Middle School Science Enrichment

2 of 2

Wayne-Westland
COMMUNITY SCHOOLS

Antibiotics

Specification Link:
Infection & Response

Highlight key words in the question below:

Antibiotics are substances that slow down or stop the growth of bacteria. They are commonly prescribed medicines, examples include penicillin and amoxicillin. These can be taken to cure the disease by killing the pathogen, but only cure bacterial diseases and not viral ones.
Antibiotics damage the bacterial cells but do not damage the host cells. They have the ability to cure some bacterial diseases that would have previously killed many people. Since their introduction, they have had a large influence on the world's health and death rate.
Different bacteria cause different diseases. One antibiotic may only work against one type of bacteria, or a few types. This means that a range of different antibiotics is needed for the treatment of the whole range of bacterial diseases.

What do antibiotics do to bacteria?

_____

_____

What is an example of an antibiotic?

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Why don't antibiotics work on viruses?

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What effect have antibiotics had on the Earth's death rate?

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Why are different antibiotics needed?

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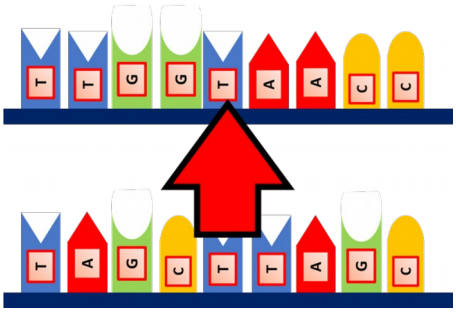

A Mutation occurs when a DNA gene is damaged or changed in such a way as to alter the genetic message carried by that gene. A Mutagen is an agent of substance that can bring about a permanent alteration to the physical composition of a DNA gene such that the genetic message is changed.

What is a mutation?

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Using the diagram to the right, explain how bacteria become resistant to antibiotics:

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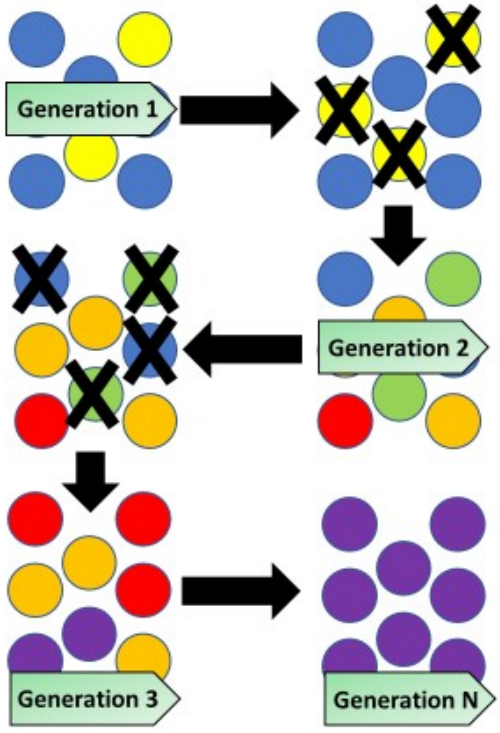

How can we stop antibiotic resistant bacteria from evolving?

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ATMOSPHERE IN BALANCE

Specification Link:
Home School Project

Highlight key points below

The Earth's atmosphere is the relatively thin layer of gases that surround the planet. It provides us with the oxygen we need to stay alive. The three most abundant gases (the ones with the highest percentages) are all elements: 78% nitrogen, N.
The atmosphere is the layer of gases that surrounds the Earth. It provides gases that are essential to life. It has evolved over time and human activity is having an impact on the atmosphere.

On a news website, there was an article about the increasing amount of carbon dioxide in the air and the effects that it will have on our planet.

Task:
Using the expert knowledge you have gained from your science lessons, reply to the forum, putting Mr. Point right. Explain why carbon dioxide is increasing, using diagrams.

Write up a brief plan of how you are going to complete this, noting key things you need to remember

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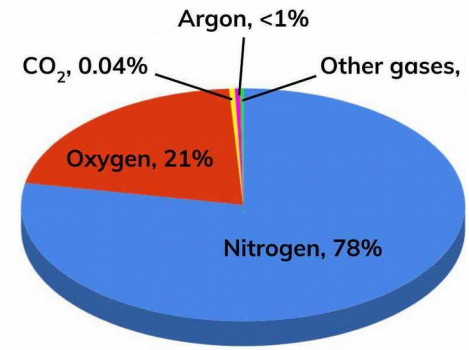


Done	You might have:
	• Identify a way that carbon dioxide is added to the atmosphere. • Identify a way that carbon dioxide is taken out of the atmosphere. • Identify one reason why carbon dioxide is increasing. • Identify one effect of an increasing amount of carbon dioxide in the atmosphere.
	• State two ways that carbon dioxide is added to the atmosphere. • State two ways that carbon dioxide is taken out of the atmosphere. • State one reason why carbon dioxide is increasing. • State one effect of an increasing amount of carbon dioxide in the atmosphere.
	• Describe two ways that carbon dioxide is added to the atmosphere, using scientific words. • Describe two ways that carbon dioxide is taken out of the atmosphere. • Describe one reason why carbon dioxide is increasing, using scientific words. • Describe one effect of an increasing amount of carbon dioxide in the atmosphere.
	• Name and explain a range of processes that add carbon dioxide to the atmosphere. • Name and explain a range of processes that remove carbon dioxide from the atmosphere. • Explain why carbon dioxide is increasing, using two or more examples. Use a range of word equations and simple symbol equations for atoms and molecules.

Questions that you should ask yourself while completing this

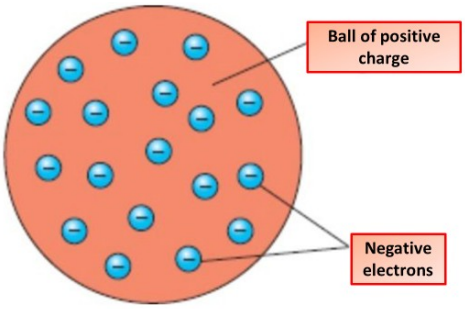
- What should I do first?
- Is something confusing me?
- Could I explain this to someone else?
- Could I have used more scientific terms?
- Where can I look for help?
- Have I double checked what I need to include?
- How can I do it better?

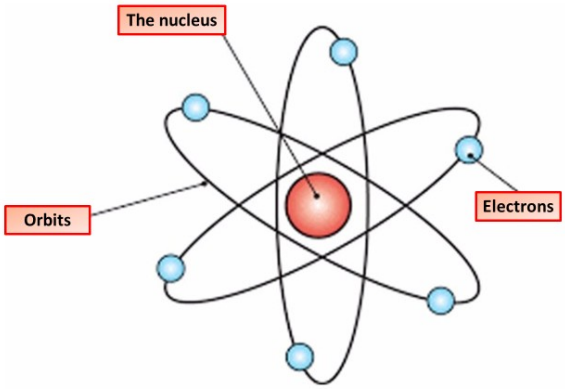
Atomic Theory

Specification Link:
Atoms & the Periodic Table

Highlight key words in the information below:

The Plum Pudding Model is a model of atomic structure proposed by J.J. Thomson in the late 19th century. Thomson had discovered that atoms are composite objects, made of pieces with positive and negative charge, and that the negatively charged electrons within the atom were very small compared to the entire atom.

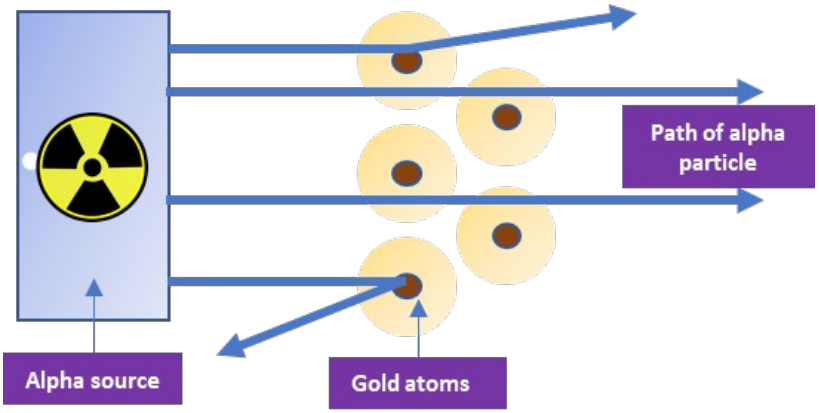




How is the plumb pudding model different from the current model of the atom?

Describe the structure of an atom using the atomic theory

The structure of an atom, theoretically consisting of a positively charged nucleus surrounded and neutralized by negatively charged electrons revolving in orbits at varying distances from the nucleus, the constitution of the nucleus and the arrangement of the electrons differing with various chemical elements.



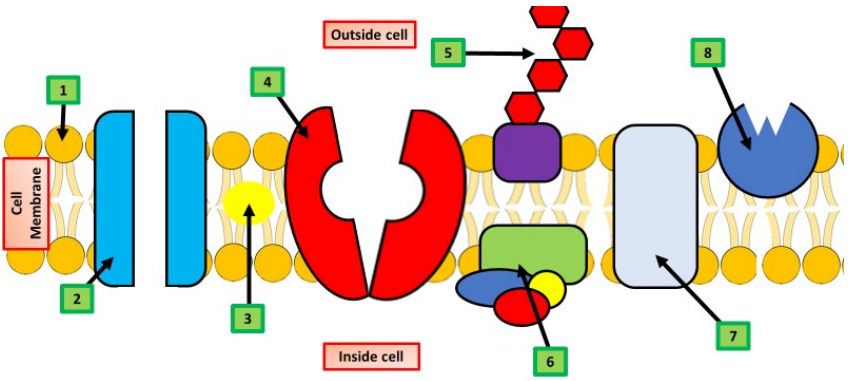
Rutherford overturned Thomson's model in 1911 with his well-known gold foil experiment in which he demonstrated that the atom has a tiny and heavy nucleus. Rutherford designed an experiment to use the alpha particles emitted by a radioactive element as probes to the unseen world of atomic structure.
Rutherford's experiment utilized positively charged alpha particles (He with a +2 charge) which were deflected by the dense inner mass (nucleus). The conclusion that could be formed from this result was that atoms had an inner core which contained most of the mass of an atom and was positively charged

How was the experiment set up?

