O1.24	What is the rule of converting ml to cubic centimeter?			1						1	
O1.25	Explain what is density?		1						1		
O1.26	Question 14 pg. 13 in book. Predict/Circle the item in each pair that is more dense.				1				1		
O1.27	Why is foam ball used for covering new furniture?					1		1			1
O1.28	Why not use sponge rather than foam?					1					1
	Total:	3	10	7	6	4	0	4	14	8	11

Table 69: Observation #1 – Instructional Questions RBT Analysis

	Grade 6	Date: Sunday September 22nd, 2013. Time Started: 11:20 Time Ended: 12:00									
	Learning Objectives	To review lesson and solve section review									
	Questions Asked	Cognitive Process Dimension						Knowledge Domain			
		Rem	Und	App	Ana	Eva	Crea	Fact	Conc	Proc	Meta
O2.1	How do we find the density of a marble of an irregular shape?			1						1	1
O2.2	What do we use a graduated cylinder to measure?		1					1			
O2.3	How do you find mass, if we find out volume?			1						1	1
O2.4	What material do we use to find mass?	1						1			
O2.5	If I know mass and volume, do I have enough information to find density?				1	1				1	1
O2.6	An object's weight is the amount of space it occupies. Explain why false.		1						1		
O2.7	A golf ball and a table tennis ball, will they have the same volume?			1	1				1		1
O2.8	Explain why they would not have the same volume?		1						1		
O2.9	What do we mean by volume?	1						1			
O2.10	What do we mean by amount of space?	1						1			
O2.11	The mass of an object is equal to its weight. This is false explain and discuss why?				1				1		1
O2.12	What is the SI unit for mass and weight?	1						1			
O2.13	How do we read cm3?	1						1			
O2.14	The volume of a solid can be expressed in units of cm3. True or false?	1						1			
O2.15	An object that floats in water is less dense than water. True or false				1				1		
O2.16	Describe Write a set of instructions that describe how to find the density of an object. Write the instructions so that they work for a regularly shaped object and or an irregularly shaped object.		1				1			1	1
O2.17	What is the formula for density	1						1			
O2.18	What do we mean by regular and irregular solid?		1						1		
O2.19	Showing a marble and whiteboard eraser, the teacher asks which one is regular and which is irregular?				1			1	1		1
O2.20	Can I use Lx WxH to find the volume of a marker?			1						1	1
O2.21	How would I find the volume of this marker?			1						1	1
O2.22	Remember the volume of the marble? How do we get the volume?			1						1	1
O2.23	Can you tell me what is a graduated cylinder?	1						1			
	Total:	8	5	6	5	1	1	10	7	7	10

Table 70: Observation #2 – Instructional Questions RBT Analysis

	Grade 6	Date: Sunday September 22nd, 2013. Time Started: 12:45 Time Ended: 1:30									
	Learning Objectives	To determine regular and irregular solid objects.									
	Questions Asked	Cognitive Process Dimension						Knowledge Domain			
		Rem	Und	App	Ana	Eva	Crea	Fact	Conc	Proc	Meta
O3.1	How do you derive the volume of the two objects given?			1						1	1
O3.2	What is the formula of the volume of a cube?	1						1			
O3.3	Did you measure the length, width, and height? How using what instrument?		1	1					1	1	
O3.4	Explain what you did to find the first shape"a cube"?			1						1	
O3.5	Why for the marble you did not take Height, length, and width?				1				1		
O3.6	How did you find the volume of the marble?			1						1	
O3.7	Show me the height, which side of the cube is it?		1						1		
O3.8	What is the name of the tool for putting water?	1						1			
O3.9	Why did you convert ml to cubic cm? Explain		1						1		
O3.10	Why for marble we use cubic cm, not ml?		1						1		
O3.11	What did you use to measure height, width, and length	1						1			
O3.12	What is matter?		1						1		
O3.13	What is mass?		1						1		
O3.14	What is volume? Define Volume		1						1		
O3.15	Give the formula for Density	1						1			
O3.16	What is weight?		1						1		
O3.17	What is Density?		1						1		
O3.18	Explain the experiment done on the density of different objects?		1	1						1	
O3.19	What happened to bleach, vinegar, oil, corn oil when we mixed them together?				1				1		1
O3.20	What type of change took place?					1			1		
O3.21	What changes were taking place?					1			1		
O3.22	Did the heavy liquid go down or up?				1				1	1	
O3.23	Can we use the word more dense for heavy?		1						1		
O3.24	More dense liquids will be on top or bottom? Why?		1						1		
O3.25	What else should we consider when talking about Density?		1		1				1		
O3.26	How can we relate volume with density?		1						1		
O3.27	If we have liquids A and B, I take 20 ml of A and 2 ml of B? Which will be down A or B?			1						1	
O3.28	Why is liquid A at the bottom, it is supposed to be up? Explain Why?					1			1		
O3.29	What is the SI Unit for mass, volume, and density?	1						1			
	Total:	5	14	6	4	3	0	5	19	7	2

