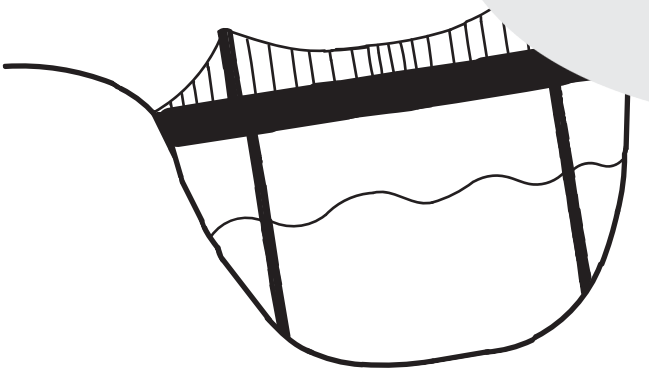
WISE Activity Booklets

A STEM activity booklet for fun on-the-go learning!

Made by WISE Kid-Netic Energy

DIY Activities
Puzzles
Challenges
... and more!



Grade 7
MAY 2020

Interactions within the ecosystems - Forces and structures - Particle theory of matter - Earth's crust

University of Manitoba

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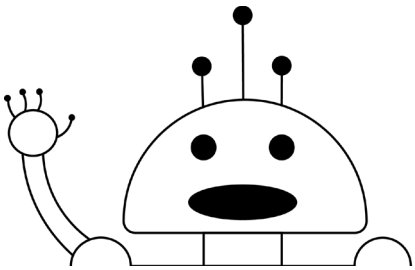


Hello there!

WISE Kid-Netic Energy is a not for profit STEM (Science, Technology, Engineering, and Math) outreach organization at the University of Manitoba. Our organization offers science and engineering workshops, clubs, camps and events to youth from Kindergarten to Grade 12 throughout the province of Manitoba. We reach on average 25 000 to 50 000 youth depending on funding levels. Our approach is simple – present STEM in messy, memorable and engaging ways so Manitoba youth feel motivated to learn more and more. We reach all Manitoba youth, and we particularly target underrepresented youth like girls, indigenous youth and youth facing socio-economic challenges.

All of us at WISE Kid-Netic Energy have been working hard to create these booklets to continue to bring our fun and educational STEM activities to Manitoba youth during these unprecedented times. We are disappointed that we cannot see you in person, and hope that these monthly booklets bring some STEM excitement to your life.

These booklets have been created by our student instructors who are all studying engineering, science, or in another STEM-related field at university. Peek the last page of this booklet to see who created the activities, experiments and recipes within.

All the activities in this booklet are based on the Manitoba Science curriculum. For any teachers viewing this booklet, all the SLO codes are listed at the bottom of each page.

If a link is listed at the bottom of the page, and you have access to the Internet, follow it to check out a video of the activity our instructors have created just for you.

We hope that you enjoy doing the experiments and activities as much as we loved creating them for you.

In this Grade 7 booklet, the science topics you will be exploring are: interactions within the ecosystems, forces and structures, particle theory of matter, earth's crust, and more!

Best of luck, and until we see you again,

the WISE Kid-Netic Energy Crew

P.S. If you have any suggestions for activities or experiments you would like us to try, contact us through our website, or social media accounts that are listed on the last page of this booklet.

Meet our Amazing Authors!

Alora

Alora is currently attending the University of Winnipeg where she is working towards her bachleor of Science degree with a major in Neuroscience and a minor in French. She aspires to become a high school science teacher and a guidance counsellor. In her spare time, she enjoys reading, writing, and playing the ukelele.

Amelia

Amelia just completed her first year of the two-year after-degree program in early years education. When she isn't reading, she loves writing lists, running, having quality conversations with friends, knitting and singing show-tunes.

Habiba

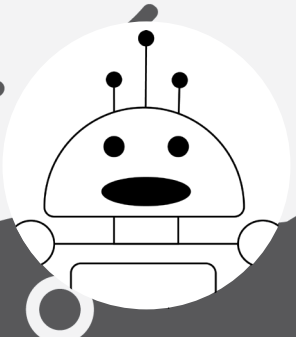
Habiba is a second year computer engineering student. In her free time, Habiba loves to learn about everything computer and internet related, but in her free time she likes to draw, go outside as well as cook.

Shannon

Shannon is finishing up her first year of Engineering. In her spare time she enjoys drawing, exercising, being outdoors, and trying new things. She is super pumped to be apart of WISE this summer!

Zoe

Zoe is in her first year of Engineering, and is planning on going into the Civil Engineering department. She loves math, and in her free time enjoys walking her dog, as well as playing volleyball and ultimate frisbee.