How was it proven that most of an atom is empty space?

Cell Membranes Practice Quest

Specification Link:
Membranes: 2.1.5



The diagram shows a cell membrane, what are each of the numbered pieces

1. _____
2. _____
3. _____
4. _____
5. _____
6. _____
7. _____
8. _____

Glycoprotein molecules are positioned in the plasma (cell-surface) membrane with the carbohydrate chain outside the cell. This is to allow the glycoproteins to act as receptors in the process of cell signalling. Explain what is meant by the term 'cell signalling'.

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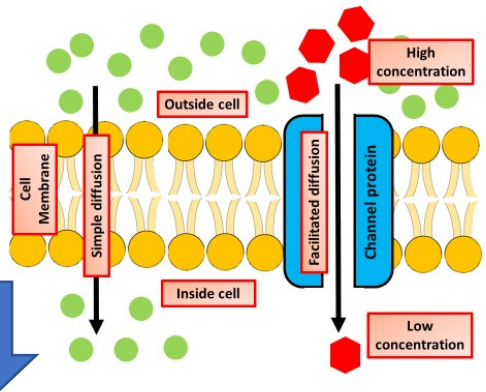
Highlight key words in the information below:

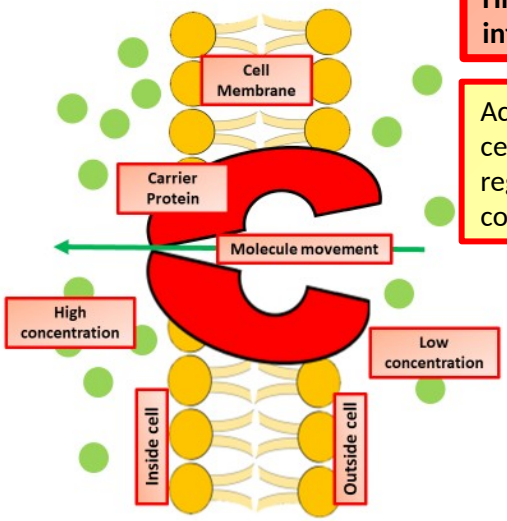
Cells need to interact with their environment and other cells around them. This is called Cell Signalling. Single cellular organisms need to detect nutrients in their environment, and cells in multicellular organisms are involved in a complex system of communication with each other.
There are four basic categories of chemical signaling found in multicellular organisms: paracrine signaling, autocrine signaling, endocrine signaling, and signaling by direct contact.

Highlight key words in the information below:

Facilitated diffusion is a form of facilitated transport involving the passive movement of molecules along their concentration gradient, guided by the presence of another molecule – usually an integral membrane protein forming a pore or channel.



Highlight key words in the information below:



Active transport is the movement of dissolved molecules into or out of a cell through the cell membrane, from a region of lower concentration to a region of higher concentration. The particles move against the concentration gradient, using energy released during respiration.

Describe two differences between: active transport and facilitated diffusion

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Desalination Question

Specification Link:

Highlight key words in the information below:

Pure water, also known as purified water, is water from a source that has removed all impurities. Distilled water is the most common form of pure water. Pure water can be purified by carbon filtration, micro-porous filtration and ultraviolet oxidation. Some places use a combination of purification processes.

What is pure water?

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Describe what happens during evaporation

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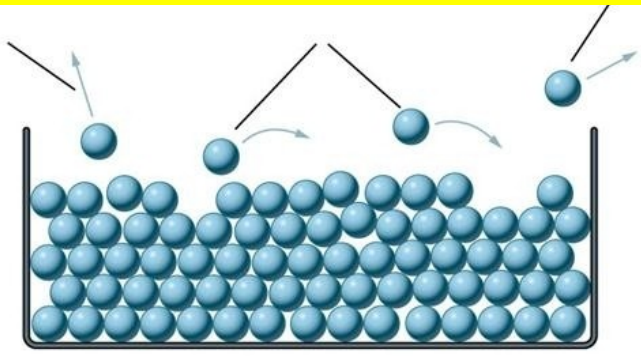

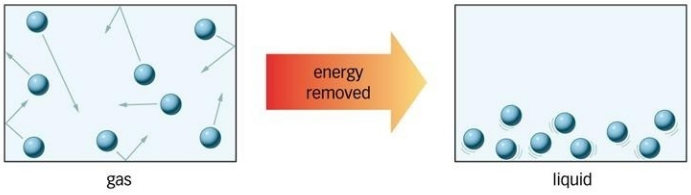

Explain what happens during condensation

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What is desalination?

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Desalination is a process that removes minerals from saline water. More generally, desalination refers to the removal of salts and minerals from a target substance, as in soil desalination, which is an issue for agriculture. Saltwater is desalinated to produce water suitable for human consumption or irrigation.

Distillation is a process of separating the component substances from a liquid mixture by selective evaporation and condensation. Distillation may result in essentially complete separation (nearly pure components), or it may be a partial separation that increases the concentration of selected components of the mixture.

What is distillation?

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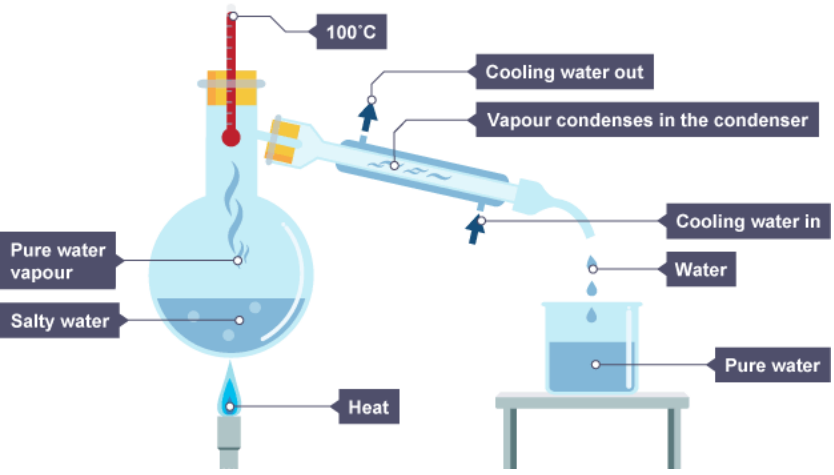

Describe how pure water can be produced

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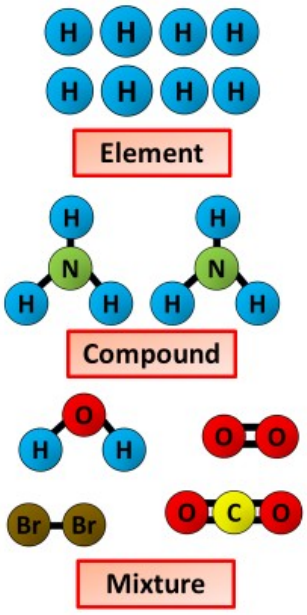
Elements, Mixtures, Compounds & Separation

Specification Link:
Atoms & the Periodic Table



What is an element?

_____

_____

What is a compound?

_____

_____

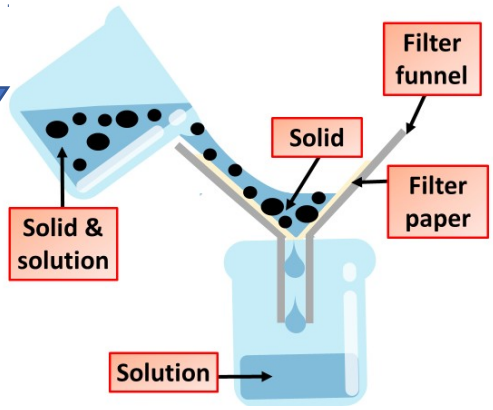
What is a mixture?

_____

_____

Highlight key words in the information below:

Filtration is technically defined as the process of separating suspended solid matter from a liquid, by causing the latter to pass through the pores of a membrane, called a filter. The most common example is making of tea. While preparing tea, a filter or a sieve is used to separate tea leaves from the water.



Describe how a solid and a liquid can be separated

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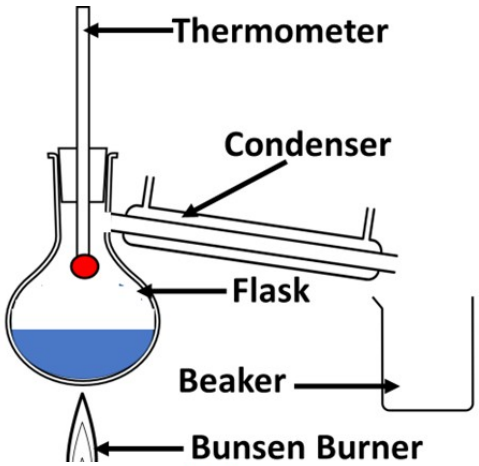
Distillation is the process of separating the components or substances from a liquid mixture by using selective boiling and condensation. Distillation may result in essentially complete separation, or it may be a partial separation that increases the concentration of selected components in the mixture



Describe how two substances can be separated by distillation

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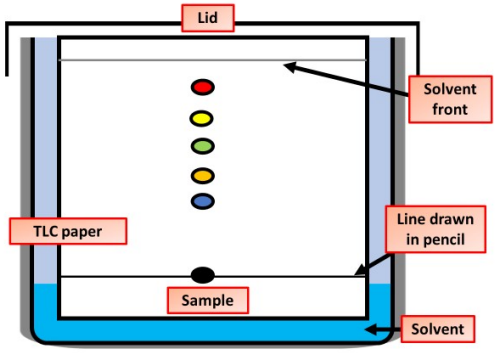
Chromatography is a laboratory technique for the separation of a mixture. The mixture is dissolved in a fluid called the mobile phase, which carries it through a structure holding another material called the stationary phase. The various constituents of the mixture travel at different speeds, causing them to separate.