Table 71: Observation #3 – Instructional Questions RBT Analysis

	Grade 6	Date: Sunday October 6th, 2013. Time Started: 9:05 Time Ended: 9:50									
	Learning Objectives	To discuss the properties of matter. To solve revision questions									
	Questions Asked	Cognitive Process Dimension						Knowledge Domain			
		Rem	Und	App	Ana	Eva	Crea	Fact	Conc	Proc	Meta
O4.1	Explain Solubility		1						1		
O4.2	What is a property?		1						1		
O4.3	Solubility/ flammability is a physical property.	1						1			
O4.4	The melting point of a substance is the temperature at which the substance changes from a solid to a gas/liquid.	1						1			
O4.5	Reactivity with water/ Magnetism is a chemical property.	1						1			
O4.6	Flammability is the ability of a substance to transfer heat/burn.	1						1			
O4.7	The characteristic properties of a substance do/ do not depend on the size of the sample.	1						1			
O4.8	(Synthesize) You have two solid substances that look the same. What measurements would you take and which tests would you perform to determine whether they actually are the same?						1			1	
O4.9	Fill in the blank with the term that best completes the following sentence. Flammability is an example of a _____property.	1						1			
O4.10	Fill in the blank with the term that best completes the following sentence. Electrical conductivity is an example of a _____property.	1						1			
O4.11	(Identify) What are three physical properties of aluminum foil?	1						1			
O4.12	(Describe) What effect does observing a substance's physical properties have on the substance?		1						1		
O4.13	(Explain) Describe how a physical property, such as mass or texture, can change without causing a change in the substance.		1						1		
O4.14	(Justify) Must new substances be formed when you observe a chemical property? Explain		1						1		
O4.15	(Infer) You are given samples of the substances shown in the table. The samples are labeled A, B, and C. At room temperature, sample A is a solid, sample B is a liquid, and sample C is a gas. What are the identities of samples A, B, and C? (Hint: Room temperature is about 20 degree celsius)		1						1		
O4.16	(Conclude) The density of gold is 19.3 g/cm cubed. The density of iron pyrite is 5 g.cm cubed. If a nugget of iron pyrite and a nugget of gold each have a mass of 50 g, what can you conclude about the volume of each nugget?			1					1		
O4.17	(Predict) Suppose you need to build a raft to cross a fast-moving river. Describe the physical and chemical properties of the raft that would be important to ensure your safety.				1				1		
	Total:	8	6	1	1	0	1	8	8	1	0