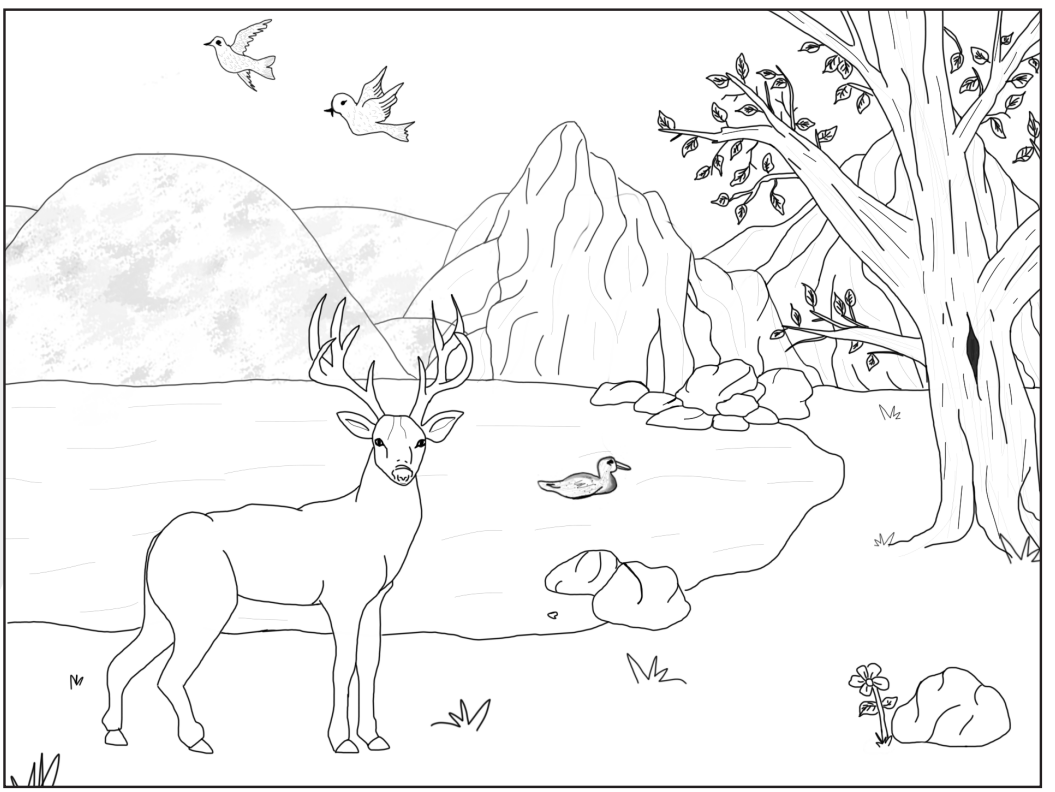


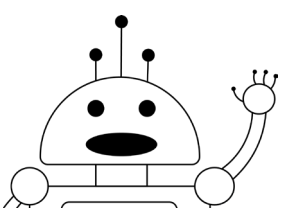
Esiw the Robot

Esiw is a friendly robot that loves to help kids learn about computers & coding! Esiw loves to do math, solve problems and make people laugh!

Biotic and Abiotic, what is the difference?

An ecosystem is a community where living things interact with other living things as well as non-living things. The living things in the ecosystem are called Biotic Factors, and all of the non-living things are called Abiotic Factors. Abiotic factors affect the ability of organisms' to survive and reproduce. Examples include water and temperature. Biotic factors directly affect the organisms environment: organims, interactions, waste, parasitism, disease, predation. Examples include humans and plants.



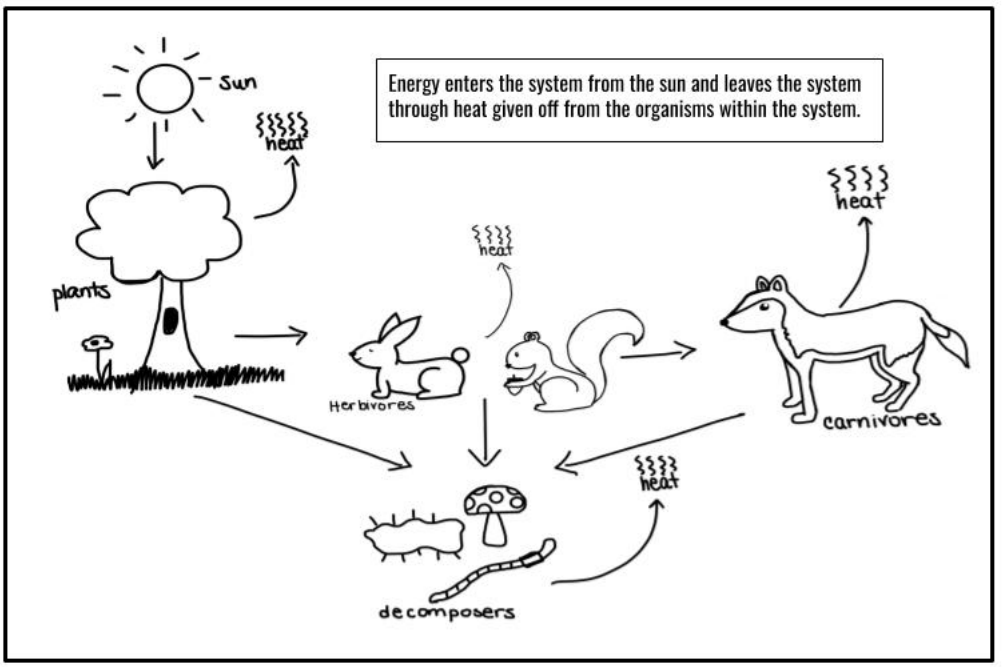


In the picture above, sort its abiotic and biotic components. Include things that are obvious to point out, as well as those things you can't see but feel certain are present.

Abiotic	Biotic

Self-Sustaining Ecosystem in a Jar!

Have you ever wanted a pet but worried you wouldn't be able to take proper care of it? Worry no more! You can create your own living ecosystem at home by following the directions below.
An ecosystem is a collection of organisms and materials, biotic and abiotic, that exist together and benefit from each other. Ecosystems can be many different sizes and can exist in just about any climate you can think of on Earth. The coolest thing about ecosystems is the fact that energy and matter are conserved within it: this means that energy gets transferred and transformed throughout the system, and matter gets recycled as well. An example of this process would be the plants in an ecosystem absorbing sunlight and using it in photosynthesis to create their own energy. This energy is then transformed when the plant is consumed by a herbivore and produces energy for that organism. The energy continues to be transferred through the food chain, which looks something like this:

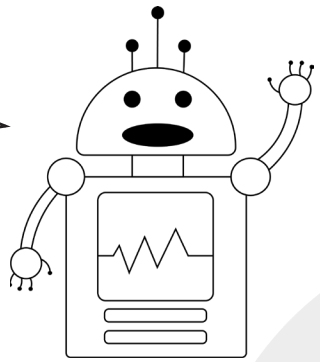


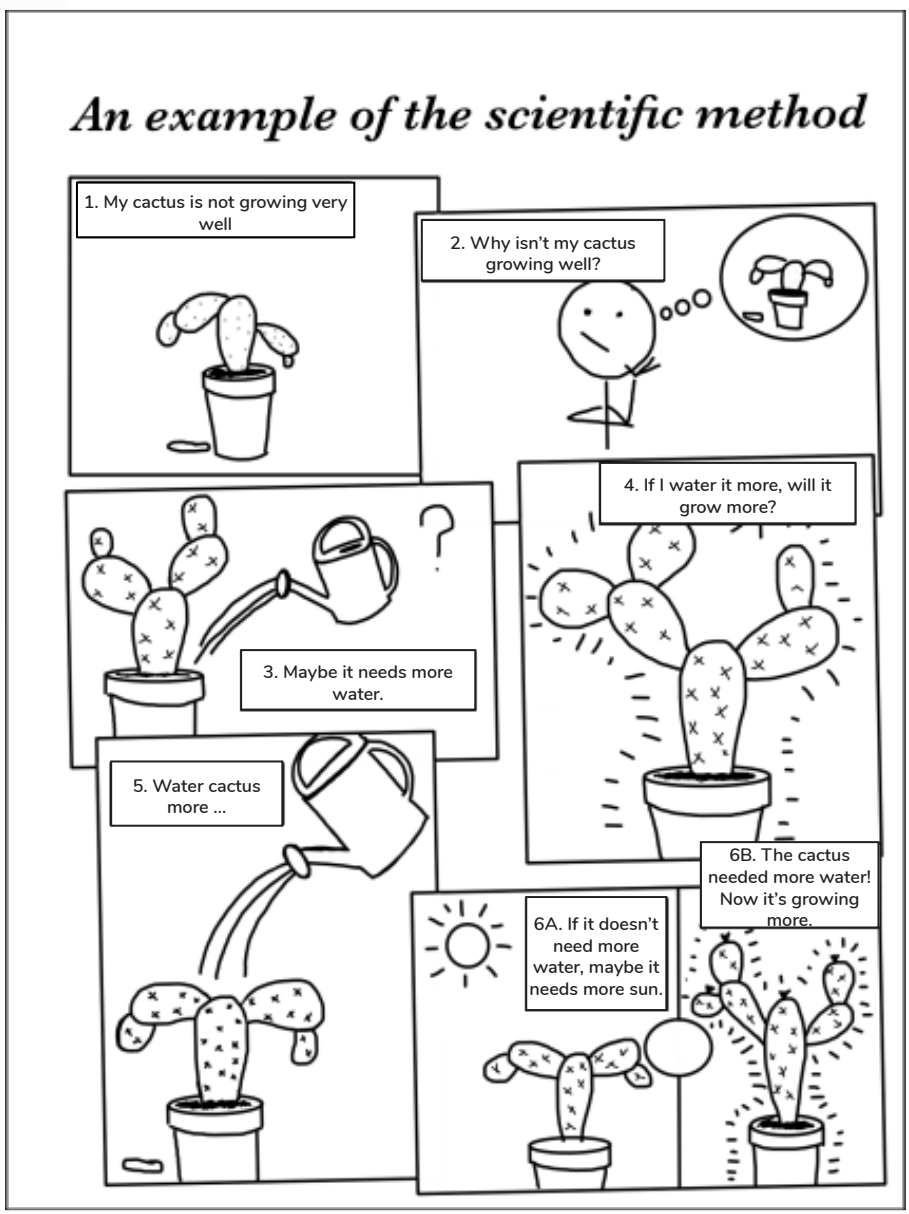
The conservation of matter also occurs throughout this cycle because the waste decomposers produce is critical to the proliferation of healthy plants. It's also important to note that the flow of energy through the system is one-way or unidirectional.
Typically, the more biodiverse an ecosystem is, the more resilient it is to any changes or disruptive events that may occur.

As mentioned above, ecosystems can vary widely in size and type, so an ecosystem can be anything from bacteria living on a doorknob to the boreal forest to some marsh water in a jar! This activity will be focusing on the latter. However, in order to make this into a real experiment, we need to follow the scientific method!

The Scientific Method

Did you know, the scientific method is used in all areas of science, even when coding for experiments that collect data? They use logic and IF/ELSE statements.





The scientific method:

The scientific method is used universally by scientists in order to organize and complete their research.

It consists of 5 different steps plus one reflection step at the end:

1. Make an observation.
2. Ask a question.
3. Form a hypothesis/ testable explanation.
4. Make a prediction about the hypothesis.
5. Test your prediction.

Reflect on results, use these results to make new predictions and create new questions and hypotheses.

Applying the scientific method to our ecosystem in a jar!

1. Observation: Ecosystems are self-sustaining and resilient to changes.

2. What if I could replicate an ecosystem at home?

3. Form a hypothesis/ testable prediction: marshes contain stagnant water and very resilient organisms that adapt to hard environments, therefore, it would be a good ecosystem to replicate at home.

4. Make a prediction about the hypothesis: If I take samples of all the critical components of my selected environment, I should be able to successfully replicate the ecosystem at home in a closed system.

5. Test your prediction: it's very important to make lots of observations during this time.

6. Reflect on results: are there any changes I should make for when I try again?

Now it's your turn!
Steps 1 and 2 will be the same, but replicate the study at home and fill out the following blank spaces with your results and observations.