Fossils

Specification Link Inheritance:

Highlight key words in the information below:

A fossil is the preserved remains of a dead organism from millions of years ago. Fossils are found in rocks and can be formed from:

- Hard body parts, such as bones and shells, which do not decay easily or are replaced by minerals as they decompose.
- Parts of organisms that have not decayed because one or more of the conditions needed for decomposition are absent. For example, dead animals and plants can be preserved in amber, peat bogs, tar pits, or in ice.
- Preserved traces of organisms, such as footprints, burrows and rootlet traces - these become covered by layers of sediment, which eventually become rock.

Draw a diagram summarizing the problems with the fossil record

What are fossils?

_____

_____

What are hard body parts replaced by?

_____

_____

What sorts of conditions stop organisms from decomposing?

_____

_____

What do organisms need to be covered by before becoming fossils?

_____

_____

Evidence about extinct species of animals and plants comes from fossils.
Below is a photograph of a fossil of a bird-like animal called Archaeopteryx. Archaeopteryx lived about 150 million years ago.
Suggest how the fossil of Archaeopteryx was formed.

Answer:

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Scientists have found other fossils of the ancestors of modern birds, but the fossil record is very incomplete.
Suggest two reasons why there are gaps in the fossil record.

Answer:

_____

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HEAT IN THE KITCHEN

Specification Link:
Home School Project

Highlight key points below

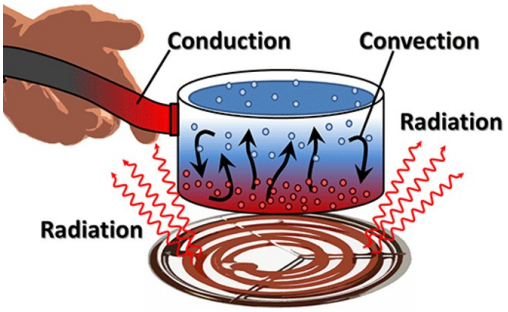
When a substance is heated, its particles gain internal energy and move more vigorously. The particles bump into nearby particles and make them vibrate more. This passes internal energy through the substance by conduction, from the hot end to the cold end.
The particles in liquids and gases can move from place to place. Convection happens when particles with a lot of thermal energy in a liquid or gas move, and take the place of particles with less thermal energy. Thermal energy is transferred from hot places to cold places by convection.
All objects transfer energy to their surroundings by infrared radiation. The hotter an object is, the more infrared radiation it gives off.
No particles are involved in radiation, unlike conduction. This means that energy transfer by radiation can work when objects are not touching, even in space

During a Food Technology lesson, some students were wondering why the metal spoon gets hot, but the wooden handle of the saucepan does not. Use your knowledge and understanding to explain how the energy is transferred from the cooker to the end of the metal spoon.

Task:

- Show how the energy from the gas ring is transferred to the end of the spoon. Describe how the energy is transferred.
- Use particle diagrams to show what is happening.

Done	You might have:
	• Draw the saucepan and spoon. • Use the key words 'metal', 'wood', 'water', 'insulator', 'conductor', 'conduction', 'convection' and 'radiation' to label the diagram. • Draw arrows to show heat energy transfers from the gas ring to the spoon handle. • Identify some energy transfers.
	• Use the key words 'metal', 'wood', 'water', 'insulator' and 'conductor' to label the diagram. • Draw arrows to show heat energy transfers from the gas ring to the spoon handle and the water. • Explain simply why energy is transferred from the hob to the spoon. • Identify energy transfers by conduction, convection and radiation.
	• Label the diagram with a range of key words and short explanations to explain why the spoon gets hot but the wooden handle does not. • Use simple energy transfer diagrams to show heat energy transfers from the gas ring to the saucepan handle and spoon. • Explain why energy is transferred from the hob to the saucepan and spoon. • Use particle diagrams to explain conduction.
	• Label the diagram with a range of key words in detailed explanations to explain why the spoon gets hot but the wooden handle does not. • Explain why energy is transferred from the hob to the saucepan and spoon. • Use particle diagrams to explain conduction and convection.



Questions that you should ask yourself while completing this

What should I do first?

Is something confusing me?

Could I explain this to someone else?

Could I have used more scientific terms?

Where can I look for help?

Have I double checked what I need to include?

How can I do it better?

HOW ARE FOSSILS MADE?

Specification Link:
Home School Project

Look at this drawing of an ammonite, a sea animal that lived 350 million years ago. It is an invertebrate which has a soft body like a squid and a shell containing a chemical called calcium carbonate. Many fossils of these organisms have been found in rocks.

Task:
Draw a series of pictures to explain how fossils are made. For each picture, describe and explain how the ammonite might have become fossilised.

Highlight key points below

A fossil is the preserved remains or traces of a dead organism. The process by which a fossil is formed is called fossilisation.
It's very rare for living things to become fossilised. Usually after most animals die their bodies just rot away and nothing is left behind. However, under certain special conditions, a fossil can form.
After an animal dies, the soft parts of its body decompose leaving the hard parts, like the skeleton, behind. This becomes buried by small particles of rock called sediment.
As more layers of sediment build up on top, the sediment around the skeleton begins to compact and turn to rock.
The bones then start to be dissolved by water seeping through the rock. Minerals in the water replace the bone, leaving a rock replica of the original bone called a fossil.

Write up a brief plan of how you are going to complete this, noting key things you need to remember

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Done	You might have:
	• State simply what a fossil is. • Draw a series of three diagrams identifying three stages of fossilisation. • Use the key words in simple descriptions of each stage.
	• Describe what a fossil is. • Describe three stages of fossilisation. • Draw a diagram to show each stage. • Use the key words in your descriptions.
	• Explain 3-5 stages of the process of fossilisation. • Draw 3-5 stages of the process of fossilisation. • Explain how the ammonite becomes fossilised. • Explain why only some parts of the ammonite becomes fossilised. • Use the key words in your explanations.
	• Explain in detail several stages of the process of fossilisation, including the chemicals involved. • Draw a diagram of the stages of the process of fossilisation. • Explain in detail why only some parts of the ammonite becomes fossilised.

Questions that you should ask yourself while completing this

What should I do first?

Is something confusing me?

Could I explain this to someone else?

Could I have used more scientific terms?

Where can I look for help?

Have I double checked what I need to include?

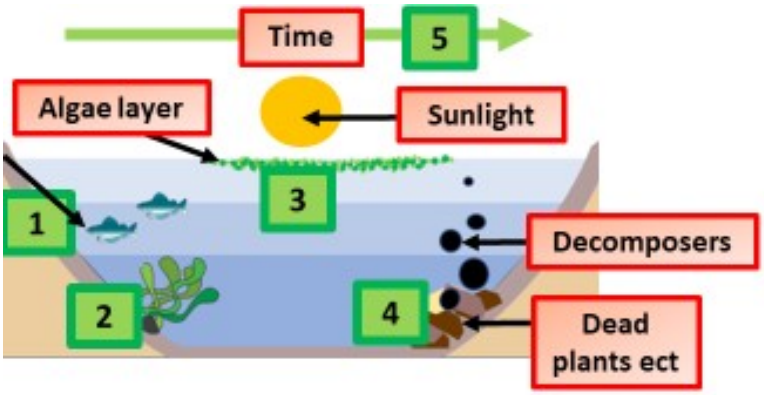
How can I do it better?

Man Made Pollution

Specification Link:
Ecology

Highlight key words in the information below:

Eutrophication. Nitrates are necessary nutrients for algae and phytoplankton growth. Discharge of nitrates to surface water bodies greatly accelerates the natural process of eutrophication, causing algal blooms which ultimately lead to depleted oxygen levels and generally poor water quality.



What are the main causes of eutrophication?

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What effect doe eutrophication have on algae growth?

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What happens to underwater plants if no light can get to them?

_____

_____

When bacteria respire under water, what gas do they take out of it?

_____

_____

What are the main causes of acid rain?

_____

_____

What effect does acid rain have on trees?

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_____

What effect does acid rain have on limestone?

_____

_____

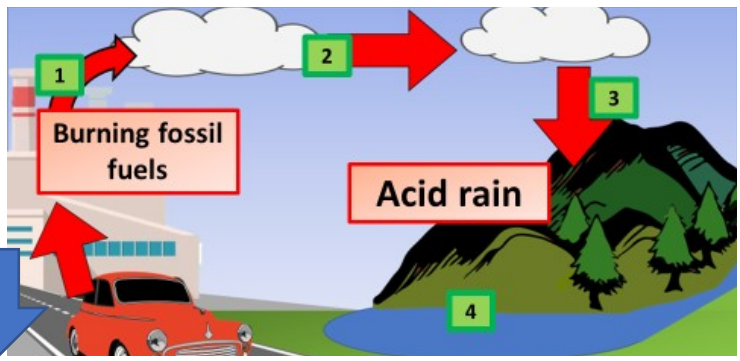
What effect does acid rain have on lakes?

_____

_____

Highlight key words in the information below:

Rainfall made so acidic by atmospheric pollution that it causes environmental harm, chiefly to forests and lakes. The main cause is the industrial burning of coal and other fossil fuels, the waste gases from which contain sulphur and nitrogen oxides which combine with atmospheric water to form acids.



Highlight key words in the information below:

Global warming is projected to have a number of effects on the oceans. Ongoing effects include rising sea levels due to thermal expansion and melting of glaciers and ice sheets, and warming of the ocean surface, leading to increased temperature stratification.

