5-2023

Development of Secondary Special Education Science Assessments and Curriculum Map

Heather Thompson
Utah State University

Development of Secondary Special Education Science Assessments and Curriculum Map

Heather Ware Thompson

A project submitted to the faculty of

Utah State University

in partial fulfillment of the requirements for the degree of

Masters in Special Education

Dr. Sophia D'Agostino, Chair

Dr. Tim Slocum

Heather Weese

Emma Eccles Jones College of Education and Human Services

Utah State University

March 2023

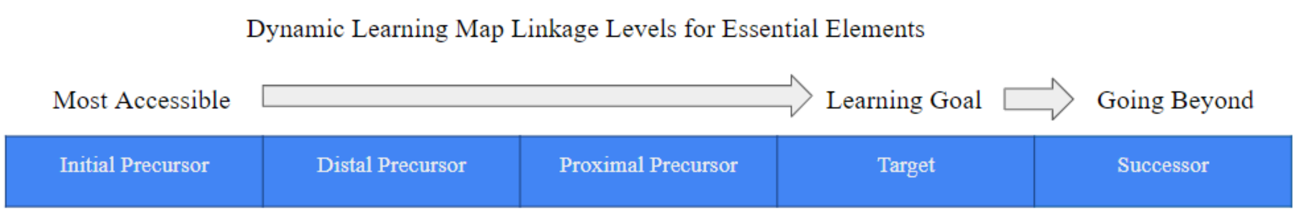
Development of Secondary Special Education Science Assessments and Curriculum Map

Introduction

Students with the most significant cognitive disabilities receive instruction based on the Essential Elements developed from the grade level standards. These Essential Elements cover the breadth but not the depth of the grade level standards (DLM, 2019). Each element is a statement of knowledge or a skill to be mastered at a specific grade level. The Essential Elements are organized into a Dynamic Learning Map (DLM). The DLM allows educators to tailor instruction to each student's specific learning needs by providing a variety of linkage levels for each element (see Figure 1). Students who receive instruction on the Essential Elements have an alternate assessment at the end of the year. This DLM assessment is also tailored to the specific abilities of the student, by utilizing the linkage levels and changing based on the student's previous performance.

Figure 1

Dynamic Learning Map Linkage Levels for Essential Elements



The Essential Elements of the DLM, as developed in 2014, included the content areas of math, reading and writing. In 2019, the DLM added Science Essential Elements for elementary, middle and high school students with severe special needs. The high school elements include the most critical concepts from the physical, life, and earth/space sciences (see Figure 2). Currently the science elements have only three linkage levels, (initial, precursor, and target) with plans to expand the linkage levels in the future (Figure 3).

Figure 2

Science Essential Elements

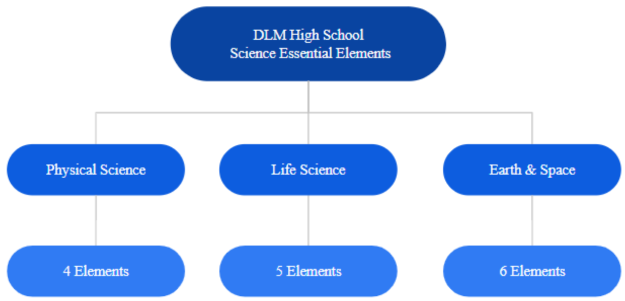


Figure 3

Dynamic Learning Map Linkage Levels for Science Essential Elements

The initial linkage level is the most basic access to the essential element, the precursor level prepares the student to access the element and the target level is the learning goal of the Essential Element. For example, when studying chemical reactions, the initial level would indicate yes or not for if there was a change or not, the precursor level would identify the chemical reaction (i.e., rust or releasing gas) and the target level would identify the reaction as well as the reasons why there was a reaction.

In the Dynamic Learning Maps Essential Elements for Science (2019), it states, "The purpose of the DLM Essential Elements is to build a bridge from the content in the general education science framework to academic expectations for students with the most significant cognitive disabilities" (p. 4). Speaking of the development of the state standards it says, "Most states' science standards included scientific investigation practices, typically integrated into the core content areas” (p. 5). In the Alpine School District, at the high school level, severe special education students' core content classes are reading, writing, math, and life skills. As science is a relatively new content area for assessment, there is not a class specified to cover the content and special education teachers must teach science within the other core subjects, typically within life skills.

In 2020, the Alpine School District developed a curriculum map and lesson outlines for science dividing the Essential Elements into six units to be covered monthly from September through March with the goal of being prepared for DLM testing in April. In the summer of 2022, as the Alpine School District high school collaboration team for severe special needs met and discussed the implementation of these units over the past two years, they proposed that the next step in developing the science curriculum would be to break the units into smaller, more manageable concepts, create leveled objectives for each concept and relate them to the functional life skills of the students.

Drawing upon my teaching experience with Alpine School District, I referenced their shared drive for secondary life skills teachers to find the Science Essential Elements curriculum map and associated lesson plans. To find the DLM learning map, I used the Google search engine and the search term “dynamic learning maps science” to find the Dynamic Learning Map’s Essential Elements for Science. Using the USU library and search terms such as “science special education” and “science severe special education”, I reviewed 50 titles. Limiting those titles to what may be applicable to secondary education, significant disabilities and teaching science, I reviewed 11 abstracts and chose four articles to review.

Review of Literature

History of Research

Capraz and Boynikoglu (2021) set the stage for researching science in special education by stating that "The lack of studies on teaching science to students with intellectual disabilities is the most significant evidence that the importance has not been attached sufficiently to this field" (p. 675). Seeking to discover the trends in those studies, Tosun (2022) conducted a bibliometric and content analysis of the articles published in the Social Science Citation Index (SSCI) journals on science education for special education students over the last 40 years. Of the 193 publications identified by his search terms and used in the bibliometric analysis, he found that only 100 directly related to the topic and used those for the content analysis.

According to Tosun's (2022) analysis, the first article addressing science education for special education students was published in 1982 and there was a significant spike of publications in 1994 with that being the year most commonly cited by future publications. Other than the 1994 spike, there was a general trend upwards in the number of articles published with the highest numbers in 2018 and 2020. The number of citations, however, has trended downward since 2012. Thus, it can be seen that the body of research is growing but may require more foundational breakthroughs to continue to progress. He continues stating that the four most common keywords were science education, science, inclusion, and universal design for learning with the most recent trends in keywords being disabilities and inclusive education. These trends suggest that research is focused on expanding the general education science curriculum to include students with disabilities as opposed to developing the alternative assessment curriculum.

The most common special education types mentioned by Tosun (2022) were: students with disabilities (15%), various disabilities (18%), and students with learning disabilities (36%). Notably lacking were any studies specific to students with severe disabilities. The majority of the studies (62%) looked at primary and/or middle school age students with only 22% of the articles related to middle and/or high school students. Although high school students with severe disabilities are not specifically mentioned, many of the concepts applicable to student with disabilities and in younger age brackets are also applicable to students with severe disabilities in a high school setting as they cover similar content areas and have similar learning challenges.

Value of Science Education

Science has a reputation of being overly complex and difficult to learn. When adding disabilities to the equation, it is understandable why teaching science to students with severe special needs has been delayed. Yet, according to Tosun (2022), “Every student needs science to solve daily life problems” (p. 352). An education in science develops a framework to engage more actively in daily life, improves student’s sensitivity to and understanding of the environment around them, fosters creativity, adaptability, and creates a problem-solving approach to life decisions (Capraz & Boynikoglu, 2021). While the body of research provides a consensus as to the value of including science at the core of a qualifying education, “individuals with intellectual disabilities are generally deprived of basic education which is requisite to take life responsibilities, to make choices, to make decisions, and to effectively engage in society” (Capraz & Boynikoglu, 2021, p. 676).