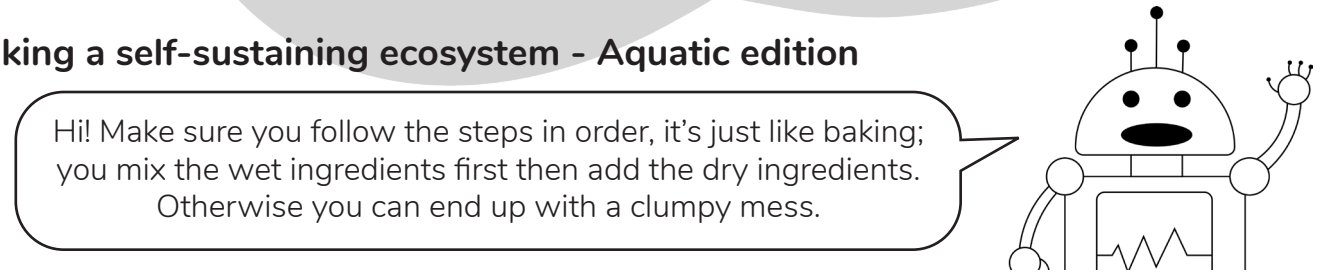
Form a hypothesis/testable prediction:

Make a prediction about the hypothesis:

Test your prediction and make observations:

Reflect on your results, any changes you would make?:

Making a self-sustaining ecosystem - Aquatic edition



The activity can be done with different types of environments other than a marsh, as long as the ratios of materials in your homemade environment are similar to that of the original (ex. If you picked a more terrestrial environment, be sure you're not drowning it with tap water).

The reason I chose a marsh is because of the resilience of the environment: the water is typically stagnant so I wouldn't need to change it over time, and the organisms I collected are very small and thrive off of the materials I collected. The aquatic ecosystem of a riverbank would be similar and would work just as well. Marshes are wildly biodiverse and filled with little microorganisms that will thrive even in harsh conditions.

Materials:

- Large mason jar (or any other clear, long term storage container)
- Disposable water bottle
- Mud /dirt
- Aquatic plants
- Other elements of the environment (i.e. sticks, rocks...)
- Water from the selected environment
- Containers for your materials (be sure to take containers people won't be eating or drinking out of)

Procedure:

1. Locate your environment of choice to replicate the ecosystem of. Pack up your containers and water bottle for transportation of materials.
2. Collect mud/dirt, sticks, rocks, and other elements of the environment in the containers you've prepared. Don't forget the plants!
3. Fill the water bottle with water from the selected environment. (NOTE: for a marsh, you want your self-sustaining ecosystem to be mostly water)
4. Bring your materials home/ to your large mason jar. It's time to layer!
5. Place a layer of mud/dirt at the bottom of the long-term storage container.
6. Carefully place the rocks on top of the mud/dirt, so you don't break the glass container.
7. Layer the last of the mud/dirt on top.
8. Once this base of mud/dirt and rocks is complete, you can place the sticks and other stiff material in the jar.
9. Pour the water into the jar.
10. Place the aquatic plants and any other greenery you have collected for your ecosystem on top of the water, it's okay if they sink, we just want them near the top.
11. Seal the jar and allow the sediment to settle. The water will clear up as time passes.
12. Place in a sunny window or somewhere it will be exposed to lots of sunlight.
13. Enjoy your ecosystem in a jar!

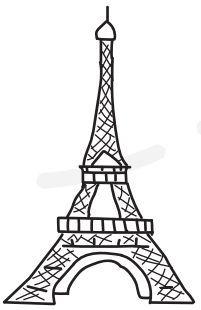
Note: Be sure to let your ecosystem breathe a couple of times a day for at least 30 minutes for the first couple of weeks. This is the only upkeep it should need. For the marsh specifically, the plants will be using the sunlight to produce oxygen for the waterbugs and microorganisms within the system. The waterbugs and microorganisms will produce carbon dioxide in return for the plants. The mud will contain debris and other nutrients for the microorganisms and the plants.
The equilibrium will not occur right away, just be sure to stay patient.

SLOs: 7-1-01, 7-1-02, 7-1-03, 7-1-04

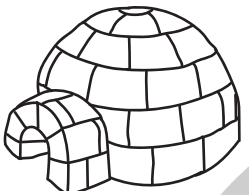
Forces and Structures

A structure is something which will support an object or a weight. It can also be described as anything that provides support and is made from one or more parts. There are three main classifications of structures:

Solid Structure



Frame Structure



Shell Structure

Solid Structures

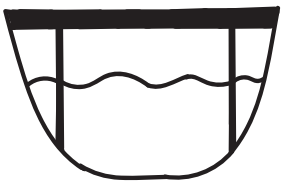
- Most solid structures are solid all the way through. *Examples are The Great Wall of China and the Egyptian pyramids*

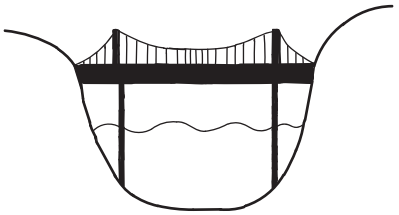
Frame Structures

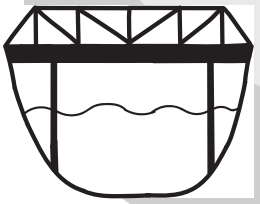
- These are made of parts fastened together. The parts are often called structural components. *Your skeleton, the frame of your house, and the Eiffel Tower are good examples of a frame structure.*

Shell Structures

- Most strong, hollow structures are shell structures. *Examples of shell structures are igloos, coconuts, and seashells.*







Bridges are among one of the most popular structures across the world. Bridges must be able to withstand several types of forces and the most common are Compression, Tension, Torsion, and Shearing.

Compression

- This is a pushing force. It pushes or presses an object to make it shorter and thicker.

Tension

- This is a pulling force. It occurs when two forces pull on an object in opposite directions to stretch it.

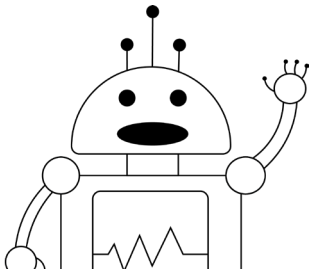
Torsion

- This is a twisting force. When you wring out a cloth, you are applying torsion to the cloth to release the liquid.