Describe how we can reduce global warming:

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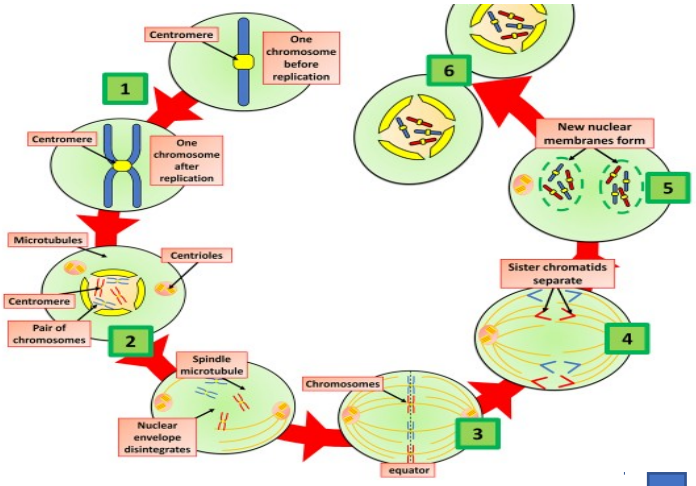
Mitosis & Meiosis

Specification Link:
Inheritance: 4.6.1.2

Highlight key words in the information below:

Mitosis is cell division which produces two identical diploid cells for growth and repair. Differentiation occurs when cells become specialised. Stem cells can develop into different cell types.
The first stages of the cell cycle involve cell growth, then synthesis of new DNA , to replicate the original DNA. The single strand of DNA that makes up each chromosome produces an exact copy of itself. In mitosis, two cells called daughter cells are produced, each identical to the parent cell.



In mitosis why do the chromosomes need to replicate?

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In mitosis what role is played by spindle fibres?

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Compare the number of chromosomes in daughter cells to it's parent cell in mitosis

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The questions below all refer to meiosis

What is crossing over?

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What sort of cells are made?

_____

Describe what happens to chromosomes

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_____

Compare the number of chromosomes at the start to the number of chromosomes at the end

_____
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Highlight key words in the information below:

Sexual reproduction uses the process of meiosis , which creates gametes . These are sperm and eggs (ova) in animals, and pollen and ova in plants. The process of meiosis happens in the male and female reproductive organs. .the cell divides twice to form four gametes, each with a single set of chromosomes.
Meiosis is a type of cell division that reduces the number of chromosomes in the parent cell by half and produces four gamete cells. This process is required to produce egg and sperm cells for sexual reproduction.

Meiosis and mitosis are different types of division in human cells. Compare the two processes by referring to where each takes place and the kind of products that are made.

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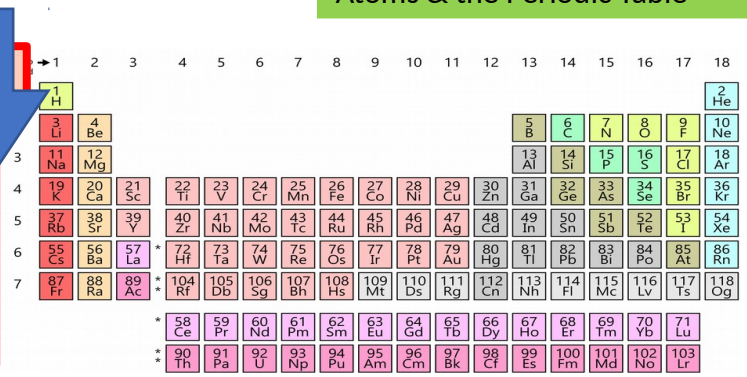
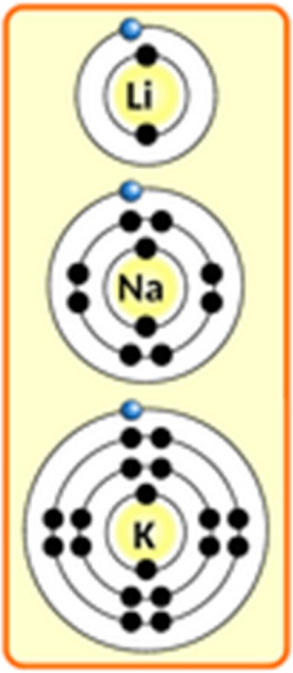
The Periodic Table

Specification Link:
Atoms & the Periodic Table

Highlight key words in the information below:

To read the periodic table, start at the top left with the elements with the lowest atomic numbers, which tells you how many protons each atom has. Then, as you move right across the chart, make note that the atomic weight, shown at the bottom of the square, also increases



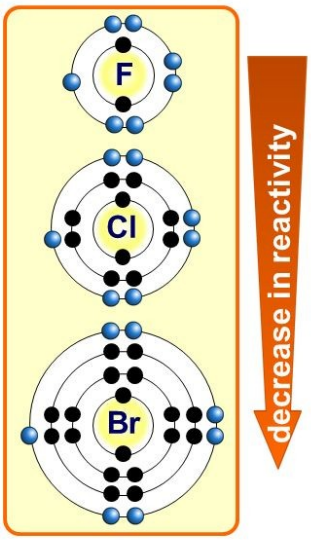


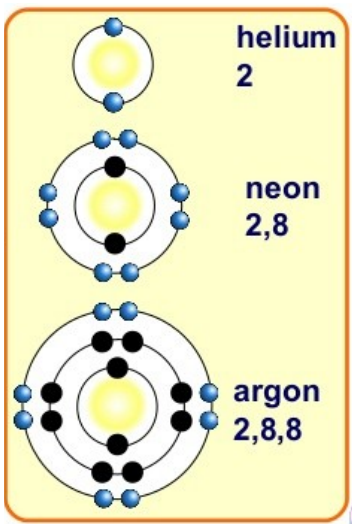
Describe how Mendeleev developed the modern periodic table

The group 1 elements are all soft, reactive metals with low melting points. They react with water to produce an alkaline metal hydroxide solution and hydrogen. Reactivity increases down the group.

Explain why the reactivity increases as we move down group 1

The Group 7 elements are called the halogens. They are placed in the vertical column, second from the right, in the periodic table . Chlorine, bromine and iodine are the three common Group 7 elements. Group 7 elements form salts when they react with metals.





Explain why the reactivity decreases as we move down group 7

The group 0 elements, the noble gases, are all unreactive non-metal gases. They show trends in their physical properties. Their uses depend on their inertness, low density and non-flammability.

CLONING *Extinct* SPECIES

Jurassic Park and its sequels are fascinating because of the idea that an extinct species can be resurrected. Taking DNA from the bellies of ancient mosquitoes preserved in amber was the ticket to reviving dinosaurs. Although it sounds like a fabulous idea there are many considerations to be made.

The movie did get one thing correct. DNA must be acquired to clone an extinct animal. The DNA must be almost entirely intact to be useful to the process. Animals that have lived most recently have a better chance of being cloned. Unfortunately, 65 million years have passed since dinosaurs walked the earth. This time frame leaves little possibility of bringing them back.

Scientists have made a list of possible candidates for cloning. One of those animals is the wooly mammoth. Let's look at why this animal made the list.

Wooly mammoths are large furry mammals that are an extinct relative to today's elephants. They lived during the Ice Age, which lasted until about 11,700 years ago. A small population survived until 4,000 years ago. Four thousand years is considered recent history in geologic time.

They may have died off when the weather became warmer, and their food supply was affected. The reason mammoths make good candidates for cloning is because many species have been found frozen in the Arctic tundra and because they went extinct so recently.

In 2013 a well-preserved mammoth body was found embedded in ice on an island near Russia. Scientists even found a liquid that looked like oozing blood. They are still studying the samples to see if there is enough intact DNA for cloning.

Harvard researchers are looking to today's closest relative of the wooly mammoth, the Asian elephant. Because they don't have the exact gene sequence, their creation would not be exactly like either of the two animals, but a creature called a "mammophant." Its characteristics are predicted to be shaggy hair, small ears, cold-blooded and elephant-like. Scientists would take genes of a wooly mammoth and implant it into the Asian elephant.

There are ethical issues associated with this type of project. Asian elephants are on the endangered list. Using them as cloning experiments would mean keeping them in captivity, but they don't do well outside of the wild. It could also be dangerous for the mother elephant during the birth process. Also, wooly mammoths live in herds, and their social system would break down.

It will take scientists several years to study all the data regarding animal cloning. Some are not even sure it is a good idea.

CLONING *Extinct* SPECIES

Answer the questions below based on the article about cloning extinct species.

COMPREHENSION QUESTIONS:

1. What movie was based on the cloning of dinosaurs? Underline your answer.

2. What is required for cloning? Highlight your answer in the text.

3. What animal do scientists consider a candidate for cloning, and why?

4. What was found in Russia in 2013?

5. How are scientists looking to clone the woolly mammoth without the complete gene sequence?

6. What would be some characteristics of the mammophant?

Mini-PROJECT: **VENN DIAGRAM**

Extend your research to cloning in general (not just extinct species). Then, create a detailed Venn Diagram using the template provided with the pros and cons of cloning. Finally, come to a personal conclusion on whether you think there are more positive or negative aspects to cloning and why. Include the following items:

- ❑ A detailed and factual Venn Diagram that highlights the pros and cons of cloning.
- ❑ At least 10 pros and 10 cons to help you determine whether or not you believe cloning is a good or bad idea.
- ❑ A three (3) paragraph essay that explains why you believe cloning is either good or bad for society. Be sure to include a grammatically correct introduction, body, and concluding paragraph.

EXOTIC Animals

Baby wild animals are adorable, and it is understandable why a person might be attracted to them. To make them a pet, however, can be a dangerous proposition because of their unpredictability. How many news stories have you seen where a wild pet surprises its owner by turning on him or her? Smaller animals are just as likely to cause injury through scratching, biting, and spreading diseases as larger animals.

Think about how wild animals have evolved over the course of millions of years. Because of their genetics and environment, they have developed particular needs, instincts, and behaviors. Removing animals from the wild cannot meet all their needs and can leave them confused and stressed.

People love exotic animals such as lions, tigers, wolves, bears, reptiles, and non-human primates (monkeys). Unfortunately, they are rather easy to purchase from breeders over the Internet. These dangerous animals have injured both children and adults. This behavior comes from the fact that the animals typically are isolated, live in small enclosures, and are not free to express their natural behaviors.

Monkeys are common pets, but about two years of age they become unpredictable and aggressive and can bite people. Felines are adorable when they are young but have the potential to kill or maim people as they grow. Some felines have escaped from their enclosures and terrorized neighborhoods. Reptiles, particularly snakes, are a common exotic pet and can pose injury by biting or constricting people. There have been several reported incidences involving strangulation by snakes as well as death from bites from venomous snakes.