To investigate the reason for the deficit in science education in special education, Capraz and Boynikoglu (2021) conducted a qualitative research study with 10 special education teachers working in Erzurum, Turkey in order to ascertain their views on teaching science to students with intellectual disabilities. Each participant was interviewed for 5-20 minutes using a semi-structured 5-question catalog. The interviews were then transcribed and analyzed by categorizing terms and combinations of terms into categories then summarizing each category. Significantly, they found that all the teachers viewed science instruction to students with disabilities as a necessary endeavor but half of them made the necessity conditional on mental competence or after the ascertaining of basic life skills. The basic life skills they thought prerequisite included self-care, social ability, and literacy. This shows that there is a lack of understanding as to how the Essential Elements of scientific principles can be applied to basic aspects of daily life. Some practical examples include learning why water boils is applicable to cooking pasta and learning about the seasons is applicable to clothing choices (Capraz & Boynikoglu, 2021). They concluded that meeting the educational needs of the students and teachers is a prerequisite in order to be effective in teaching science to students with disabilities.

What Students Need

Obstacles teachers have reported in teaching science to students with intellectual disabilities are the abstract nature of the topics and the thought that they do not encounter science concepts in their daily lives (Capraz & Boynikoglu, 2021). Kasnett (2020) said, “Independence and self-reliance should always be primary goals when working with students of this functioning level” (p. 111).

There are many reasons that support the use of the Dynamic Learning Map (DLM) essential elements and assessment models for students with the most significant cognitive disabilities. Within the DLM, “the levels build up to, touch, and then go beyond the Essential Element” (Kingston, 2017). This maintains the focus on the content standards while adapting to different cognitive levels. At the most basic level, concepts are more concrete and daily life applications can easily be made. For example, what animals eat (EE.MS-LS2-2) relates to what food someone would feed their pet and identifying objects that reduce heat transfer (EE.MS-PS3-3) relates to what someone would use for a hot pad. Thus, obstacles for teaching science to students with intellectual disabilities are being overcome.

Kinston (2017) explains that the history of the DLM has its roots in the civil rights and anti-segregation movements as many students with disabilities were entirely denied access to public education. This led to the development of the Individuals with Disabilities Education Act (IDEA), which requires public schools to offer a free and appropriate public education (FAPE) within the least restrictive environment (LRE). As teachers strive to build the bridge from the grade level standards to those students with the most significant cognitive disabilities, they will need a wide continuum of services to offer a free and appropriate public education to all students (DLM, 2019).

The DLM allows students to learn in proportion to their intellectual abilities (Capraz & Boynikoglu, 2021). Students are individually taught challenging material and tested on what they are taught (Kingston, 2017). As progress is typically much slower, short term objectives within IEP goals are required by law for students who take the alternative assessment in order to more closely monitor their progress (Tatgenhorst, 2018). A framework for creating these short-term goals is supported by the fine-grain learning map models and instructionally based assessments of the DLM (Kingston 2017)

What Teachers Need

Common reasons that teachers have reported for being hesitant to teach science is a lack of sufficient training, materials and knowledge of adequate teaching methods, which leads to a negative attitude towards science (Capraz & Boynikoglu, 2021). This relates to what Kingston (2017) said, “The body of literature suggests a chicken-and-egg problem. If teachers feel they cannot teach well in an inclusive classroom setting, they will not teach well. If they do not teach well, their negative attitudes will be reinforced, perpetuating the challenge” (p. 111). This can be overcome through collaboration between special education teachers, science teachers, and related service providers using a learning from success model (Kasnett, 2020).

Collaboration in special education is already central to a teacher's mode of operation given the requirements of the IEP process; they already collaborate with other special education teachers, general education teachers and related service providers. A traditional organizational learning approach would use this collaboration as an opportunity to resolve problems whereas a learning from success model is a pedagogical shift to create an environment that encourages sharing experiences of success. This will create a more positive educational and learning environment where even the most minor successes are noted and learned from. Learning from success represents a shift from teachers teaching to the role of the learner. These collective learning mechanisms increase teachers' use of inquiry-based instruction, instructional materials and practices (Kasnett, 2020). As teachers collaborate, learn from their success, and use the DLM model, they can develop a science curriculum that allows all special education students access to an appropriate education in science and progress towards the general curriculum.

Development of Curriculum Map

Procedures

Previous to this project, the Alpine School District Life Skills science curriculum consisted of six-monthly units. The units did not have weekly learning objectives, they were broad and generally aimed at the highest functioning level of our student. The curriculum lacked the specificity required to adequately cover the science essential elements and adapt it to the variety of students present in a life skills classroom.

The Alpine School District Life Skills collaboration team developed curriculum maps for teaching math, reading and writing. Using their model and with their collaboration, I created a curriculum map for teaching science to the same demographic (see appendix A). This map distributes all of the Dynamic Learning Map science essential elements annually into weekly leveled learning objectives. The language of the elements is simplified in the map to make it more readily accessible to teachers. The corresponding DLM links are included for reference and clarity when needed. Critical vocabulary words are also included with the corresponding essential elements.

The DLM linkage levels are reflected in the map as level 1, 2 and 3. Level 1 is the most accessible and roughly correlates with the Initial linkage level. Level 2 is the intermediate level and roughly correlates with the Precursor linkage level. Level 3 is for the most advanced students who may be at the Target linkage level or beyond. For simplicity hereafter I will refer to them as level 1, 2, and 3. An example from the reading curriculum map is shown in Table 6 and a correlating example from the science curriculum map is shown in Table 7.

Table 6

Example from the Reading Curriculum Map

Reading Week #	Identify Characters & Traits
Level 1	What is a character (who); list characters
Level 2	Different Types of Traits (Personality, Physical) Identify character traits
Level 3	Different Types of Traits with Descriptive Language (vocab) Develop Characters with Traits

Table 7

Example from the Science Curriculum Map

Science Week #	Energy Conservation

Level 1	Sort hot and cold fluids
Level 2	Sequence hot, warm and cold fluids
Level 3	Predict hot, warm and cold when mixing different temperatures of water

Collaboration Report for Curriculum Map

General Education Feedback on Curriculum Map

In October of 2022, I divided the curriculum map into the three content areas and asked for feedback from the corresponding general education teacher. For physical science, I talked to Carson Chandler, the physics teacher. For life science, I talked to Kari Trejo, the biology teacher. For earth/space, I talked to Peter Edmondson, a physics and earth/space science teacher. I asked each of them the same two questions: “Is it true to the general education science standard?” and “If you were trying to cover the breadth but not the depth of physical science what would you add or change?”

The consensus from all three was that the elements as represented on my map are true to the general education science standards, covering the most basic aspects of what they teach. Mr. Chandler suggested adding more information pertaining to fields, how objects can interact without even touching. He offered the use of his van de Graaff generator to demonstrate this effect. Mrs. Trejo suggested simplifying organ systems by only covering one and defining carrying capacity within ecosystems. Mr. Edmondson suggested extending by talking more about the materials earth provides and where they can be found. I added this information to the curriculum map.

Special Education Collaboration Team Feedback on Curriculum Map

On November 2, 2022, I brought the curriculum map to the collaboration team for feedback. I again divided the map by the three content areas and divided the team into small groups to get feedback on the map. I asked three questions: “Is it true to the standards?” “Are the levels accessible to our students?” and “Any feedback on the extra weeks?”