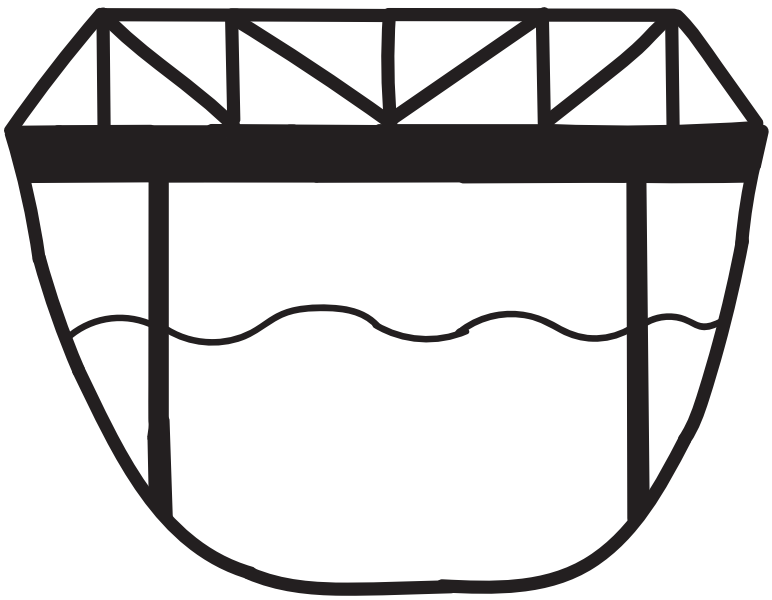
Shearing

- This happens when there are two opposing forces acting on the same point. Walking is an example; as you take a step, one leg pushes into the ground while you lift the other one up.

Structures: True or False?



I need your help to determine whether the statements below are true or fale using boolean variables (computers interpet everything into 1's and 0's), where **True = 1** and **False = 0**. Circle your answer and answer the extension questions based on your 1 or 0 choice.



A twisting force that acts on structures is called torsion. **1** **0**

If **1**, then use arrows to label the direction the force may act on the bridge.

If **0**, then what is the proper name of the twisting force? _____

Most solid structures are made up of fastened parts. **1** **0**

If **1**, then provide an example of a solid structure: _____

If **0**, then correct the statement to read the definition of a solid structure:

_____

Forces acting in opposite directions of each other results in a shear force. **1** **0**

If **1**, then label the direction the force may act on the bridge above.

If **0**, then what is the proper name? _____

A frame structure is hollow. **1** **0**

If **1**, then provide an example of a frame structure: _____

If **0**, then correct the statement to read the definition of a hollow structure:

_____

_____

A structure can only have one force exerted on it at a time. **1** **0**

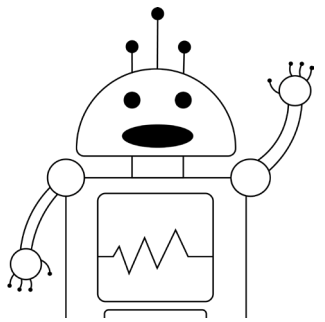
If **1**, then explain why: _____

_____

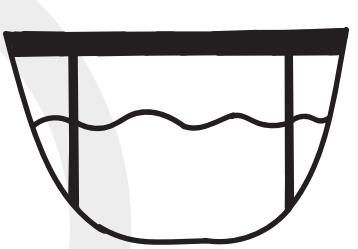
If **0**, then explain why: _____

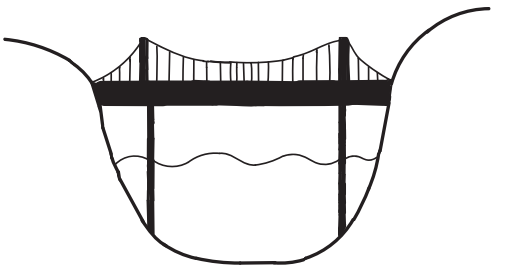
_____

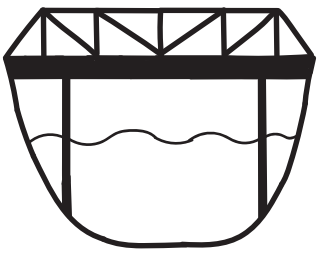
The Engineer's Bridge Building Code



Let's look more into how to build a bridge using code! Fill in the blanks below to complete the code that will predict the structure of a bridge based on the description.







A_bridge = "A structure that allows people and vehicles to cross over an open space, like a body of water or deep pits";

Bridge_structures = ["Truss Bridge","Suspension Bridge","Beam Bridge"];

If the_bridge_shape == "A horizontal beam with supports on each ends";

The_bridge_structure ==" _____ "

If the_bridge_shape == "A beam with triangular supports at the top making it one of the strongest bridge supports";

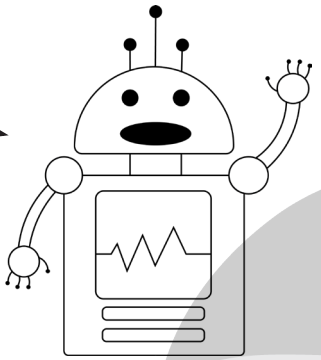
The_bridge_structure ==" _____ "

If the_bridge_shape == "A base that hangs from strong wires called cables that allow it to extend longer distances than any other type of bridge";

The_bridge_structure ==" _____ "