Table 72: Observation #4 – Instructional Questions RBT Analysis

	Grade 6	Date: Sunday October 6th, 2013. Time Started: 12:00 Time Ended: 12:45									
	Learning Objectives	To understand how mass is conserved.									
	Questions Asked	Cognitive Process Dimension						Knowledge Domain			
		Rem	Und	App	Ana	Eva	Crea	Fact	Conc	Proc	Meta
O5.1	Teacher holding different apparatus and asking the Names of these items.	1						1			
O5.2	What do we use a weighing scale to measure?		1						1		
O5.3	What is the unit to measure mass?	1						1			
O5.4	How do you measure 50 ml of vinegar, using what apparatus ?			1						1	
O5.5	Please explain the procedure to measure the mass of baking soda using a beaker?			1						1	
O5.6	What is water displacement?		1						1		
O5.7	What do I use a flask/ beaker to measure baking soda?	1						1			
O5.8	If I have 20g beaker and 25g baking soda? What is the measurement of the mass of baking soda?			1						1	
O5.9	What do you have to total to get the total mass? Do you include the weigh of the beaker? Explain Why?		1						1	1	
O5.10	What does the total mass mean add or subtract?		1						1		
O5.11	What happens to the balloon when mixing baking soda and vinegar? Describe				1				1		1
O5.12	What is inside the balloon that makes it inflate?				1				1		
O5.13	What type of change has taken place when mixing baking soda and vinegar?				1				1		
O5.14	What is the difference between physical and chemical change?		1						1		
O5.15	What is reactivity?		1						1		
O5.16	Can you explain the chemical properties of the reaction taking place?				1				1		
O5.17	What was the main idea of the experiment?		1						1		
O5.18	After mixing the items and finishing the experiment. Weigh the material and explain your answer. Deduce a conclusion by comparing before and after.			1	1				1	1	1
O5.19	Explain the difference in mass if there is some difference in mass?				1				1		
O5.20	What do we mean by mass?		1						1		
O5.21	Why is the mass almost the same eventhough we had a chemical change?		1						1		
O5.22	Does mass change after a chemical or a physical change?		1						1		
	TOTAL:	**3**	**10**	**4**	**6**	**0**	**0**	**3**	**16**	**5**	**2**

Table 73: Observation #5 – Instructional Questions RBT Analysis

	Grade 6	Date: Sunday October 20th, 2013. Time Started: 11:20 Time Ended: 12:00									
	Learning Objectives	To review physical and chemical changes.									
	Questions Asked	Cognitive Process Dimension						Knowledge Domain Dimension			
		Rem	Und	App	Ana	Eva	Crea	Fact	Conc	Proc	Meta
O6.1	What is the meaning of a precipitate?	1						1			
O6.2	How does a precipitate form?		1						1		
O6.3	Give an example of two liquids that are mixed to give a precipitate?	1						1			
O6.4	Explain what is a physical change?		1						1		
O6.5	What is a chemical change?		1						1		
O6.6	Give me signs of chemical change?	1						1			
O6.7	Is malleability a chemical change?	1						1			
O6.8	Who can explain the law of conservation of mass?		1						1		
O6.9	Teacher holds vinegar and a balloon, she adds baking soda inside the balloon. Can anyone explain why I am not adding directly into the flask?		1						1		
O6.10	If I do not put the balloon, what will happen to my mass?		1						1		
O6.11	Explain the reaction that took place when adding baking soda and vinegar?		1							1	
O6.12	What is mass?	1						1			
O6.13	What will happen to the mass in the experiment? Has the mass changed?		1						1		
O6.14	What is the change that has taken place?		1						1		
O6.15	Teacher writes a problem with the following data: Flask + vinegar = 10g, baking soda = 5g, balloon = 1g. Total is 16g. What will be the weight of all: the flask, vinegar, baking soda, and balloon after mixing the baking soda and vinegar and having the balloon blow up?		1	1					1		
O6.16	IF we burn wood of 20 kg and we get ashes of 8 kg? What happened to the remaining 12kg? Explain with the law of conservation of mass.		1	1					1		
	Total:	**5**	**11**	**2**	**0**	**0**	**0**	**5**	**10**	**1**	**0**