The consensus was that the map was true to the standards and that with the levels, it was accessible to our students. It was suggested that in life science we teach body parts first, cells second and organs last so I rearranged that section accordingly. In earth/space it was suggested that we could talk about the other planets so I added that as an optional extension. In physical science there was a concern that there was insufficient time to cover the content but given the optional content included and the weeks for review I left how to cover the most critical content up to the teacher’s discretion.

Development of Common Assessments

Procedures

In order to determine a student's progress towards a learning goal, teachers use formative assessments. A formative assessment is given before and after instruction to determine the effect of the instruction on the students’ progress towards a learning goal. Assessments are used in conjunction with a curriculum map to coordinate the timing of instruction and assessments. After collecting data, the collaboration team meets to discuss the data and determine which teaching methods produced the greatest improvement in the student’s comprehension. The teachers who see the most improvement share their instructional methods with the team. This process is called the Professional Learning Cycle and is an application of the learning from the success ideology.

As previously detailed, the learning goals for special education are leveled and thus the formative assessments must also be leveled in order to accurately assess each student's progress towards their particular learning goal. I developed three leveled assessments (see appendices

B,C, and D), one for each of the three DLM science domains, physical science, life science, and earth/space science as previously detailed in figure 2.

Collaborative Feedback on Assessment Development

Physical Science Assessment

On 9/21/22, I received feedback from my district supervisor on the leveled physical science assessment (see Appendix A). I provided a copy of the applicable EE's and asked her if the assessment was accurately representing the students' knowledge of the EE. Her comments focused on the student's ability to adequately see the pictures when they are printed in black and white. I found different pictures that were easier to see.

On November 2, 2022, I received feedback from my collaboration team on the physical science assessment. For level 1, they suggested having two pictures representing a before and after rather than demonstrating the change in one picture. Second, they suggested only using pictures of liquids when asking about hot and cold. Finally, they suggested some wording changes for the question pertaining to the bike helmet.

For level 2 they suggested changing the pictures for the seatbelt question and for level 3 they suggested adding detail to the collision question. I updated the assessment to reflect this feedback. As the feedback came after the pre-assessment date, the post assessment was slightly different than the pre-assessment and the difference should be noted when analyzing the data.

Earth/Space Science Assessment

On Jan 13, 2023, I received feedback on the leveled earth/space assessments (see Appendix B) from my district supervisor. She pointed out that the energy conservation questions were focused on organizing data rather than understanding energy conservation itself. I agreed with her on a practical level but as the EE reads, “organize data” and “analyze data” so I felt it was best to leave those questions as they were.

On Feb 15, 2023, I received feedback from my collaboration team on the earth/Space assessment. I provided a list of the EE’s for each level of assessment and asked the questions: “Does this assess the above element?”, “Is it accessible to our students?”, and “Do you have any other feedback?”. On level 1, they determined it assessed the elements and was accessible to our students. They suggested removing glass from the recycling sort as it is infrequently available. They also suggested rephrasing the questions to ask the student to point to the correct season rather than draw a line to increase the accessibility for students with limited motor function.

On level 2, they agreed it assessed 2 of the 3 elements. On comparing one conservation strategy to another, the question I had was too open ended to elicit the comparison aspect. Again, as with my district supervisor feedback, the conservation data questions were difficult to understand, but there was no other suggestion made.

For level 3, they felt that it assessed the elements, was accessible to our students and suggested a different alignment format. As this assessment had already been administered before collaboration feedback was available, the changes will be for, if and when, the assessment is used by the team.

Life Science Assessment

On February 15, 2023, I also received feedback from my collaboration team on the life science assessment (see Appendix C). As with the previous assessment feedback, I provided the coordinating list of Essential Elements and asked: “Does this assess the above element?”, “Is it accessible to our students?”, and “Do you have any other feedback?”.

For level 1, they suggested having a comparison question rather than a yes/no question, so I implemented that change. They also suggested that the habitat pictures were difficult to discern in black and white and so I added labels so the proctor could read it to the student.

For level 2, they first suggested rewording the question regarding the environmental factors requiring specialized traits. Second, they suggested adding the organ system to the matching question of organs with their function. Finally, they suggested that I add more clear labels for the graph. I was able to implement all of these changes in the assessment.

For level 3, they determined it assessed the elements and was accessible to our students. One of the graphs was difficult to read in black and white but as it was a duplicate, I simply eliminated that question.

Assessment Results

For the purposes and scope of this project, I chose one student from each of the three levels to track and report on the assessment data. A description of their demographic is as follows:

Level 1 - 17-year-old male student with autism who reads at a kindergarten level. Student is non-verbal. He uses sign language and an AAC device to communicate.

Level 2 - 16-year-old male student with autism who reads at a third-grade level

Level 3 - 17-year-old male student who qualifies for special education with “other health impairment” and who reads at a seventh-grade level.

Table 3

Physical Science Data

	Pre-assessment	Post-assessment	Change

	9/27/22	11/30/22	
Level 1	60%	71%	+11%
Level 2	57%	64%	+7%
Level 3	53%	100%	+47%

This assessment showed improvement on all three levels but as the pre-test was not the same version as the post-test, results are inconclusive.

Table 4

Earth/Space Science Data

	Pre-assessment 1/11/23	Post-assessment 2/8/23	Change
Level 1	45%	45%	0%
Level 2	63%	63%	0%
Level 3	45%	85%	+40%

This assessment showed no improvement for level 1 or 2. For level 2, the student had some medication changes that made completing the assessment a difficult task due to fatigue. It was spread out over several days and may not accurately reflect the benefits of instruction. Level 3 improved dramatically and so it may be inferred that the instruction was better suited for the more advanced students. There is an opportunity for improved instruction on levels 1 and 2 for this domain.

Table 5

Life Science Data

	Pretest Score on	Posttest Score on	Improvement
Level 1	57%	57%	0%
Level 2	63%	63%	0%
Level 3	100%	100%	0%

This assessment showed the need for more advanced information for the higher functioning students and more level appropriate instruction for the lower two levels of students.

Discussion

This project provides the necessary tools for a collaboration team to engage in the Professional Learning Cycle in regards to the instruction of secondary special education science. When common formative assessments and a correlating curriculum map are being used by a district, each school teaches the concept at the same time and assesses it the same way. The results of the assessments are then brought to a collaboration meeting and teachers share the success of the most effective instructional methods so that all students in the district can benefit from improved instruction.

Through continued pursuit of this Professional Learning Cycle, a more detailed curriculum map could be developed and a pool of instructional resources relevant to the topics could be collected. As this process is developed, it is likely that the assessments would likewise continue to be modified to correlate with the coordinating materials collected.

This learning process will allow teachers to make the scientific concepts and thought processes available to all students. This sets the foundation to develop these concepts in greater detail in the future. It is likely that in the coming years, the DLM will add more levels to their science assessment similar to what they have developed in the other subject areas. As this occurs future collaboration teams may consider adding learning objectives and assessments for those levels.

A limitation of this project was that the learning objectives did not always match what a teacher may consider to be the functional application of a concept. For example, when the earth science learning objective stated that a student should be able to put information in a table and my supervisor was more concerned about whether or not they understood the information presented. These differences and how learning goals should be reflected in an assessment would be a constructive topic for a collaboration team to pursue.

Another limitation is the engagement factor of students with a variety of adapted levels. What may be interesting to one student will not engage another student. This is another important reason for collaboration between teachers to brainstorm a variety of ways to present the same information. As teachers improve the presentation of the information all students can benefit from the varied methods of instruction.

Conclusion

As stated in my literature review, science has functional value to students in special education. It has practical applications and encourages a curious mindset. The students need to have this information presented to them in an engaging and adaptive manner in order for it to be accessible to them. Teachers are often lacking the understanding and resources necessary to provide this educational opportunity. A “share from success” approach through the Professional Learning Cycle process can provide the teachers with these necessary resources. A curriculum map and common assessments are prerequisites for engaging in this cycle and are now available to the Alpine School District Life Skills Team.