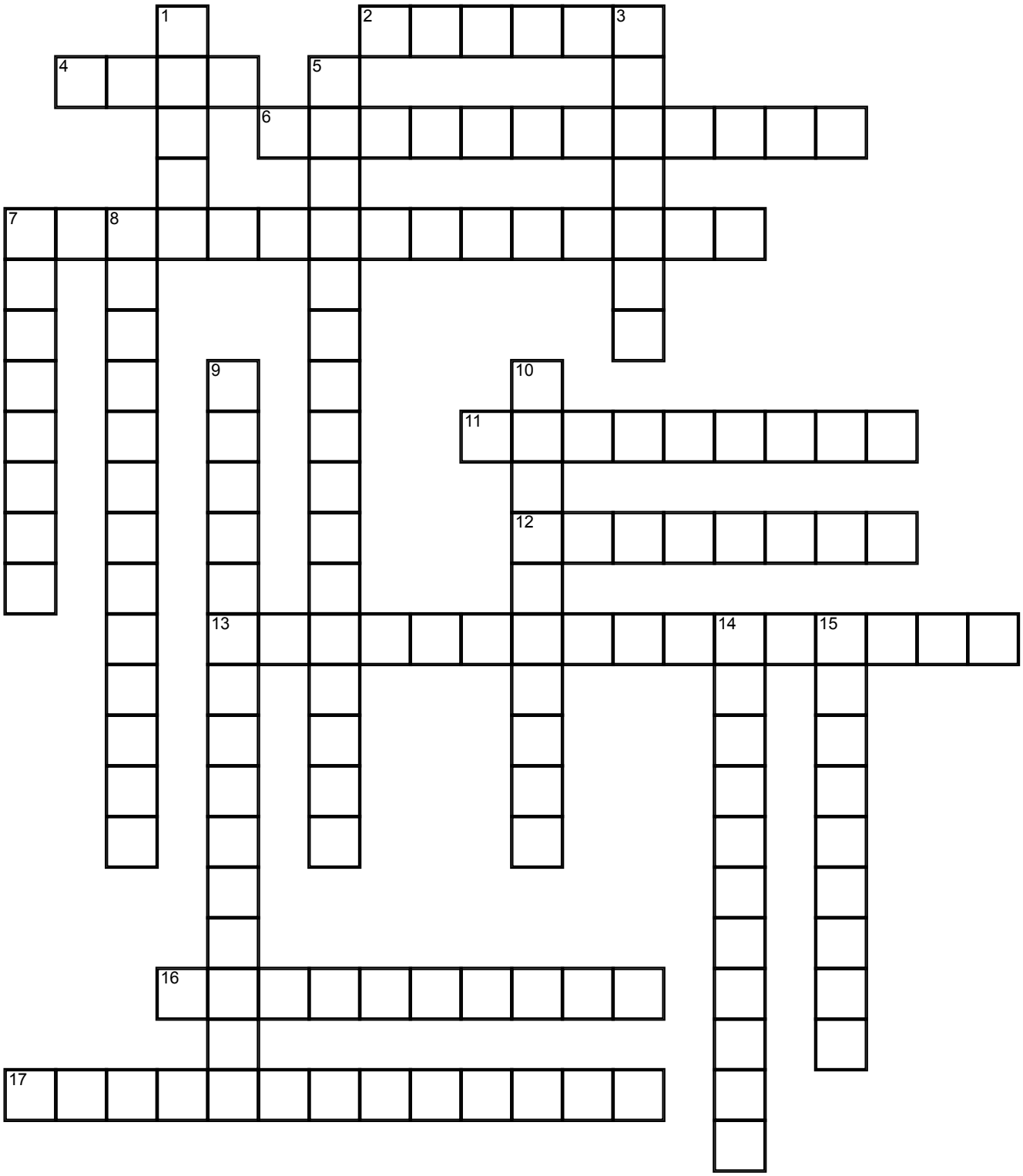
The Earth's Crust Word Scramble

Hi! Can you help me unscramble these words below? They were encrypted by a previous user, the definition is across from it for a clue. An underscore (_) represents a space, some of them have more than one word for the definition and the placement of the (_) is deceiving. What an encryption we have to decode!



1. ustrc = _____	The outer most layer of the earth's crust.
2. ruoceer_ot = _____	The only liquid layer of the earth's crust.
3. _ieonrncer = _____	A big ball of iron.
4. gnheeiartw = _____	The name of the breaking down process caused by exposure to natural elements.
5. reisoon = _____	The name for slow destruction caused by wind or water.
6. leco_rcykc = _____	The process that forms rocks in the earth's crust.
7. matenl = _____	The thickest layer of the earth's crust.
8. rgyteheaoegml_ern = _____	Energy created by heat from the earth's crust.
9. fsiefllous = _____	The name of a natural fuel such as coal or gas.
10. tecldtrinytonfe_oahnt_ri = _____	The scientific theory that the earth's continents have shifted overtime.
11. rhte_ottocetipyfoal_cen_s =_____	A theory that explains the structure of the earth's crust.

Earth's Crust Crossword!



Using the definitions below, solve the crossword on page 13.

Please note: Some of these answers are two words and some do contain a space in between the two words and some do not. Good luck!

Across

2. Thickest layer of the earth's crust

4. Name of the innermost part of the earth's crust

6. A person that studies earthquakes.

7. The modern version of continental drift - a theory that the earth's continents move over time.

11. A person that studies the earth.

12. Scientific ideas which are not yet irrefutable fact, but help to explain aspects of life on earth.

13. A theory that explains how the continents shift overtime.

16. Name for the process of hot material near the earth's core rising and colder mantle rock sinking.

17. Scientist responsible for developing theory of plate tectonics.

Down

1. The name of the outermost layer of the earth.

3. The name for the natural process of breaking down over a long period of time.

5. Energy produced naturally by the heat from the earth's core.

7. Having to do with the body; tangible or concrete.

8. Malleable layer of the earth's crust that allows the lithosphere to move around.

9. Place where the plates move and sink downward.

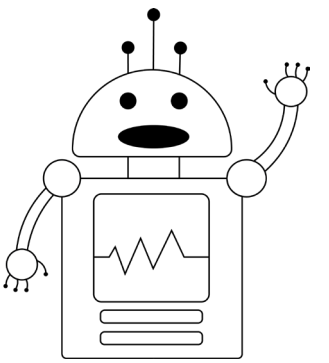
10. The breaking down of materials caused by natural elements such as water, air and wind.

14. The name for the strong outer layer of the earth's crust that contains the crust crust and the outer part of the mantle.

15. The name of the process that forms rocks in the earth's crust.

Fill in the blank for Mechanical Mixtures

Hi! I need some help, when I opened this activity, some words were missing. Can you help sort the words from the word bank to fill in the blanks to complete each sentence?