Table 74: Observation #6 – Instructional Questions RBT Analysis

	Grade 6	Date: Sunday October 27th, 2013. Time Started: 11:20 Time Ended: 12:00									
	Learning Objectives	To identify the difference between boiling point and evaporation									
	Questions Asked	Cognitive Process Dimension						Knowledge Domain Dimension			
		Rem	Und	App	Ana	Eva	Crea	Fact	Conc	Proc	Meta
O7.1	Can anyone explain what is a solid?		1						1		
O7.2	What is the shape, size, and volume of a solid?		1						1		
O7.3	Explain what is a liquid in terms of size/ volume?		1						1		
O7.4	Explain what is a gas in terms of size and volume?		1						1		
O7.5	Do the particles in gas have less or more energy?		1						1		
O7.6	When ther is a change from solid to liquid what happens in terms of energy?				1				1		
O7.7	What is the point when solid is changed from liquid to a gas?	1							1		
O7.8	What is the process when liquid changes into gas?	1							1		
O7.9	Write in your copybook what you understand about boiling point and evaporation?		1						1		
O7.10	What is the boiling point of water?	1						1			
O7.11	The teacher is showing kettle, opens the lid and vapour comes out, she asks what is the process?			1				1			
O7.12	What is the a thermometer	1						1			
O7.13	How do you use a thermometer?		1							1	
O7.14	What unit do we use to measure temperature?	1						1			
O7.15	You all had what temperature? Is this the boiling point or evaporation?				1				1		
O7.16	Why is the temperature not specific?				1				1		
O7.17	What happens at the surface in evaporation?		1						1		
O7.18	Why is the temperature not specific?				1				1		
	Total:	**5**	**8**	**1**	**4**	**0**	**0**	**4**	**13**	**1**	**0**

Table 75: Observation #7 – Instructional Questions RBT Analysis

	Grade 6	Date: Sunday October 28th, 2013. Time Started: 11:20 Time Ended: 12:00									
	Learning Objectives	To define evaporation, and explore its properties. To identify the boiling point of water									
	Questions Asked	Cognitive Process Dimension						Knowledge Domain			
		Rem	Und	App	Ana	Eva	Crea	Fact	Conc	Proc	Meta
O8.1	What is condensation?	1							1		
O8.2	What is melting?	1							1		
O8.3	In terms of particles arrangement what happens to particles during condensation?		1						1		
O8.4	Why does condensation have any point and therefore why is evaporation the same?		1						1		
O8.5	Do the particles in gas have less or more energy?		1						1		
O8.6	When ther is a change from solid to liquid what happens in terms of energy?				1				1		
O8.7	What is the point when solid is changed from liquid to a gas?	1							1		
O8.8	What is the process when liquid changes into gas?	1							1		
O8.9	In seawater does evaporation happen all the time?				1				1		
O8.10	Water boiling...Look at the beaker on the bunsen burner? Describe what is happening?				1			1			
O8.11	Explain if you think it is boiling? Why is not boiling? Why have I added colouring?		1					1			
O8.12	Can you see smoke? Do you thin its evaporation?				1			1			
O8.13	The teacher asked a student to read the temperature?			1						1	1
O8.14	What happens to the mercury? Why?		1						1		
O8.15	Can you see more change? Check the temperature?				1				1		
O8.16	The teacher takes the thermometer out and asks what happens to the temperature?				1				1		
O8.17	Will it reach 100, though we see boiling from the bubbles?She gives them a hint I took the water from the tap				1				1		
O8.18	What do we mean with distilled water?		1					1			
O8.19	In a group, summarize the difference between boiling point and evaporation?		1					1			
O8.20	What do you mean by boiling point?		1					1			
O8.21	Evaporation happens at which part of the liquid? Where does boiling point happen?				1			1			1
	TOTAL:	**4**	**8**	**1**	**8**	**0**	**0**	**7**	**13**	**1**	**2**