Overall, the feedback from the team was positive and they appreciated having the curriculum map and the common assessments available for future use. We determined that if we were to use these assessments as a team, then we would likely want to adapt them to a digital version in order to make the images more easily distinguishable in color and to make the grading more efficient. The team set aside a day in the summer 2023 collaboration to revisit the use of the science curriculum map and common assessments as a team. For my own classroom, I find them both to be useful resources which improve the science education of my students.

References

Capraz, C., & Boynikoglu, F. (2021). Special education teachers' views on teaching science to students with intellectual disabilities. *International Online Journal of Educational Sciences*, *13*(3), 675-688.

Dynamic Learning Maps Science Consortium (2019, February 7). *Dynamic Learning Maps Essential Elements for Science*. Lawrence, KS: University of Kansas. https://dynamiclearningmaps.org/sites/default/files/documents/Science/Science_EEs_Combined.pdf

Kasnett, T., & Schechter, C. (2020). Exploring learning from success in a special education school for students with severe intellectual disabilities. *Journal of Special Education Leadership*, *33*(2), 106-122.

Kingston, N. M., Karvonen, M., Thompson, J. R., Wehmeyer, M. L., & Shogren, K. A. (2017). Fostering inclusion of students with significant cognitive disabilities by using learning map models and map-based assessments. *Inclusion*, *5*(2), 110-120.

Tatgenhorst, A., Norlin, J. W., & Gorn, S. (2014). *What do I do when--: The answer book on special education law* (6^{th} edition). LRP Publications.

Tosun, C. (2022). Bibliometric and content analyses of articles related to science education for special education students. *International Journal of Disability, Development and Education*, *69*(1), 352-369.

Appendix A

Science Curriculum Map

This map is based on the Dynamic Learning Maps Essential Elements, education standards for students with severe disabilities. These standards are derived from the General Education standards which are available here for reference:
Utah Science with Engineering (SEEd) Standards Graded 9-12

Month: September • Scientific Method • Physical Science	Dynamic Learning Map Links and Coordinating General Education Standards **Temperature** - DLM Essential Element: SCI.EE.HS.PS3-4 (dynamiclearningmaps.org) State G.E. Standard-HS-PS3-4: Plan and conduct an investigation to provide evidence that the transfer of thermal energy when two components of different temperature are combined within a closed system results in a more uniform energy distribution among the components in the system. **Chemical Reactions** - DLM Essential Element: SCI.EE.HS.PS1-2 (dynamiclearningmaps.org) State G.E. Standard -HS-PS1-2: Construct and revise an explanation for the outcome of a simple chemical reaction based on the outermost electron states of atoms, trends in the periodic table, and knowledge of the patterns of chemical properties.

	Week 1	Week 2	Week 3	Week 4
Topic	Introduction to Science Scientific Method Not Tested	Temperature (Energy Conservation or Transfer)	Extend or Review Temperature	Chemical Reactions (Matter and its Interactions)
Vocabulary	**Observation**: Look carefully to obtain information **Hypothesis**: Educated guess **Experiment**: Test Hypothesis **Conclusion**: What we learned	**Temperature**: the degree of hotness or coldness of an object	**Liquid**: a state of matter that conforms to the shape of a container in which it is held, and which acquires a defined surface in the presence of gravity **Solid**: a state of matter that retains its shape and density when not confined **Gas**:a state of matter that has no	**Chemical Reaction**: a chemical change that occurs when two or more substances combine to form a new substance. **Examples:** When wood burns, carbon-dioxide and vapors leave the wood, reducing it to ashes and carbon

			defined shape or volume	substances. When baking soda and vinegar are combined a gas is released
Level 1	Name objects in a picture	Sort hot and cold		Is there a change? Yes/No
Level 2	Make observations and a Hypothesis	Sequence hot, warm and cold		Identify the change (rust, burn, create gas)
Level 3	Make observations, a hypothesis and design a simple experiment	Predict hot warm and cold temperatures when mixing different temperatures of water		Identify the change and say why it happened
Teaching Resources				

Month: October ● Physical Science	Dynamic Learning Map Links and Coordinating General Education Standards **Safety Devices** - DLM Essential Element: SCI.EE.HS.PS2-3 (dynamiclearningmaps.org) State G.E. Standard: HS-PS2-3: Apply scientific and engineering ideas to design, evaluate, and refine a device that minimizes the force on a macroscopic object during a collision. **Light Waves and Sound Waves Content**: Microsoft Word - Science_EEs_Combined (dynamiclearningmaps.org) State G.E. Standard: HS-PS4-5: Communicate technical information about how some technological devices use the principles of wave behavior and wave interactions with matter to transmit and capture information and energy.

	Week 1	Week 2	Week 3	Week 4
Topic	Extend or Review Chemical Reactions	Safety Devices (forces and interaction)	Review or Extend Safety Devices	Light Waves and Sound Waves Not Tested
Vocabulary	**Corrosion:** The chemical	**Force**: The push or pull on an object with	Possible extension:	**Light waves**: forms of moving

	deterioration of a material, usually a metal **Rust:** a form of corrosion. It is caused by a chemical reaction that affects masses of iron and steel	mass causes it to change its velocity. **Collision**: when two things crash into each other	Fields Use a van de Graaf and/or magnets to talk about how objects can interact without even touching!0	energy made of tiny microscopic particles called photons **Sound waves**: vibrating forms of energy that are made of molecules and look like waves. Sound waves can travel through solids, liquids and gasses. The vibrations from sound waves cause our ears to send signals to our brains to create sound
Level 1		Identify safety equipment i.e. when I ride a bike I wear a helmet, when I drive in a car I wear a seatbelt		Show how to use a radio or other electronic device.
Level 2		Evaluate safety equipment data		Identify which devices use sound waves and light waves.
Level 3		Create safety equipment i.e. egg drop		Explain how devices use light and sound waves to transmit and capture information.
Extra for advanced students				Fields - Use a van de Graaf generator to demonstrate how forces can interact without touching

Teaching Resources				

Month: November • Earth and Space	Dynamic Learning Map Links and Coordinating General Education Standards **Earth Rotation/Seasons**: DLM Essential Element: SCI.EE.HS.ESS1-4 (dynamiclearningmaps.org) State G.E. Standard: HS-ESS1-4: Use mathematical or computational representations to predict the motion of orbiting objects in the solar system. **Weather and Climate**: https://dynamiclearningmaps.org/sites/default/files/documents/Science/Science_EEs_Combined.pdf State G.E. Standard: HS-ESS2-4: Use a model to describe how variations in the flow of energy into and out of Earth's systems result in changes in climate.