Federal, State, and Local laws all have something to say about keeping exotic animals as pets. The problem is these laws are difficult to enforce as breeders do their best to avoid them. Usually, it isn't until an animal hurts someone that the laws get enforced.

If a captive animal does not adapt well as a pet, it is difficult to return them to the wild. If a person can no longer keep the animal, it is best to take them to a licensed wildlife rehabilitator. They have the proper training, skills, permits, and knowledge to give the animal the best chance to be released back into the wild.

EXOTIC Animals

Answer the questions below based on the article about exotic animals.

COMPREHENSION QUESTIONS:

1. What can happen when a wild animal is tried to be made into a domestic pet?

2. Why do many wild pets become aggressive? Underline your answer in the text.

3. What are some common wild animals that are sold as pets?

4. Who makes laws against keeping wild animals as pets? Highlight your answer in the text.

5. What should happen to a wild pet that an owner can no longer keep?

6. How do you feel about keeping wild animals as a domestic pet?

Mini-PROJECT: PUBLIC SERVICE ANNOUNCEMENT

Based on your answer to QUESTION number six, design a poster lobbying for or against the sale and purchase of wild animals as domestic pets. Your poster should be a Public Service Announcement (PSA) that informs your audience of your perspective.

- ❑ Poster/PSA arguing your stance on the purchase of wild animals.
- ❑ Creative, colorful, and bold graphics that persuade your audience.

GENETICALLY Modified

Genetically modified organisms, or GMOs, are plants or animals whose genetic makeup is modified in a laboratory. This process is called genetic engineering or transgenic technology. By artificially inserting or removing gene components of another organism, genetic engineering gives the original organism new characteristics. As with most scientific issues, there are pros and cons which need examining.

An enormous advantage to genetically engineered crops is they are made more resistant to insecticides and herbicides. This resistance allows farmers or ranchers to grow crops faster and increase their yield. Over 90% of the soybeans and corn crops have already been genetically modified. Some seeds are engineered to tolerate heat, cold, or drought. Imagine the advantage this has to farmers in drought-ridden areas across the globe.

Other engineered seeds give GMO foods brighter colors which appeal to buyers. Increasing the shelf-life is another advantage to GMO products. Ever notice the expiration date of your snack food? This long-lasting effect helps in shipping them to remote locations. Have you wondered why watermelons no longer have large black seeds? The seeds in both watermelon and grapes have been genetically engineered almost to disappear.

Why is there a reluctance in some people to eat GMO foods? Some studies have shown that GMO corn and soybeans fed to rats led to a higher risk of them developing liver and kidney problems. Currently no one knows if these results transfer to humans. People opposed to GMO's are not confident they are thoroughly tested, and if these organisms do not occur naturally, people are highly suspicious.

Some people believe GMOs effect on people with allergies is unpredictable. There are lots of GMO's used in snack food, which makes it hard for people with allergies to avoid them. Other folks believe there might be a connection between GMOs and cancer. There is no direct link proven at this time. Some wonder if there is a link between GMOs and the rise of antibiotic-resistant bacteria. Again, more research is needed. However, many seeds have been engineered using antibiotic-resistant genes.

It appears that GMOs are here to stay, so consider your options carefully when deciding whether they are worth the avoidance.

GENETICALLY Modified

Answer the questions below based on the article about GMOs.

COMPREHENSION QUESTIONS:

1. What is a GMO? Underline your answer in the text.

2. How is an organism modified?

3. What is an advantage to genetically engineered crops? Highlight your answer in the text.

4. Why is there reluctance to embrace the GMO crops?

5. How has a watermelon been genetically altered?

6. Do you have any problem eating GMO foods? Why or why not?

Mini-PROJECT: DESIGN A MENU

A local restaurant has hired you to create an organic, farm-to-table menu for their establishment. Research where you would get the fruits, vegetables, and mean without any GMOs. Then, create a menu based on the information you find. Your menu should include:

1. Appetizers, entrees, desserts, and drinks (at least 2 of each)
2. Menu items that are based on local or surrounding farms without GMOs
3. A unique and creative design

INHERITED traits

Known as the "father of modern genetics," Gregor Mendel was an Austrian-born monk born in 1822. Using pea plants as his subjects, Mendel was able to show that inherited traits follow patterns. His work became the foundation of modern genetics which led to the study of heredity.

A trait is a characteristic or a feature of an organism. Some examples of traits are hair and eye color, the shape of a leaf, and the tendency for an organism to behave in a certain way.

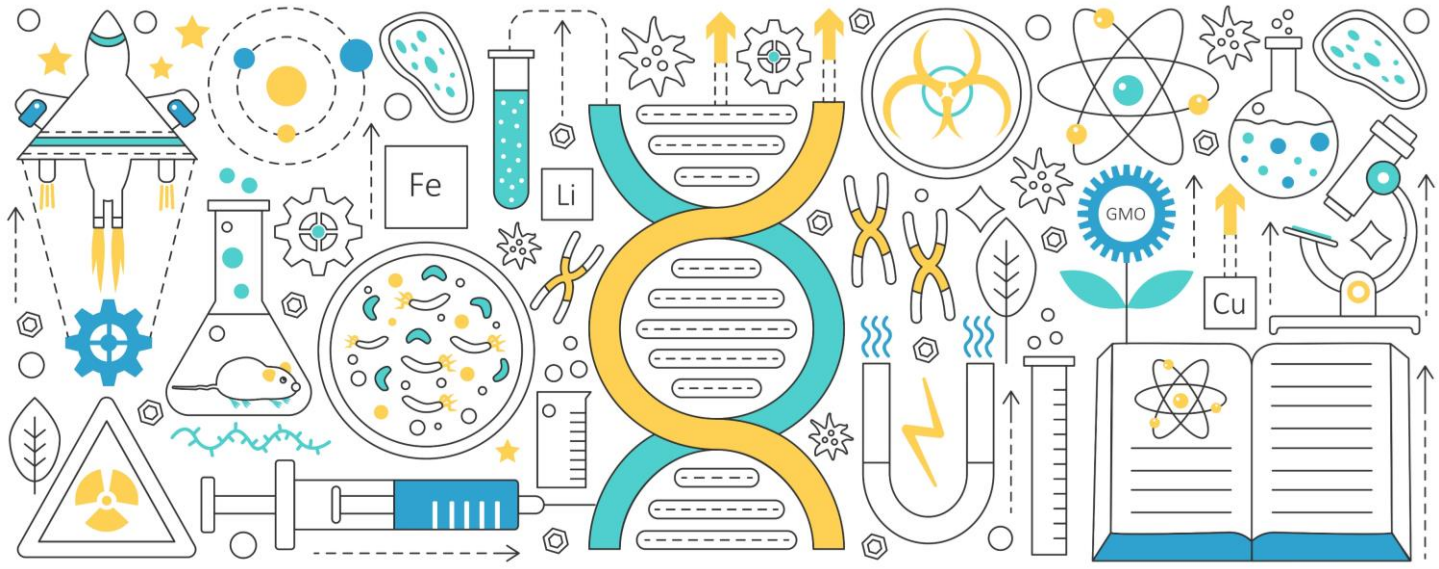
Today, scientists use the word phenotype to refers to the observable physical properties of an organism. Appearance, development, and behavior are examples of the phenotype. An organism's phenotype is dependent on their genotype. Genotype refers to the set of genes in the DNA which is responsible for that trait. In other words, the genotype determines the phenotype.

Genes contain the genetic codes for traits and are located on the chromosome in the cells. Traits pass from your mother and father. Alleles are different forms of the same trait. The color of eyes would be an example of a trait, and the different eye colors (blue, brown, hazel, etc.) would be the alleles.

Sometimes parents pass on the same allele to their offspring. Homozygous refers to this type of offspring because homo means the same, such as two brown-eyed parents. Heterozygous, meaning different, refers to parents providing different alleles, such as a blue and a brown-eyed parent.

Besides homozygous and heterozygous alleles produce the phenotype of physical traits that may be either dominate or recessive. A dominate allele will mask a recessive allele. In the case of eye color, brown eyes are dominate over blue eyes. For an offspring to be blue-eyed, the child must inherit two blue-eyed alleles. A child will be brown eyed if he inherits two brown alleles or a brown and blue allele.

It can be interesting to compare your phenotypes with your parents. Here are some inherited traits you can use to compare. Decide what type of alleles you inherited based on your phenotype. Here is a list of some inherited traits: attached earlobes, tongue rolling, dimples, right or left-handedness, curly hair, freckles, red or green colorblindness, and hairline shape.



INHERITED *traits*

Answer the questions below based on the article about inherited traits.

COMPREHENSION QUESTIONS:

1. Who is Gregor Mendel? Underline your answer in the text.

2. What role did pea plants play in his research?

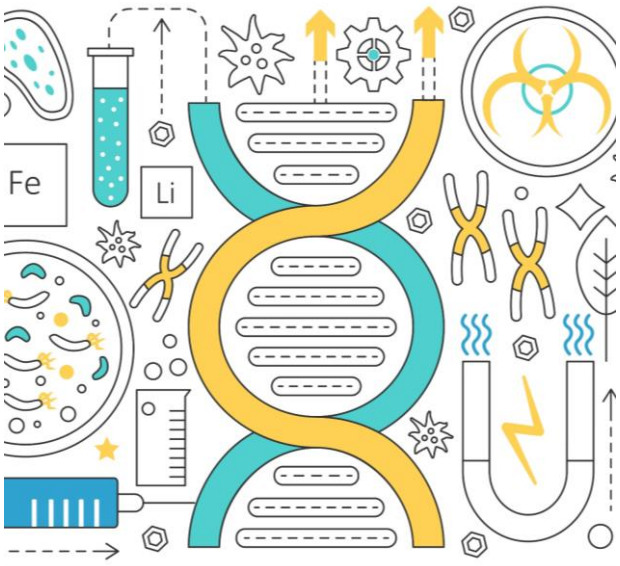
3. What is a trait? Highlight your answer in the text.