Table 76: Observation #8 – Instructional Questions RBT Analysis

Appendix G
(Second Rater Questions RBT Analysis)

						Cognitive Process Dimension						Knowledge Dimension					
Unit No.	Lesson No	Learning Outcome	Page No.	Question No.	Question	Rem	Und	App	Ana	Eva	Crea	Fact	Conc	Proc	Meta		
1	2. Properties of Matter	To classify and compare substances based on their physical and chemical properties	20				1										ok
			21	U1.2.1.	(Predict) Check T or F to show whether you think each statement is true or false. A. Liquid water freezes at the same temperature at which ice melts: 0 degree celsius. B. A bowling ball weighs less than a styrofoam ball of the same size. C. An object with a density greater than the density of water will float in water. D. Solubility is the ability of one substance to dissolve in another.		1					1				21	ok
			21	U1.2.2.	(Describe) If you were asked to describe an orange to someone who had never seen an orange, what would you tell the person?	1						1				21	ok
			21	U1.2.3.	(Sythesize) Many English words have their roots in other languages. The root of the word solubility is the latin word solvere, which means "to loosen". Make an educated guess about the meaning of the word solubility.						1		x		1	21	no
			21	U1.2.4.	(Apply) As you learn the definition of each vocabulary term in this lesson, create your own definition or sketch to help you remember the meaning of the term.			1							1	21	ok
			22	U1.2.5.	(Describe) Does observing a physical property of a substance change the identity of the substance? Explain		1						1			22	ok
			23	U1.2.6.	(Observe) Describe the physical properties of objects you see in this photo.			1					1	1		23	ok
			23	U1.2.7.	(Apply) Describe a common object by naming its properties. Trade your mystery-object description with a classmate's and try to guess what object he or she has described.			1					1	1		23	ok
			24	U1.2.8.	(Explain) The photo above shows oil and vinegar in a pitcher. The top layer is the oil. Describe the density of the vinegar compared to the density of the oil.		1						1			24	ok
			24	U1.2.9.	(Predict) If you let all of the liquid evaporate out of the pitcher. Would you be able to see the solid particles of the drink mix? Explain.		1						1			24	ok
			25	U1.2.10.	(Identify) Name something made of aluminium and explain why malleability is a useful property.	1	1					1	1			25	ok
			25	U1.2.11.	(Infer) Compare what happens when a geyser erupts to what happens when a tea kettle whistles.		1						1			25	ok
			26	U1.2.12.	(Identify) As you read, underline the definition of a chemical property	1						1				26	ok
			26	U1.2.13.	(Predict) Why do automobiles rust more easily in wet climates than drier climates?		1						1			26	ok
			28	U1.2.14.	(Compare) Describe the difference between a physical property and a chemical property?		1						1			28	ok
			28	U1.2.15.	(Distinguish) What type of property is being shown by each nail?				1				1			28	ok
			28	U1.2.16	(Predict) Check the correct box to show whether each property of an iron nail is a physical or a chemical property.		1						1			28	ok
			29	U1.2.17.	(Identify) List physical and chemical properties used to identify evidence at a crime scene.	1						1	1			29	ok