	Week 1	Week 2	Week 3	Week 4
Topic	Earth Rotation (Earth and the Solar System)		Climate Change (Weather and Climate) Not tested	
Vocabulary	**Seasons**: summer, fall, winter spring **Rotation:** Turning of the earth on it's axis every 24 hours **Orbit**: a regular, repeating path that one object in space takes around another one. **Tilt**: Earth is slightly tilted (slanted) on its axis as it rotates on its axis and orbits around the Sun. Tilt means turned toward one side.		**Climate Change:** Climate change describes a change in the average conditions — such as temperature and rainfall — in a region over a long period of time.	
Level 1	Identify Seasons		Recognize differences in geographical climates i.e. desert vs. rainforest	
Level 2	Use a model to explain seasons in relation to Earth's orbit		Recognize that climate changes have occurred	
Level 3	Use a model to explain seasons in relation to Earth's tilt and orbit		Use a model to demonstrate how climate change can impact human life	
Connection with Math	Express quantities to the appropriate precision of measurement. DLM Essential Element: M.EE.HS.N.Q.1-3 (dynamiclearningmaps.org)		Express quantities to the appropriate precision of measurement	

	1 Identify an algebraic expression DLM Essential Element: M.EE.HS.A.SSE.1 (dynamiclearningmaps.org) Solve one-step inequalities DLM Essential Element: M.EE.HS.A.CED.2-4 (dynamiclearningmaps.org)	
Extra for advanced students		EE.SL.11-12.5 Use digital media strategically in representations to support understanding and add interest
Teaching Resources		

Month: December • Earth and Space	Dynamic Learning Map Links and Coordinating General Education Standards **Natural Hazards:** https://dynamiclearningmaps.org/sites/default/files/documents/Science/Science_EEs_Combined.pdf State G.E. Standard: HS-ESS3-1: Construct an explanation based on evidence on how the availability of natural resources, hazards, and climate have influenced human activity. **Constructive and Destructive Forces**: https://dynamiclearningmaps.org/sites/default/files/documents/Science/Science_EEs_Combined.pdf State G.E. Standard: HS-ESS2-1: Develop a model to illustrate how Earth's internal and surface processes operate at different spatial and temporal scales to form continental and ocean-floor features.

	Week 1	Week 2	Week 3	Week 4
Topic	Natural Hazards (Natural Resources) Not Tested		Constructive and Destructive Forces (Earth's Materials and Systems) Not tested	
Vocabulary	**Natural Hazards**: Earthquake, Flood, Tornado, Hurricane		**Weathering**: natural possess that slowly breaks down rocks **Erosion**: tiny pieces of earth are moved from one place to another Constructive Forces (Volcanos) Destructive forces (weathering)	

Level 1	Identify natural hazards	Recognize changes on the Earth’s surface i.e. erosion or mountain formation
Level 2	Identify how natural hazards influence human activity	Distinguish between constructive and destructive forces
Level 3	Explain based on evidence how natural hazards influence human activity	Use a model to show how constructive and destructive forces change the earth's surface
Connection with ELA		EE.SL.11-12.5 Use digital media strategically in representations to support understanding and add interest
Connection with Math		EE.N-Q. 1-3 Express quantities to the appropriate precision of measurement
Teaching Resources		

Month: January • Earth and Space	Dynamic Learning Map Links and Coordinating General Education Standards **Conservation Strategie**s: DLM Essential Element: SCI.EE.HS.ESS3-2 (dynamiclearningmaps.org) State G.E. Standard: HS-ESS3-2: Evaluate competing design solutions for developing, managing, and utilizing energy and mineral resources based on cost-benefit ratios. **Conservation Data**: DLM Essential Elements: SCI.EE.HS.ESS3-3 (dynamiclearningmaps.org) State G.E. Standard: HS-ESS3-3: Create a computational simulation to illustrate the relationships among management of natural resources, the sustainability of human populations, and biodiversity.

	Week 1	Week 2	Week 3	Week 4
Topic	Review Earth Science	Conservation Strategies (Natural Resources)	Conservation Data (Human Impacts on Earth Systems)	Extend or Review Conservation
Vocabulary		**Conservation**: protecting Earth's natural resources for current and future generations **Recycle**: Taking materials which are ready to be thrown away an repurposing it into something useful		

		Reuse: Using something multiple times instead of throwing away single use items **Natural Resources**: What is available on the earth for us to use		
Level 1		Sort: garbage, reuse and recycle	Gather Data - Class or school level	
Level 2		Describe why items go in the garbage or recycle bins	Organize Data- Effects of conservation	
Level 3		Why and how do we conserve, reuse and recycle?	Analyze Data - Effects on natural resources	
Connection with Math		Express quantities to the appropriate precision of measurement. DLM Essential Element: M.EE.HS.N.Q.1-3 (dynamiclearningmaps.org)		
Extra for advanced students	Other planets in relation to earth	What are the earth's natural resources and where can they be found?		
Teaching Resources				

Month: February • Life Science	Dynamic Learning Map Links and Coordinating General Education Standards **Ecosystems**: DLM Essential Elements: SCI.EE.HS.LS2-2 (dynamiclearningmaps.org) State G.E. Standard:HS-LS2-2: Use mathematical representations to support and revise explanations based on evidence about factors affecting biodiversity and populations in ecosystems of different scales. **Adaptations:** DLM Essential Element: SCI.EE.HS.LS4-2 (dynamiclearningmaps.org) State G.E. Standard: HS-LS4-2: Construct an explanation based on evidence that the process of evolution primarily results from four factors: (1) the potential for a species to increase in number, (2) the heritable genetic variation of individuals in a species due to mutation and sexual reproduction, (3) competition for limited resources, and (4) the proliferation of those organisms that are better able to survive and reproduce in the environment. **Variation of traits:** https://dynamiclearningmaps.org/sites/default/files/documents/Science/Science_EEs_Combined.pdf State G.E. Standard: HS-LS3-2: Make and defend a claim based on evidence that inheritable genetic variations may result from (1) new genetic combinations through

	meiosis, (2) viable errors occurring during replication, and/or (3) mutations caused by environmental factors.

	Week 1	Week 2	Week 3	Week 4
Topic	Ecosystems	Adaptation	Variation of Traits Not Tested	Review or Extend Ecosystems and Adaptation
Vocabulary	**Carrying Capacity**- the number of people, other living organisms, or crops that a region can support without environmental degradation			
Level 1	Identify food and shelter needs for familiar wildlife	Match species to their environment	Compare traits in parent and offspring	
Level 2	Recognize the relationship between population size and available resources.	Identify environmental factors that require special traits to survive	Make a claim supported by evidence that parents and offspring may have different traits	
Level 3	Use graphs to explain the dependence of an animal population on other organisms for food and their environment for shelter.	Explain how traits help animals survive in their environment	Defend why reproduction may or may not result in offspring with different traits	
Connection To ELA			EE.Sl.11-12.4: Present and argument on a topic using an organization appropriate to the purpose, audience, and task.	
Connection to Math	EE.N-Q.1-3: Express quantities to the appropriate precision of measurement			
Teaching Resources				

Month: March • Life Science	Dynamic Learning Map Links and Coordinating General Education Standards **Organs and Organ Systems**: DLM Essential Elements: SCI.EE.HS.LS1-2 (dynamiclearningmaps.org) State G.E. Standard:HS-LS1-2: Develop and use a model to illustrate the hierarchical organization of interacting systems that provide specific functions within multicellular organisms. **Cells**: https://dynamiclearningmaps.org/sites/default/files/documents/Science/Science_EEs_Combined.pdf State G.E. Standard: HS-LS1-4: Use a model to illustrate the role of cellular division (mitosis) and differentiation in producing and maintaining complex organisms.