4. What are some examples of a trait?

5. What does the word phenotype refer to?

6. What are genes? Put a star next to your answer in the text.

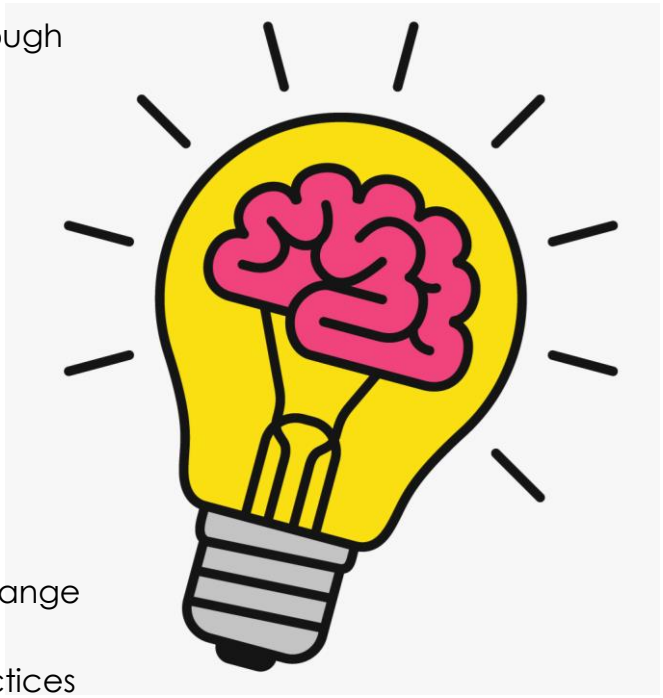
Mini-PROJECT: DIY INSTRUMENT



Define dominant trait and recessive trait. What are some physical (dominant vs recessive) inherited traits? For example, freckles are a dominant trait. Find six traits for both dominant and recessive, and determine whether or not they run in your family. Complete using the chart provided.

- ❑ List six dominant traits
- ❑ List six recessive traits
- ❑ Determine whether or not each of these traits run in your family

USE IT OR *Lose it*



Until scientists observed and mapped the brain through the use of magnetic resonance imaging (MRI), the thinking was that the brain was a stagnant hard-wired organ. Currently, we know the brain is much more malleable, or plastic-like, and that changes occur throughout a lifetime. The study of the brain and its ability to reorganize itself both physically and functionally is called neuroplasticity.

Neuroplasticity is the process by which all permanent learning takes place in your brain. This process allows people to overcome different types of brain deficits such as stokes, injury, learning disabilities, and autism. Neuroplasticity can also change peoples' brains who suffer from depression and obsessive-compulsive disorders. Other healthy practices such as behavioral therapy and meditation can encourage positive neuroplastic change and restore a person's mental health.

In his book, Soft-Wired: How the New Science of Brain Plasticity Can Change Your Life, Dr. Michael Merzenich, a leading pioneer in brain plasticity research, lists ten core principles necessary for the remodeling of your brain to take place. Let's look at a some of those principals.

First, it's interesting to note that one can just as easily generate negative changes in the brain as well as positive. The brain can easily be wired for addictions. Also, as people age they can become more negative, the "woe is me" syndrome can increase negative changes in the brain.

If you are highly engaged, motivated, and ready for action, the brain releases the neurochemicals necessary for the brain to change. If the opposite is also true, the neurochemical switch turns off. The more focused you are on trying to master a task, the greater brain change you can expect.

Assume you are highly motivated to learn a new instrument or language. As you learn a new skill, the connections between the neurons strengthen. The more you practice, the stronger these connections become. It's as if your nerve cells are coordinating an action. If you quit practicing, this coordination stops.

If you're learning a new skill or focus on more positive thoughts, neuroplasticity tells us to keep practicing so those connections between neurons can stay strong.

USE IT OR *Lose it*

Answer the questions below based on the article about neuroplasticity.

COMPREHENSION QUESTIONS:

1. What is neuroplasticity? Highlight your answer in the text.

2. What does the brain have the ability to do?

3. Neuroplasticity helps the brain and people overcome certain types of brain injury and deficits. Name some of these deficits.

4. What happens in the brain if one is highly motivated to learn a new topic?

5. Who is the leading pioneer in brain plasticity research?

6. How do scientists observe and map the brain?

Mini-PROJECT: CREATE AN ACTIVITY

A group of scientists have asked you and your classmates to design an activity that you think will encourage positive neurochemicals to be released in the brain. With a group of 2-4, design such an activity. Specifically, you should create a physical representation of the activity. For example, if it requires marbles, you'll need to provide those. If it's a board game, you'll need to design it on a piece of cardstock paper to present to the class. Lastly, in addition to your physical representation, you need to provide a rationale that explains WHY your activity will be successful.

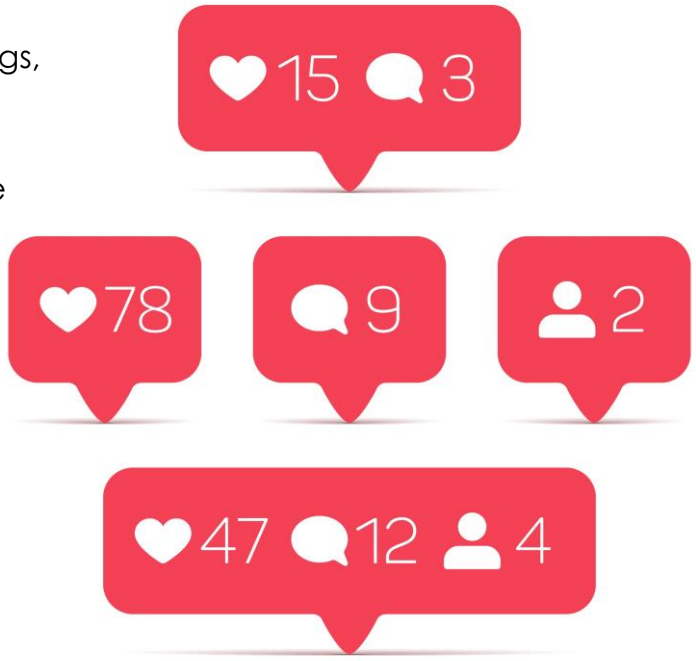
THE POWER OF "Likes"

In the 1890's a Russian psychologist, Ivan Pavlov, discovered something that is known as a conditioned stimulus. He worked with dogs and found by ringing a bell in conjunction with giving the dogs food, the dogs would generate saliva. He went one step further showing that the dogs responded to the bell even without the presence of food. The dogs were conditioned to respond (saliva) to this stimulus (bell) even though there was no food present.

This stimulus/response concept is still with us in many areas of our lives today. Let's look at social media as an example. Do you even find it's hard to not respond instantly to texts, Facebook, Instagram, or Twitter posts (stimulus)? This stimulus causes the brain to release a chemical called dopamine. Because dopamine causes you to feel good, it motivates you to repeat those behaviors that are pleasurable.

Social media is a way of getting instant gratification. Texting, tweeting, snap chatting or whatever your preferred social media style rewards you with "likes" and retweets. These rewards release dopamine. Dopamine makes you want to continue to do it because it makes you feel good. It becomes harder and harder to pull yourself away from your device because you're in a "dopamine loop."

Unpredictability is part of the allure of social media. If you knew each time you posted a picture on Facebook, it would get 150 "likes," your brain would quickly grow tired of the activity. Because you don't know exactly who is going to read your post or what they are going to comment, your dopamine system is stimulated.



What is increasingly unsettling is, like Pavlov's dogs, the conditioned response (dopamine release) occurs just by hearing the beep, buzz, or song you've chosen to alert you to a message. These sounds enhance the addictive effect of releasing dopamine. This constant stimulation of dopamine can be exhausting.

Those automatic notifications are thought to be the latest and greatest by tech companies when they are turning us into one of Pavlov's dogs. The best way to break this dopamine loop is to turn off as many auditory and visual cues as possible. As with any new habit, it's going to take practice to withdraw your brain from the world of social media feedback. At a minimum, temper your notifications so that you can get off the dopamine merry-go-round.

THE POWER OF "Likes"

Answer the questions below based on the article about the power of likes.

COMPREHENSION QUESTIONS:

1. Who is Ivan Pavlov? Underline your answer in the text.

2. What is conditioned stimulus? Highlight your answer in the text.

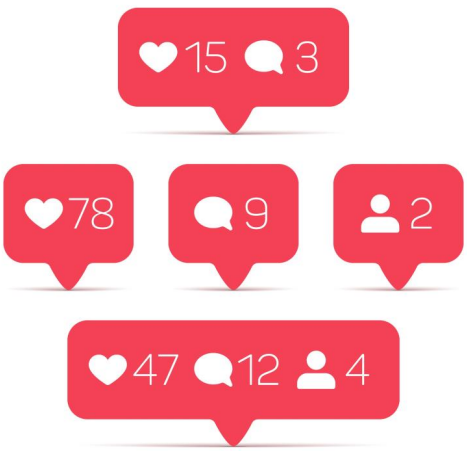
3. How is the stimulus concept currently in our lives?