			29	U1.2.18.	(Predict) When examining evidence, why might investigators want to be more careful examining chemical properties than physical properties?		1						1			29	ok
			29	U1.2.19.	(Evaluate) By examininning the physical and chemical properties of evidence at a crime scene, Investigators can often be more certain about what a suspicious substance is not than about what it is. Why do you think this is the case?					1			1		1	29	ok
			30	U1.2.20.	(Infer) Check the box to show which would tell you for sure if you had a sample of real gold.		1					1				30	ok
			31	U1.2.21.	(Calculate) A student finds an object with a mass of 64.54 g and a volume of 14 cm cubed. Find the density of the object. Could the object be gold?			1						1		31	ok
			32	U1.2.22.	Solubility/ flammability is a physical property.	1						1				32	ok
			32	U1.2.23.	The melting point of a substance is the temperature at which the substance changes from a solid to a gas/liquid.	1						1				32	ok
			32	U1.2.24.	Reactivity with water/ Magnetism is a chemical property.	1						1				32	ok
			32	U1.2.25.	Flammability is the ability of a substance to transfer heat/burn.	1						1				32	ok
			32	U1.2.26.	The characteristic properties of a substance do/ do not depend on the size of the sample.	1						1				32	ok
			32	U1.2.27.	(Synthesize) You have two solid substances that look the same. What measurements would you take and which tests would you perform to determine whether they actually are the same?						1			1		32	ok
			33	U1.R2.1.	Fill in the blank with the term that best completes the following sentence. Flammability is an example of a _____property.	1						1				33	ok
			33	U1.R2.2.	Fill in the blank with the term that best completes the following sentence. Electrical conductivity is an example of a _____property.	1						1				33	ok
			33	U1.R2.3.	(Identify) What are three physical properties of aluminum foil?	1						1				33	ok
			33	U1.R2.4.	(Describe) What effect does observing a substance's physical properties have on the substance?		1						1			33	ok
			33	U1.R2.5.	(Explain) Describe how a physical property, such as mass or texture, can change without causing a change in the substance.		1						1			33	ok
			33	U1.R2.6.	(Justify) Must new substances be formed when you observe a chemical property? Explain		1						1			33	ok
			33	U1.R2.7.	(Infer) You are given samples of the substances shown in the table. The samples are labeled A, B, and C. At room temperature, sample A is a solid, sample B is a liquid, and sample C is a gas. What are the identities of samples A, B, and C? (Hint: Room temperature is about 20 degree celsius)		1						1			33	ok
			33	U1.R2.8.	(Conclude) The density of gold is 19.3 g/cm cubed. The density of iron pyrite is 5 g.cm cubed. If a nugget of iron pyrite and a nugget of gold each have a mass of 50 g, what can you conclude about the volume of each nugget?			1					1			33	ok
			33	U1.R2.9.	(Predict) Suppose you need to build a raft to cross a fast-moving river. Describe the physical and chemical properties of the raft that would be important to ensure your safety.				1				1			33	ok
						12	15	5	2	1	2	14	20	4	3		
					Total number of questions = 35												