	Week 1	Week 2	Week 3	Week 4
Topic	Human Body Parts	Cells (Growth and development of Organisms) Not tested	Organs and Organ Systems (Structure and Function)	Extend or Review Organs and Organ Systems
Vocabulary	Learn ASL for the body parts and possibly the organs: https://'youtu.be/wKMCzjlq6tE		**Organs:** a collection of tissues that structurally form a functional unit specialized to perform a particular function	
Level 1	Name body parts.	Organisms are composed of cells	Organs have different functions	
Level 2	Name body parts and functions.	Use a model to relate the number of cells to the size of a body	Match organs to functions	
Level 3	Name body parts, functions and how they interact with each other.	Illustrate how growth occurs when cells multiply	Use a model to illustrate the organization and interaction of organ systems (General Education Biology suggested	

			that covering one system was sufficient)	
Connection to ELA	EE.SL.11-12.5 Use digital media strategically in representations to support understanding and add interest			
Connection to Math	EE.F-BF.1: Select the appropriate graphical representation (first quadrant) given a situation involving constant rate of change			
Teaching Resources				

Month: April • DLM Review	Dynamic Learning Map Links and Coordinating General Education Standards

	Week 1	Week 2	Week 3	Week 4
Topic	Physical Science	Earth and Space Science	Life Science	

Appendix B

Physical Science Assessment-Level 1

1. Is the wood the same or different after it is burned?

2. Is the vinegar the same or different after we add baking soda?

3. Are the balls the same or different?


4. What would you wear to keep you safe on a bike?

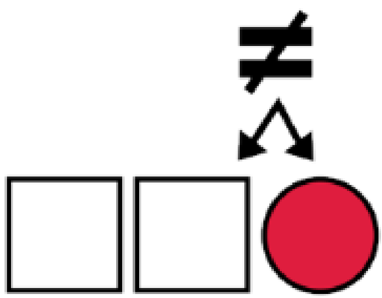
5. Use the "hot" and "cold" icons to describe the following pictures.
   a.

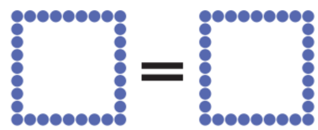
   b.

   c.

   d.

Optional Symbols to assist in administering the test:





Physical Science Assessment-Level 2

1. What change happened in this chemical reaction?

a. 

b. 

c. 

2. Circle the child who is best protected in case of a collision?

3. Match the word to the definition:

a. Force — The push or pull on a object
with mass

b. Collision — A state of matter that retains
its shape

c. Temperature — When two things crash into
each other

d. Solid — The degree of hot or coldness

4. If I add ice to boiling water and wait 5 minutes, would the water be hot, warm or cold?

5. If I add ice to room temperature water and wait 5 minutes, would the water be hot, warm or cold?

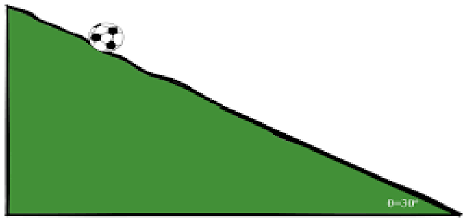
6. If I add hot water to room temperature water and wait 5 minutes, would the water be hot, warm or cold?

7. Label each picture with the most likely temperature

   a. Hot
   b. Warm
   c. Cold

Physical Science Assessment- Level 3

1. Is this a chemical reaction? Why or why not?

a. 

b. 

c. 

d. 

2. Give an example of a collision.

3. Give an example of a force.

4. What could you use to protect yourself from a collision on your bike?

5. If you were dropping an egg from the height of 4 feet, what could you do to prevent it from breaking?

6. Label each picture with the most likely temperature.

    a. 32°
    b. 212°
    c. 72°



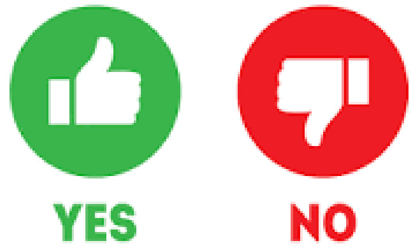
7. If my glass of water is 72° and I wanted it to be 60°, what type of water would I add?

8. If my water is 72° and I want it to be 100°, what type of water would I add?

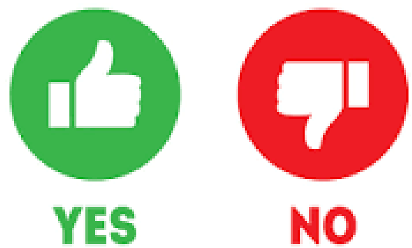
Appendix C

Earth and Space Assessment - Level 1

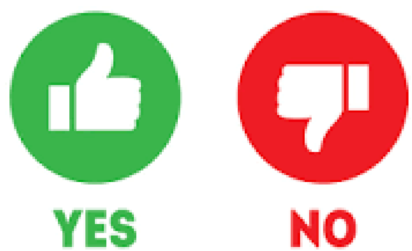
1. Is this recycling? Mark yes or no:



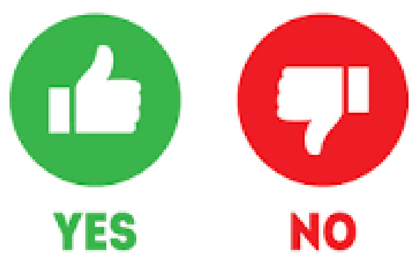
2. Is this recycling? Mark yes or no:



3. Is this recycling? Mark yes or no:



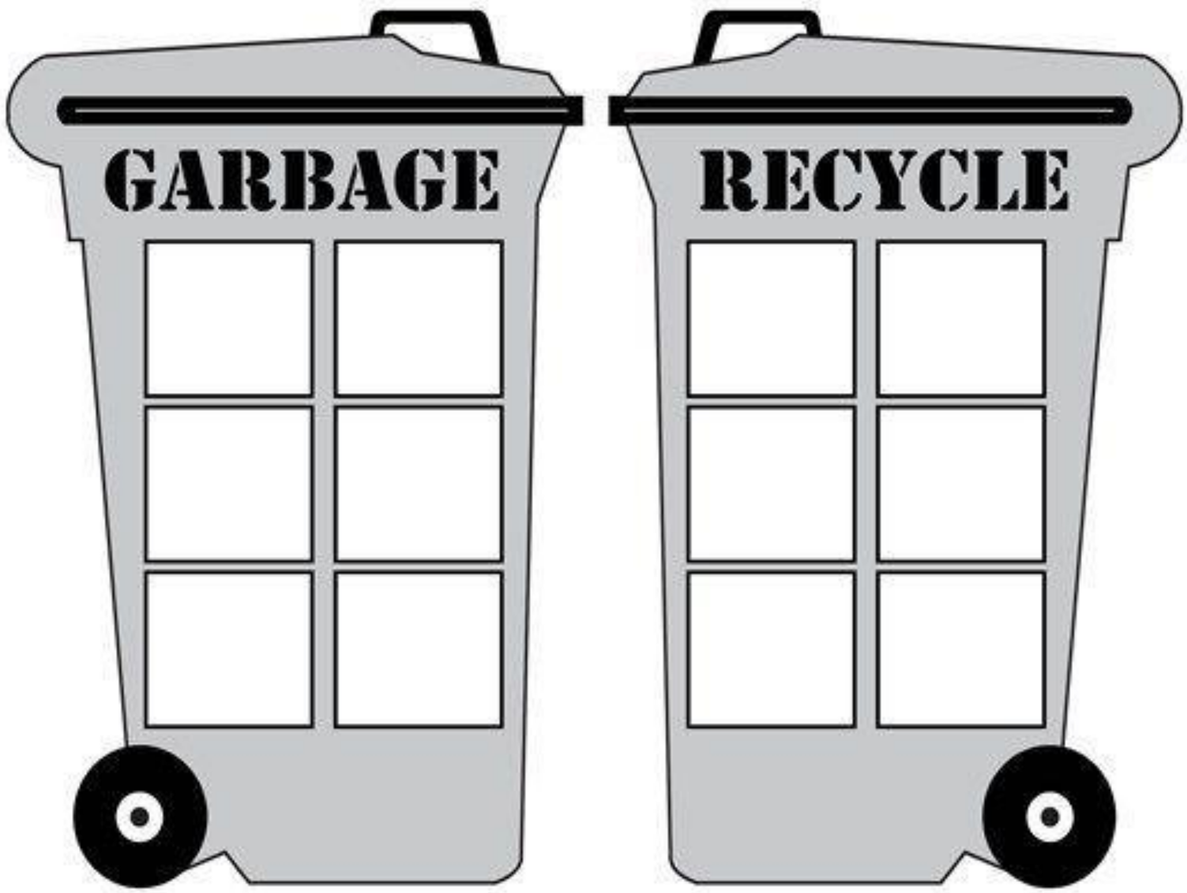
4. Is there recycling at your school? Mark yes or no:

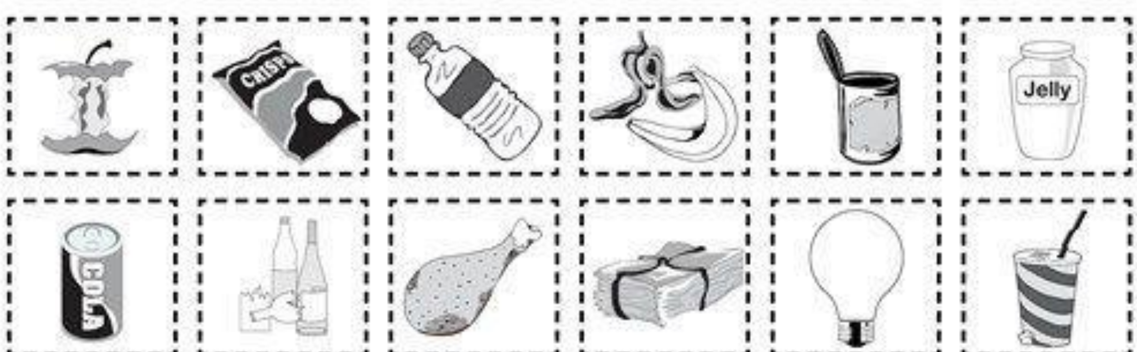


5. Sort the garbage and recycling to the correct bin:

Name: ______________________________

Sort the trash into the correct bin.





6. Draw a line to match the season with the tree:

Winter

Fall

Spring

.

Summer

Name: Date:

Earth and Space Assessment - Level 2

1. If your community does not have enough water, what should they do? Circle one:

   Reduce Reuse Recycle

2. Why did you choose that answer?

3. When you go to the grocery store, they put your items in plastic bags. How could we reduce the amount of plastic bags in the garbage? Circle one:

   Reduce Reuse Recycle

4. Why did you choose that answer?

5. Drinks often come in plastic bottles. What should we do with those bottles? Circle one:

   Reduce Reuse Recycle

6. Why did you choose that answer?

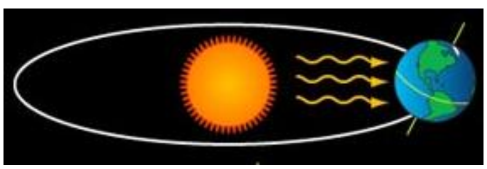
7. A family typically uses 1000 kilowatts of electricity every month. First they decide to turn off the lights when they are not in the room and their electricity use drops to 875 kilowatts per month. Then they decide to use energy efficient light bulbs and their electricity use drops again to 625 kilowatts per month. Organize their electricity usage in the chart below:

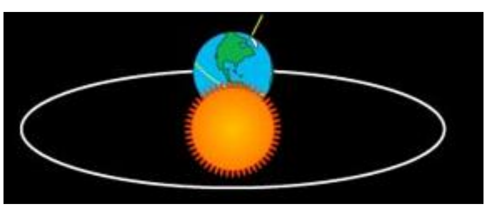
Conservation Strategy	**Electricity Used**
Typical Use	
Turning off the lights	
Turning lights off and using energy efficient light bulbs	

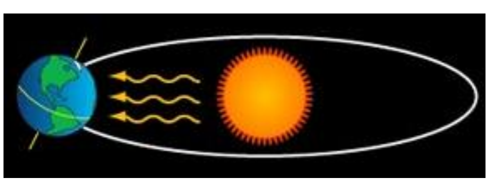
8. An alkaline battery package says it can last up to 8 hours, it can be used one time and it can sit on a shelf for 10 years before it starts to go bad. The package for the rechargeable battery says it can last up to 8 hours, it can be recharged up to 500 times and it can sit on a shelf for 20 years before it starts to go bad. Organize the data in the chart below:

Type of Battery	**Hours of Use**	**Number of Uses**	**Shelf Life**
Alkaline Battery			
Rechargeable Battery			

9. In the United States, what season (summer, winter, fall or spring) would it be for each picture below:







Name: Date:

Earth and Space Assessment - Level 3

1. What is something we can conserve?

   How would you conserve it?

   Why should we conserve?

2. Name 3 things we can recycle.

   How do you recycle?

   Why should we recycle?

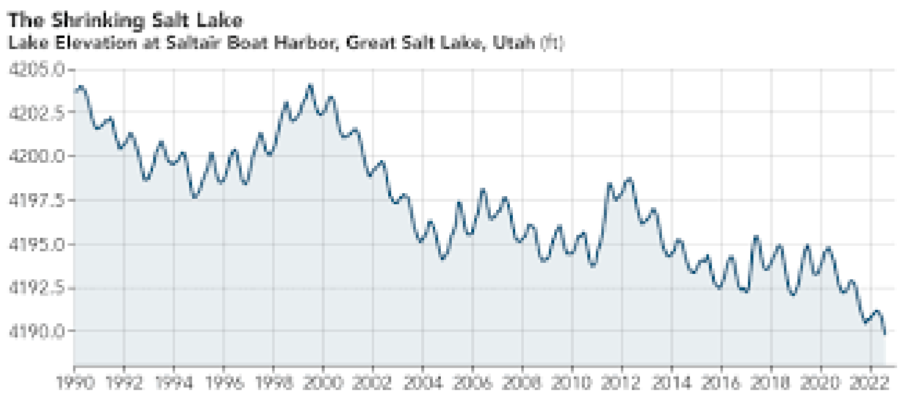
3. What is something you could reduce using to improve the environment?

   How would you reduce using it?

   Why should we reduce using it?

4. Water usage in Utah has increased over the past 30 years. Using the data below, describe the effect that is having on the Great Salt Lake.

   Answer:



5. A typical high school used 2000 sheets of paper per day. Each ton of recycled paper can save 17 trees. What effect would recycling paper have on the number of trees?

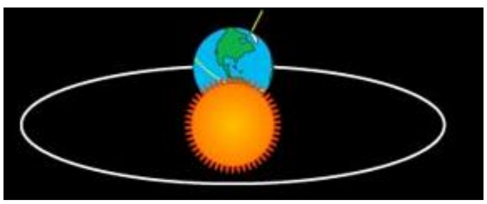
   Answer:

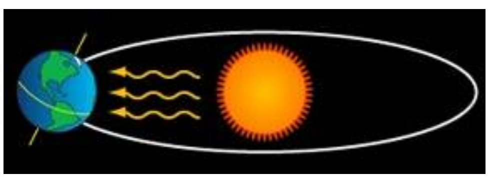
6. Using the data below, what effect does using a reusable water bottle have on the level of our natural resources?