4. What happens in our brain when a stimulus is known?

5. What in social media is a stimulus and gives instant gratification? Circle your answer in the text.

6. Can a stimulus become addictive?

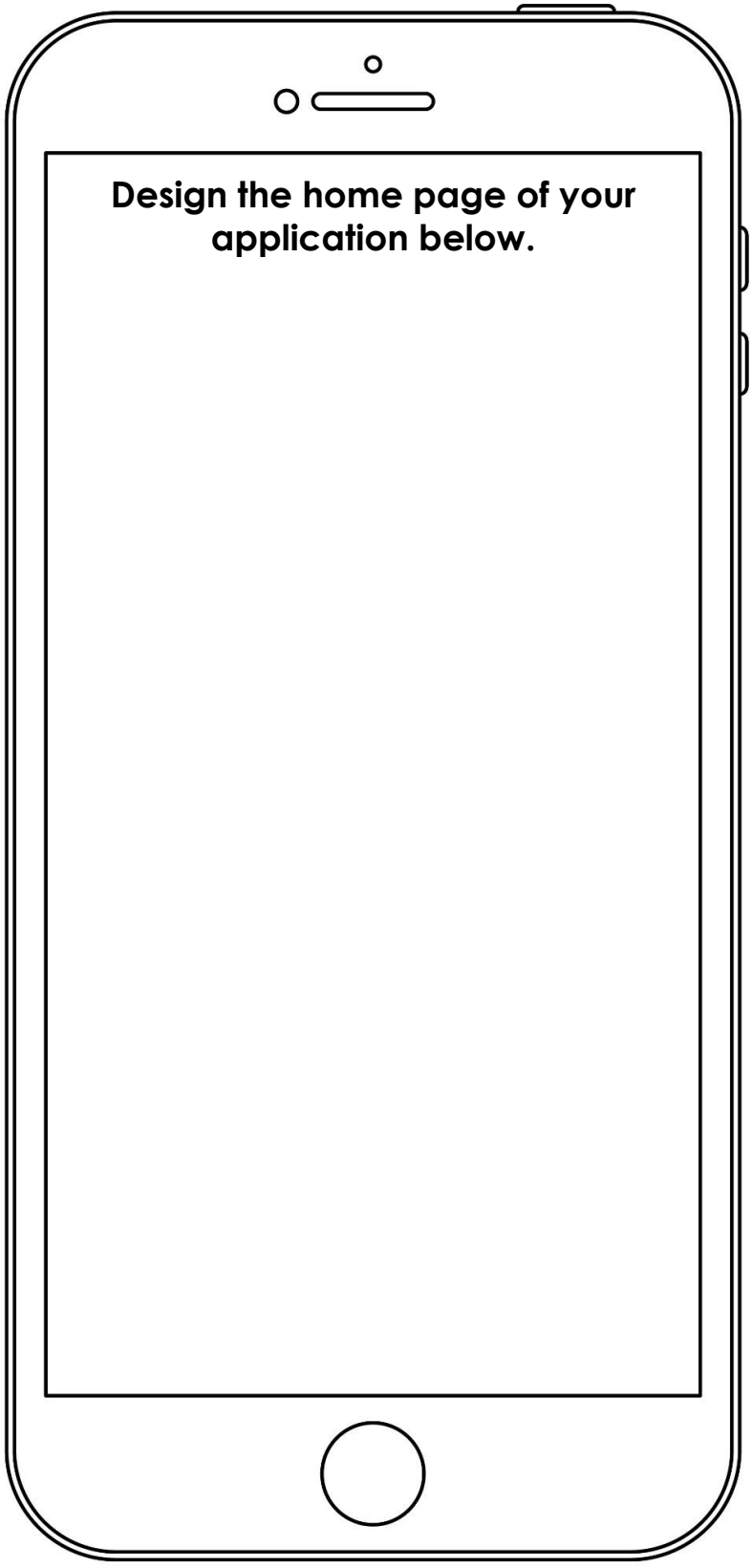
Mini-PROJECT: DESIGN AN APP



Apple has reached out to you seeking a new social media application to install on each of their iPhones. Using the page provided, design a NEW, unique social media app for users. Include the following information:

- ❑ Pricing for the app
- ❑ Concept of the app
- ❑ Logo for the app
- ❑ Features of the app
- ❑ Ultimate goal and purpose of the app

THE POWER OF "Likes"



Provide a written explanation of your application below.

Design the logo of your application below.

WATER Pollution

The Great Lakes are an important natural resource to many areas of the U.S. Together they contain five lakes: Superior, Michigan, Huron, Erie, and Ontario. These lakes make up for 20% of all the fresh water on Earth's surface. They border eight states and two countries (U.S. and Canada) They provide a way for goods to move from the Atlantic Ocean to inland areas.

Amazingly, water was not always thought about as an important natural resource. Therefore, businesses and recreational folks didn't think at all about dumping trash and dangerous chemicals into the lakes. They guessed that the lakes were so large that all the water would dilute the materials.

Deciding who the polluters are is an arduous task. There are essentially two types of pollution: non-point source pollution and point source pollution. Waste that creates runoff from farming chemicals is called non-point pollution. Another example of non-point pollution is air pollution. Chemicals from factories mix with the air making acid rain, and the acid rain changes the acidity of the lakes. It is hard to find the exact offenders who make this type of pollution.

Point source pollution is easier to trace back to the polluter. This type of pollution comes from factories directly dumping chemical waste into the lakes. In addition to chemicals, factories might also dump heated water into the lakes. Both change the equilibrium of the organisms in the lakes.

Here are two examples of water pollution. Mercury is a toxic chemical that might be dumped into a water source. The mercury moves from the water to the plants. When the fish eat the contaminated plants, they absorb the mercury. When humans eat the toxic fish, they absorb the mercury, and it causes ill effects. Humans also use the lakes and rivers nearby them for drinking water. Polluted drinking water is harmful to humans.

There is good news about the levels of pollution in Great Lakes. This has in turn reduced the pollution. Both the U.S. and Canada signed the "Great Lakes Water Quality Agreement." The contract is a promise to protect and return the water of the Great Lakes.

WATER Pollution

Answer the questions below based on the article about water pollution.

COMPREHENSION QUESTIONS:

1. What are the Great Lakes? Highlight your answer in the text.

2. Where are these lakes located?

3. What are the two types of pollution? Circle your answer in the text.

4. What is an example of non-point pollution?

5. What is an example of point source pollution?

6. What is an example of water pollution?

Mini-PROJECT: DIY INSTRUMENT

Look up the Great Lakes Water Quality Agreement. Write a summary of this agreement and explain its purpose. Then, create a multiple choice style quiz with an answer key based on the document.

- ❑ Read the Great Lakes Water Quality Agreement.
- ❑ Summarize and write about the agreement in your own words.
- ❑ Create a multiple choice quiz and answer key basked on the document
  - ❑ 10 questions minimum

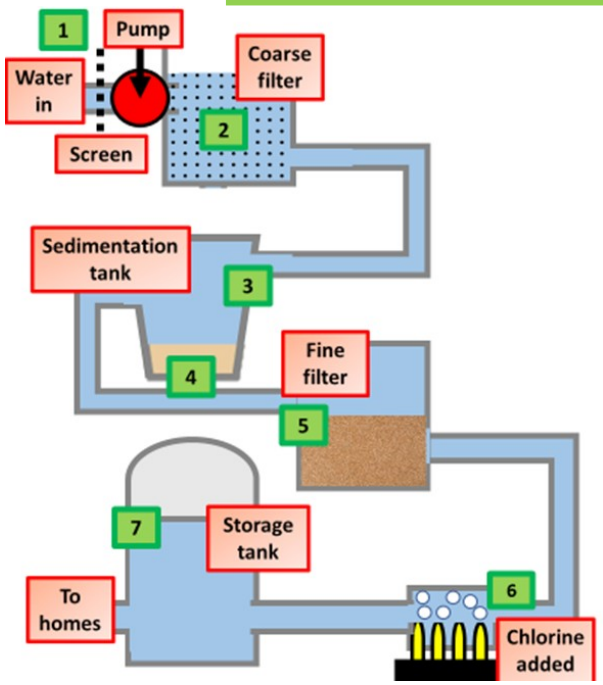
Water Treatment Question

Specification Link:
Using Resources: 4.10.1.2

Highlight key words in the information below:

Raw water may contain dissolved salts and minerals, microbes, pollutants and insoluble materials like sand and stones. Water is treated to remove any harmful components before being fed into the public supply. This is done in several ways:

- Filtration - the water is sprayed onto specially-prepared layers of sand and gravel. As it trickles through, different-sized insoluble solids are removed. The filter beds are cleaned periodically by pumping clean water backwards through the filter.
- Sedimentation - a chemical is added which causes tiny solid particles (which would pass through a filter) to clump together into larger particles. These can then be allowed to settle out or may be filtered.
- Chlorination - chlorine gas is injected into the water to sterilise it. The chlorine kills microbes.



The diagram shows how water is treated.
Summarise this process:

_____
_____
_____
_____
_____
_____
_____
_____
_____
_____

What is the purpose of running water through a screen?

_____
_____

What is the purpose of the sedimentation tank and what is added to the water?

_____
_____

What is the purpose of running water through a fine filter?

_____
_____

What is the purpose of adding chlorine to the water?

_____
_____

- Chlorine is used to make bleaches, plastics and medicines. Swimming pool water is often treated with chlorine.
- Chlorine is used to make water safe to drink. It is relatively cheap and easy to use. People who drink untreated water risk dying from typhoid and cholera.
- However, chlorine is a poisonous chemical. It causes breathing difficulties and can kill people. Some people are also allergic to chlorine.

Highlight key words or phrases

Developing countries are likely to choose chlorination as their method of making water safe to drink. Suggest why.

_____
_____
_____

WHAT HAPPENS WHEN WE BURN FUELS?

Specification Link:
Home School Project

Highlight key points below

A chemical change, also known as a chemical reaction, is a process in which one or more substances are altered into one or more new and different substances. In other words, a chemical change is a chemical reaction involving the rearrangement of atoms

A physical change is a type of change in which the form of matter is altered but one substance is not transformed into another. The size or shape of matter may be changed, but no chemical reaction occurs.

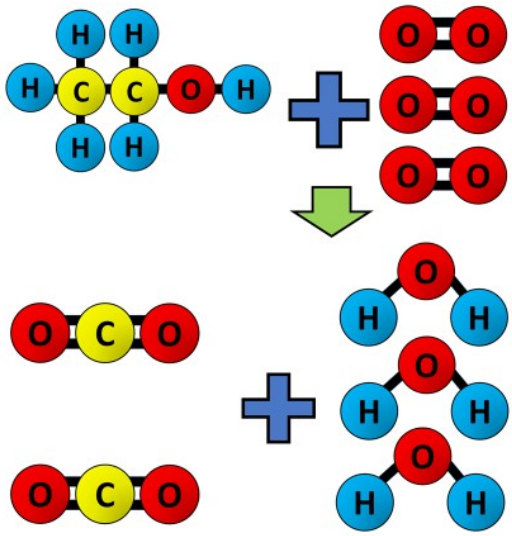
All the light a candle makes comes from a chemical reaction known as combustion in which the wax reacts with oxygen in the air to make a colorless gas called carbon dioxide. Water is also produced in the form of steam.