Table 77: Second Rater RBT Question Analysis – Textbook #1 "Matter and Energy" Unit 1 Lesson2

						Cognitive Dimension						Knowledge Dimension				
Unit No.	Lesson No	Learning Outcome	Page No.	Question No.	Question	Rem	Und	App	Ana	Eva	Crea	Fact	Conc	Proc	Meta	
1	3. Physical and Chemical Changes	To distinguish between physical and chemical changes of matter.	34						1				1			ok
			35	U1.3.1.	(Predict) Check T or F to show whether you think each statement is true or false. A. When an ice cube melts, it is still water. B. Matter is lost when a candle is burned. C. When your body digests food, the food is changed into new substances.		1					1				ok
			35	U1.3.2.	(Describe) Write a word or phrase beginning with each letter of the word CHANGE that describes changes you have observed in everyday objects.		1								1	no
			35	U1.3.3.	(Apply) Use context clues to write your own definitions for the words interact and indicate			1						1		ok
			35	U1.3.4.	(Apply) As you learn the definition of each vocabulary term in this lesson, create your own definition or sketch to help you remember the meaning of the term.physical change, chemical change, law of conservation of mass			1					1			ok
			36	U1.3.5.	(Explain) What happens to a substance during a physical change?		1						1			ok
			37	U1.3.6.	(Identify) The list below gives several examples of physical changes. Write your own examples of physical changes on the blank lines.	1						1			1	no
			37	U1.3.7.	(Analyze) How does the yarn in the sweater differ from the wool on the sheep?				1						1	no
			38	U1.3.8.	(Identify) Use the boxes provided to identify the wood, ashes, and flames involved in the chemical change. Then write a caption describing the chemical changes you see in the photo.		1						1	1		ok
			39	U1.3.9.	(Explain) How do higher temperatures influence a chemical change?		1						1			ok
			39	U1.3.10.	(Infer) Think of ways you control temperature to influence chemical changes during typical day. (Hint: Cooking, Art class)		1						1			ok
			40	U1.3.11.	(Compare) How are physical and chemical changes different?		1						1			ok
			41	U1.3.12.	(Infer) List the observations you might make as you witness each of the changes below. Then classify each change as a physical change or a chemical change.		1							1		ok
			42	U1.3.13.	(Identify) What is the law of conservation of mass?	1							1			ok
			43	U1.3.14.	(Describe) How is the physical change in the robot reversible, and how can you tell that the change follows the law of conservation of mass?		1						1	1		ok
			43	U1.3.15.	(Infer) What would you observe about the mass in the flask if you did not put the balloon on top? Why?		1						1			ok
			44	U1.3.16.	Burning/ Dying wool is an example of a physical change.	1							1			ok
			44	U1.3.17.	The formation of a precipitate signals a physical / chemical change.	1							1			ok
			44	U1.3.18.	This physical/ chemical change result in the formation of new substances.	1							1			ok
			44	U1.3.19.	The mass of the toy on the right is the same as/ different from the mass of the toy on the left.	1							1			ok
			44	U1.3.20.	(Explain) Do changes that cannot be easily reversed, such as burning, observe the law of conservation of mass? Explain.		1						1			ok
			45	U1.R3.1.	In your own words, define the following terms physical change.	1							1			ok
			45	U1.R3.2.	In your own words, define the following terms chemical change.	1							1			ok
			45	U1.R3.3.	In your own words, define the following terms law of conservation of mass	1							1			ok
			45	U1.R3.4.	(Identify) Give an example of a physical change and an example of a chemical change.	1							1			ok
			45	U1.R3.5.	(Compare) How is a chemical change different from a physical change?		1						1			ok
			45	U1.R3.6.	(Apply) Suppose a log's mass is 5 kg. After burning, the mass of the ash is 1 kg. Explain what may have happened to the other 4 kg.			1					1			ok
			45	U1.R3.7.	(Analyze) As the bright sun shines upon the water the water slowly disappears. The same sunlight gives energy to the surrounding plants to convert water and carbon dioxide into sugar and oxygen gas. Which change is physical and which is chemical?				1				1			ok
			45	U1.R3.8.	(Compare) Relate the statement "You can't get something for nothing" to the law of the conservation of mass.		1				1		1			ok
			45	U1.R3.9.	(Infer) Sharpening a pencil leaves behind pencil shavings. Is sharpening a pencil a physical change or a chemical change? Explain		1						1			ok
						10	14	3	2		1	2	23	4	3	
					Total Number of questions= 28											

Table 78: Second Rater RBT Question Analysis – Textbook #1 "Matter and Energy" Unit 1 Lesson3