Word bank

Heterogeneous mixtures	Pure	Faster	Spaces
Impure	Particles	Homogeneous mixtures	

Particle theory of matter:

1. All matter is made up of tiny _____.

2. The particles of matter are always moving.

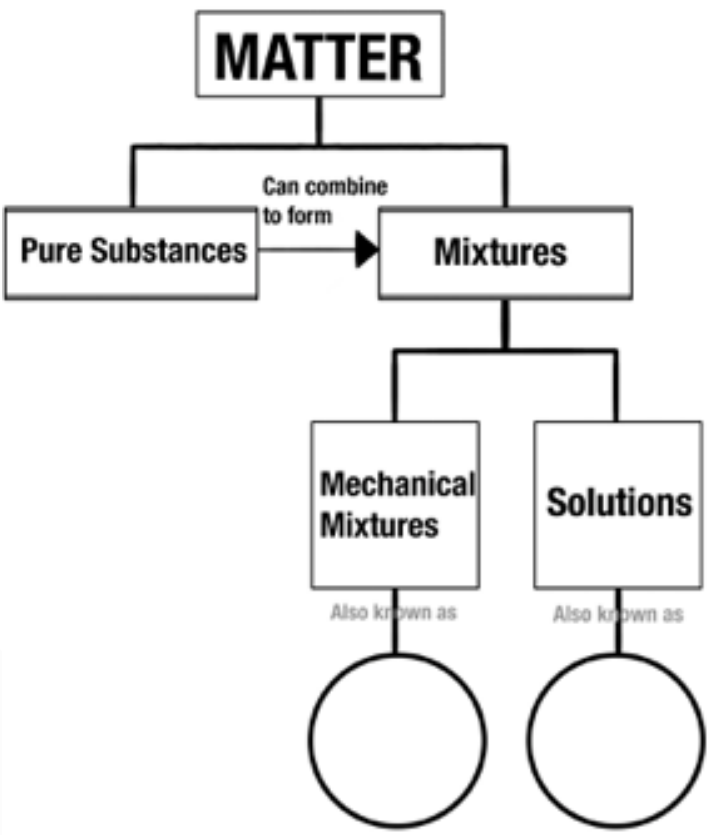
3. The particles have _____ between them.

4. Adding heat to matter make the particles move _____ .

Everything in our world is made up of matter, and different types of substances can be created from it. A substance that is made up of only a single type of particle is called a _____ substance, whereas a substance that is made up of more than one type of particle is called an _____ substance. A non-pure substance can be sorted into two different categories. These two categories are:

1. Mechanical mixtures
2. Solutions

A mechanical mixture is when more than one type of matter is clearly visible within a substance. A solution is when a substance is made up of more than one pure substance, however it appears as though it is one type of substance. Another set of names for these different mixtures are homogeneous and heterogeneous. Homogeneous means that the mixture is uniform, and heterogeneous means the mixture is non-uniform. From the above defintions we can conclude that mechanical mixtures can also be classified as _____, and solutions can be classified as _____.



SLOs: 7-2-01, 7-2-06, 7-2-13, 7-2-14

Created by: Zoe

Coding for Particle Theory of Matter

Explaining changes of state using if-statements:

1. **Solid** = particles held together strongly
2. **Heated** = particles moving faster
3. **Cooled** = particles moving slower

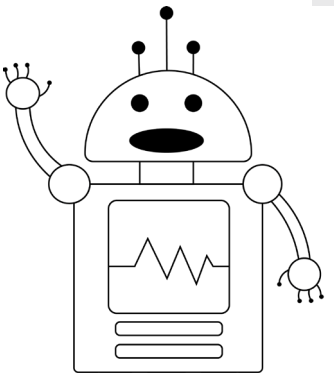
4. if **Solid** and **Heated**:
    5. **Particles** = vibrate faster until melting point
    6. if **Solid** and **Cooled**:
        7. **Particles** = vibrate slower until solidification

In the above example of code, lines 1, 2, and 3 are all variables representing certain things. The variable **Solid** is defined by its particles being held together strongly. The variable **Heated** represents how particles move faster when heated, and the variable **Cooled** represents how particles move slower when frozen or solidified.

Lines 4 and 5 are saying that if a **Solid** is **Heated**, its particles will vibrate faster until the substance reaches its melting point.

Lines 6 and 7 are saying that if a **Solid** is **Cooled**, its particles will vibrate slower until the substance reaches its solidification point.

Now, can you help me?!
Using the examples above, can you fill in the code below for the effects of heating and cooling on liquids and gases?



1. Liquid = particles move freely and take the shape of their container;

2. Heated = _____ ;

3. Cooled = particles moving slower;

4. if Liquid and Heated:
    5. Particles = _____ ;

6. if Liquid and Cooled:
    7. Particles = _____ ;