   Answer:

Amount of water one person should drink in a year: 182.5 gallons
Number of 16 oz. water bottles to equal 182.5 gallons: 1,460
Number of reusable water bottles needed to drink 182.5 gallons of water: 1

7. In the United States, what season (summer, winter, fall or spring) would it be for each picture below:



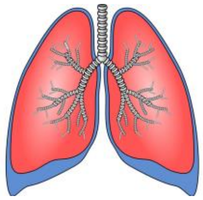


8. How does the tilt of the earth affect the seasons?

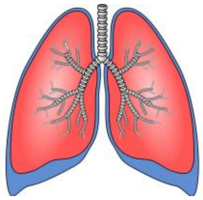
Appendix D

Life Science Assessment - Level 1

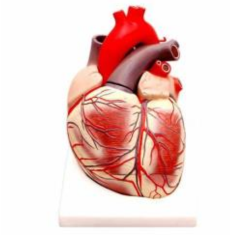
1. Circle or point to the organ that digests food:



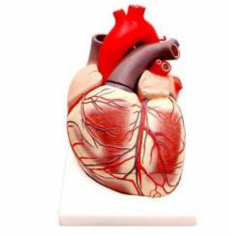
2. Circle or point to the organ that breathes air:



3. Circle or point to the organ that controls the body:



4. Circle or point to the organ that pumps the blood throughout the body:



5. Circle or point to where the clownfish finds shelter:

a. 

b. 

c. 

6. Circle or point to where the deer find shelter:


a. 
b. 
c. 

7. Circle or point to where a mouse find shelter:


a. 
b. 
c. 

8. What does a giraffe eat?


a. 
b. 
c. 

9. What does a lion eat?


a. 
b. 
c 

10. What does a bird eat?


a. 
b. 
c. 

11. Point or draw a line to match the animal to their environment:


Arctic


Desert


Forest


Ocean


Polar Bear


Fish


Deer


Camel

Life Science Assessment -Level 2

1. Desert

Use three words to describe the desert environment: 1.____________________

2.____________________________ 3.__________________________________

Plants and animals that live in the desert would need to be able to:

____

2. Ocean

Use three words to describe the ocean environment 1.____________________

2.____________________________ 3.__________________________________

Plants and animals that live in the ocean would need to be able to:

____

3. Arctic

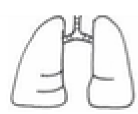
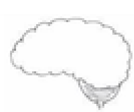
Use three words to describe the Arctic environment: 1.____________________

2.___________________________ 3.______________________

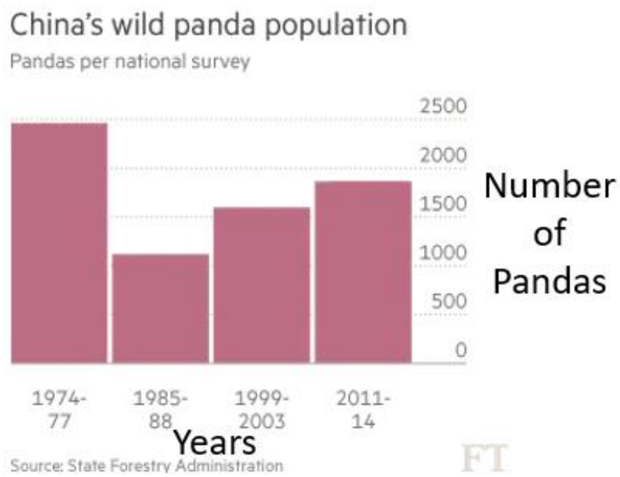
Plants and animals that live in the desert would need to be able to:

____

Draw a line to match the organ to its name and function:

Name	**Organ**	**Function**
4. Lungs		Digesting Food
5. Brain		Breathing Air
6. Heart		Pumping Blood
7. Stomach		Controlling the Body

8. Panda bears eat bamboo.



9. In the 1980's there was a problem with deforestation in China. There was less bamboo in their forests. How did that affect the Panda population?

____

____

____

10. In the 1990's, China made efforts to protect the bamboo forests. How did that affect the panda population?

____

____

____

Life Science Assessment -Level 3

1. What traits does a shark have that help it survive in the ocean? How do they help the shark?


Trait 1__________________________helps the shark___________________________

Trait 2__________________________ helps the shark___________________________

2. What traits does a polar bear have that help it survive in the Arctic? How do they help the polar bear?


Trait 1__________________________helps the polar bear___________________________

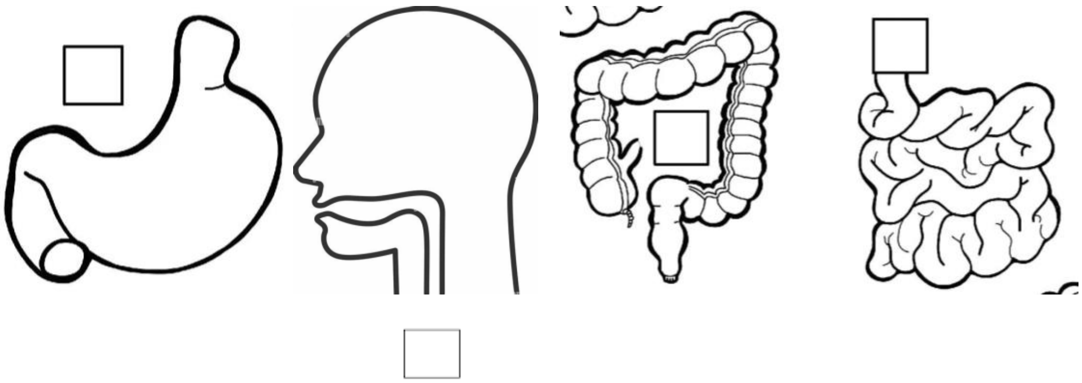
Trait 2__________________________ helps the polar bear___________________________

3. What traits does a camel have that help it survive in the desert? How do they help the camel?


Trait 1__________________________helps the camel___________________________

Trait 2__________________________ helps the camel___________________________

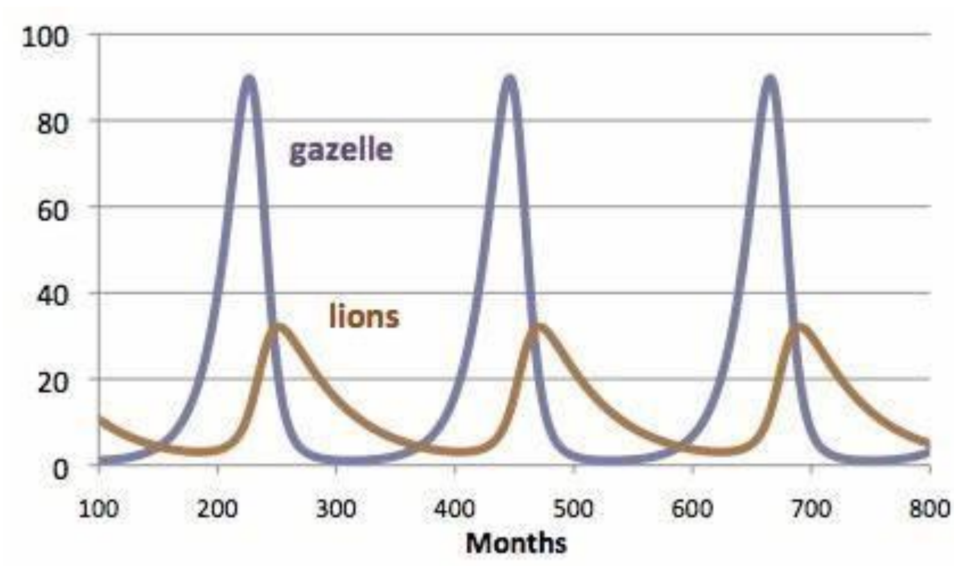
4. If you eat a hamburger, where will it go first, second, third and fourth in your body? Label the organs 1-4 in the order they will be used



5. The organs above are all parts of what organ system?

____

6. Lions eat gazelles.



What happens to the lion population when there are more gazelles?

____

What happens to the lion population when there are less gazelles?

____