						Cognitive Process Dimension						Knowledge Dimension				
Unit No.	Lesson No	Learning Outcome	Page No.	Question No.	Question	Rem	Und	App	Ana	Eva	Crea	Fact	Conc	Proc	Meta	
1	4. Pure Substances and Mixtures	To distinguish between pure substances and mixtures	50						1				1			ok
			51	U1.4.1.	(Predict) Check T or F to show whether you think each statement is true or false. A. Atoms combine in different ways to make up all of the substances you encounter everyday. B. Saltwater can be separated into salt and water C. A mixture of soil has the same chemical composition throughout		1						1			ok
			51	U1.4.2.	(Apply) Think of a substance that does not dissolve in water. Draw a sketch below that shows what happens when this substance is added to water			1					1			ok
			51	U1.4.3.	(Synthesize) Many English words have their roots in other languages. Use the Greek words below to make an educated guess about the meanings of the words homogeneous and heterogeneous.				cc		1				1	no
			51	U1.4.4.	(Identify) This list contains the key terms you'll learn in this lesson. As you read, circle the definition of each term. (atom, element, compound, mixture, pure substance, hetergeneous, homogeneous)	1							1			ok
			52	U1.4.5.	(Compare) What do elements, compounds, and mixtures have in common?		1						1			ok
			52	U1.4.6.	(Predict) If you have ever baked a cake or bread, you know that the ingredients that combine to make it taste different from the baked food, Why do you think that is?		1						1			ok
			53	U1.4.7.	(Analyze) Why are the spheres representing nitrogen and oxygen different colors?				1				1			ok
			54	U1.4.8.	(Identify) Fill in the blanks to label the two particle models.	1						1				ok
			54	U1.4.9.	(Explain) Copper is an element. How do these images of copper illustrate this?		1						1			ok
			55	U1.4.10.	(Explain) Water is a compound. How do these images of water illustrate this?		1						1			ok
			55	U1.4.11.	(Identify) What happens when a pure substance undergoes a chemical change?	1							1			ok
			56	U1.4.12.	(Identify) As you read, underline the ways in which elements are organized on the periodic table.	1						1				ok
			57	U1.4.13.	(Classify) Read about some of the ways in which compounds can be classified. Then fill in the blanks to complete the photo captions.		1						1			ok
			58	U1.4.14.	(Describe) This student is going to make and separate a mixture of sand and salt. Complete these captions to describe what is taking place in each photo.		1							1		ok
			59	U1.4.15.	(Devise) How could you separate a mixture of rocks and sand?		1							1		ok
			60	U1.4.16.	(Identify) As you read, underline the everyday examples of mixtures on this page.	1						1				ok
			61	U1.4.17.	(Summarize) Complete the graphic organizer below by filling in the blanks with terms from this lesson. Then add definitions or sketches of each term inside the appropriate box.		1						1			ok
			62	U1.4.18.	Water is a pure substance/ mixture.	1						1				ok
			62	U1.4.19.	Water is a(n) element/compound.	1						1				ok
			62	U1.4.20.	Saltwater and sand can be separated with a magnet/filter.	1						1		1		ok
			62	U1.4.21.	Saltwater is a homogeneous/ heterogeneous mixture.	1						1				ok
			62	U1.4.22.	(Predict) Why do you think that the particles of a suspension settle out but the particles of a colloid do not?		1						1			ok
			63	U1.R4.1.	Fill in the blanks with the term that best completes the following sentences. The basic building blocks of matter are called_____.	1						1				ok
			63	U1.R4.2.	Fill in the blanks with the term that best completes the following sentences. A(n) _____is a substance that is made up of a single kind of atom.	1						1				ok
			63	U1.R4.3.	Fill in the blanks with the term that best completes the following sentences. Elements and compounds are two types of _____.	1						1				ok
			63	U1.R4.4.	Fill in the blanks with the term that best completes the following sentences. A(n) _____is a combination of substances that are combined physically but not chemically.	1						1				ok
			63	U1.R4.5.	(Identify) What kind of mixture is a solution? A suspension? A colloid?	1							1			ok
			63	U1.R4.6.	(Apply) Fish give off the compound ammonia which has a pH above 7? To which class of compounds does ammonia belong?			1					1			ok
			63	U1.R4.7.	(Compare) Fill in the following table with properties of elements and compounds.		1					1				
			63	U1.R4.8.	(Identify) What type of mixture is this salad dressing?	1							1			ok
			63	U1.R4.9.	(Explain) Could a mixture be made up of only elements and no compounds? Explain		1						1			ok
			63	U1.R4.10.	(Synthesize) Describe a procedure to separate a mixture of sugar, black pepper, and pebbles.						1	1		1		
						15	12	2	1		2	13	16	4	1	

Table 79: Second Rater RBT Question Analysis – Textbook #1 "Matter and Energy" Unit 1 Lesson 4