1. Gas = particles have large spaces in between them and take the shape of their container;

2. Heated = particles moving faster;

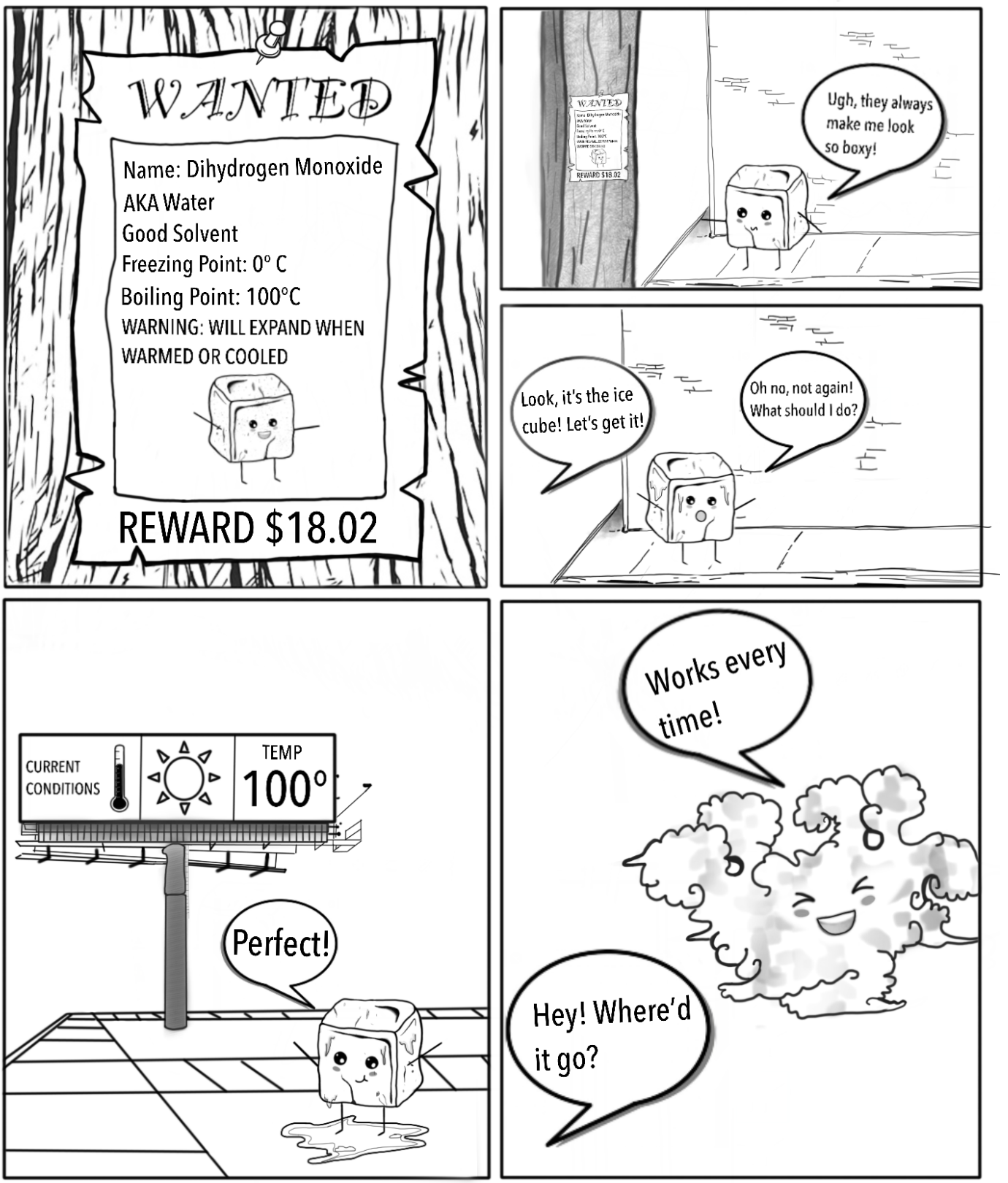
3. Cooled = _____ ;

4. if Gas and Cooled:
    5. Particles = _____ ;

6. if Gas and Heated:
    7. Particles = _____ ;

SLOs: 7-2-01, 7-2-03

THE GREAT ESCAPE

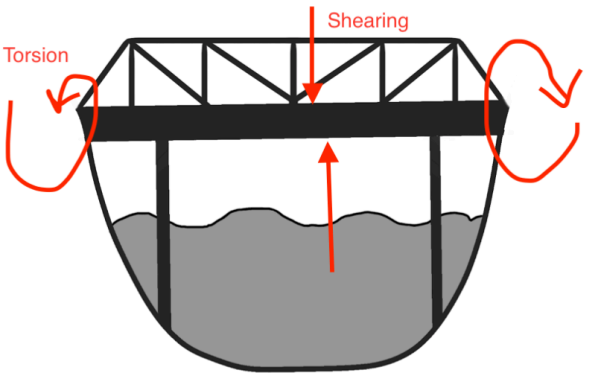


SLOs: 7-2-01, 7-2-03

Answer Key

Page 3: Answers may vary. Biotic: trees, grass, plants, birds, deer, duck. Abiotic: air, water, rocks, soil, clouds, wind.

Page 9-10:

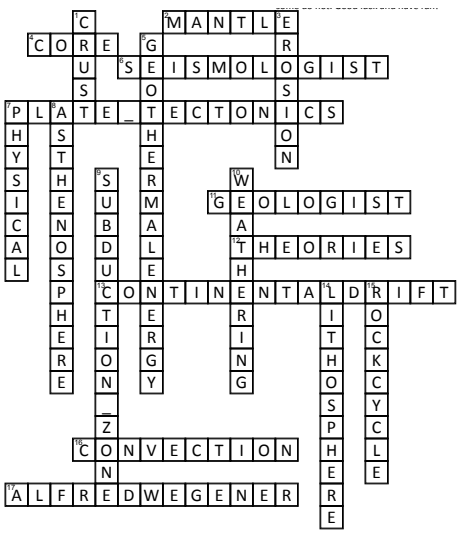


1; 0, Most solid structures are solid all the way through; 1; 0, The frame itself is not hollow but solid pieces of metal; 0, A structure can have multiple forces acting on it at once. In fact, there's almost always more than one at a given time. A bridge, for example, deals with gravity, compression, tension, torsion, and shearing all at once.

Page 11: Beam Bridge; Truss Bridge; Suspension Bridge.

Page 12: 1. crust; 2. outer core; 3. inner core; 4. weathering; 5. erosion; 6. rock cycle; 7. mantle; 8. geothermal energy; 9. fossil fuel; 10. continental drift theory; 11. theory of plate tectonics.

Page 13:



Page 15: Particle theory of matter: 1. particles; 3. spaces; 4. faster; pure; impure; heterogeneous mixtures; homogeneous mixtures. Mechanical mixtures = heterogeneous mixtures; Solutions = homogeneous mixtures.

Page 16: 2: Heated = particles moving faster; 5: Particles = move faster until some break free and evaporate; 7. Particles = move slower until freezing point; 3. Cooled = particles moving slower; 5. Particles = move slowly until they eventually turn into a liquid (condensation); 7. Particles = move even faster at a higher temp.

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