The particle model states that all matter consists of very small particles that are constantly moving. The degree to which the particles move is determined by the amount of energy they have and their proximity to other particles. In solids, the particles are packed tightly in fixed positions and are all touching.

Coal, oil and gas are fossil fuels. Coal is mainly made of carbon. Oil and gas are made of carbon and hydrogen. We burn these fuels for many reasons.

Task:

- Make a poster to explain why we burn fuels.
- Describe what happens when we burn fuels.
- Explain why these reactions are so useful.
- Use pictures and diagrams to help explain your ideas.



Done	You might have:
	• Identify which substances are solids, liquids or gases. • State one reason why we burn fuels. • State simply what happens when fuels are burnt. • Identify which changes can be reversed.
	• Describe which substances are solids, liquids or gases. • Describe some reasons why fuels are useful. • Describe what happens when fuels are burnt. • Describe simply whether the change can or cannot be reversed.
	• Describe what happens when we burn fuels, identifying the reactants and the products. • Explain simply why fuels are useful. • Use a simple particle model to explain some changes. • Identify some elements, compounds or mixtures correctly. • Describe some environmental problems with burning fossil fuels.
	• Explain, in detail, why fuels are useful. • Link a model of energy and a particle model in your explanations. • Write balanced symbol equations for each reaction. • Explain if the mass of fuel will stay the same throughout the reaction. • Describe elements, compounds and mixtures in terms of particles. • Explain in detail a range of environmental problems associated with burning each type of fossil fuel.

Questions that you should ask yourself while completing this

What should I do first?

Is something confusing me?

Could I explain this to someone else?

Could I have used more scientific terms?

Where can I look for help?

Have I double checked what I need to include?

How can I do it better?

Name_____

DATA Nugget

Coral bleaching and climate change

Featured scientist: Carly Kenkel from The University of Texas at Austin

Research Background:

Corals are animals that build coral reefs. Coral reefs are home to many species of animals – fish, sharks, sea turtles, and anemones all use corals for habitat! Corals are white, but they look brown and green because certain types of algae live inside them. Algae, like plants, use the sun's energy to make food. The algae that live inside the corals' cells are tiny and produce more sugars than they themselves need. The extra sugars become food for the corals. At the same time, the corals provide the algae a safe home. The algae and corals coexist in a relationship where each partner benefits the other, called a **mutualism**: these species do better together than they would alone.

When the water gets too warm, the algae can no longer live inside corals, so they leave. The corals then turn from green to white, called **coral bleaching**. Climate change has been causing the Earth's air and oceans to get warmer. With warmer oceans, coral bleaching is becoming more widespread. If the water stays too warm, bleached corals will die without their algae mutualists.

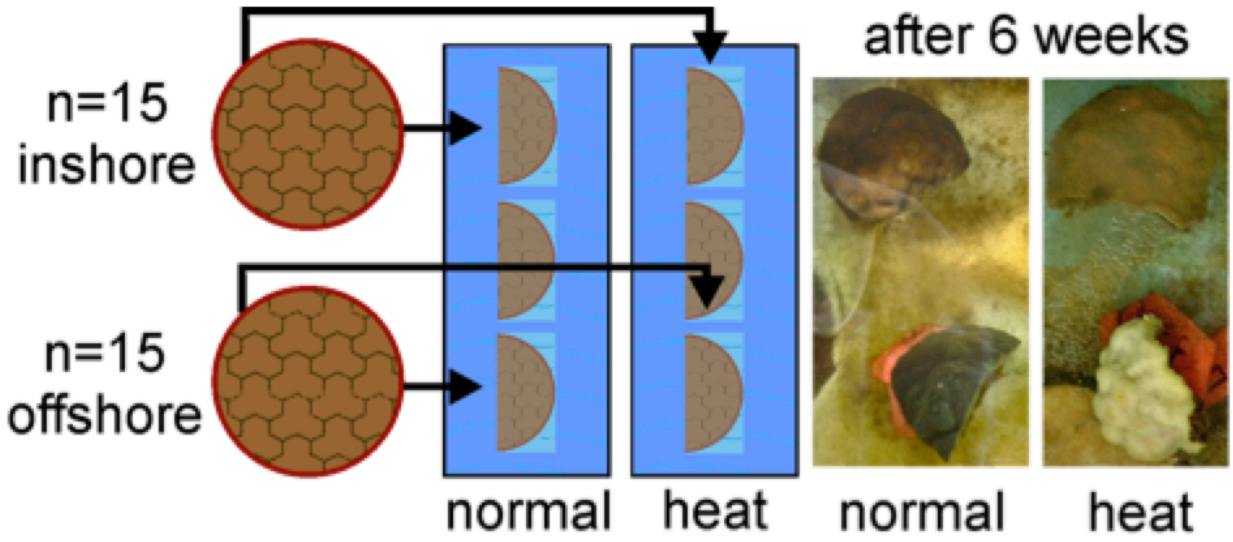
Carly is a scientist who wants to study coral bleaching so she can help protect corals and coral reefs. One day while out on the reef, Carly observed an interesting pattern. Corals on one part of a reef were bleaching while corals on another part of the reef stayed healthy. She wondered, why some corals and their algae can still work together when the water is warm, while others cannot?

A Pacific coral reef with many corals

Carly observing a coral reef

Name_____

Ocean water that is closer to the shore (**inshore**) gets warmer than water that is further away (**offshore**). Perhaps corals and algae from inshore reefs have adapted to warm water. Carly wondered whether inshore corals are better able to work with their algae in warm water because they have adapted to these temperatures. If so, inshore corals and algae should bleach less often than offshore corals and algae. Carly designed an experiment to test this. She collected 15 corals from inshore and 15 from offshore reefs in the Florida Keys. She brought them into an aquarium lab for research. She cut each coral in half and put half of each coral into tanks with normal water and the other half into tanks with heaters. The normal water temperature was 27°C, which is a temperature that both inshore and offshore corals experience during the year. The warm water tanks were at 31°C, which is a temperature that inshore corals experience, but offshore corals have never previously experienced. Because of climate change, offshore corals may experience this warmer temperature in the future. After six weeks, she recorded the number of corals that bleached in each tank.



Scientific Question: What is the effect of water temperature on corals from inshore and offshore reefs?

What is the hypothesis? Find the hypothesis in the Research Background and underline it. A hypothesis is a proposed explanation for an observation, which can then be tested with experimentation or other types of studies.

Name_____

Scientific Data:

Use the data below to answer the scientific question:

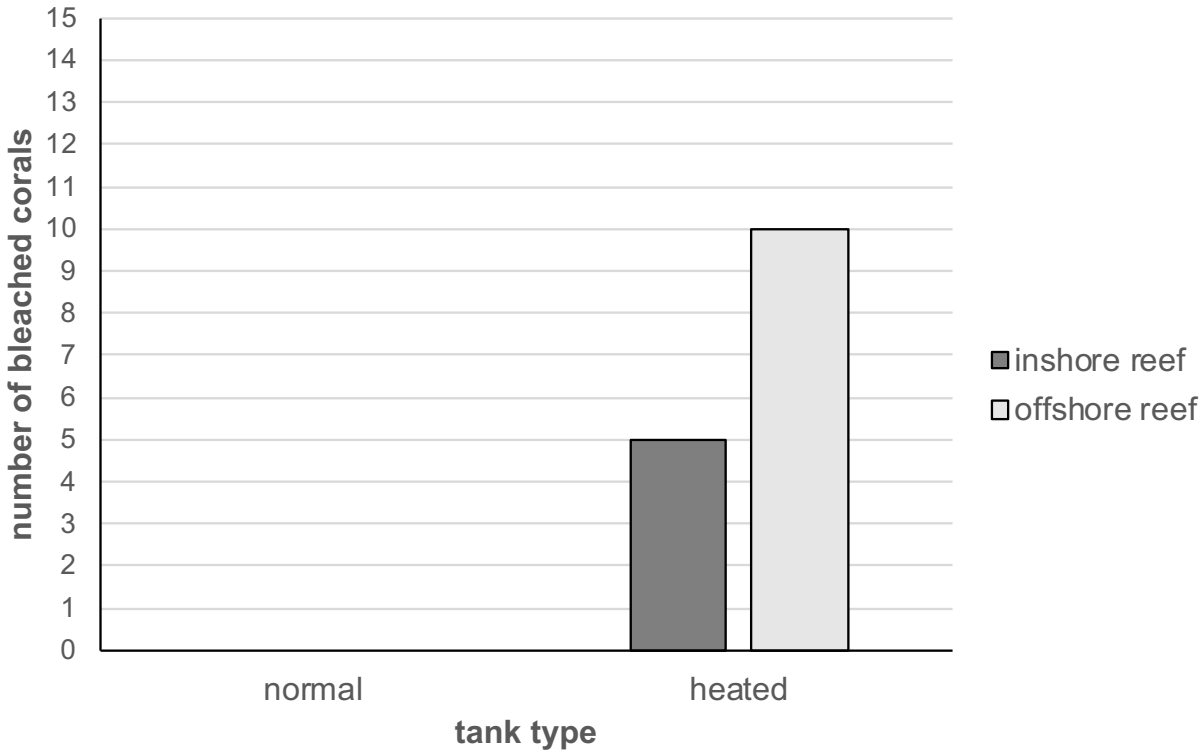
corals from	tank type	number of bleached corals
inshore reef	normal	0/15
offshore reef	normal	0/15
inshore reef	heated	5/15
offshore reef	heated	10/15

What data will you graph to answer the question?

Independent variable: _____

Dependent variable: _____

Below is a graph of the data: Identify any changes, trends, or differences you see in your graph. Draw arrows pointing out what you see, and write one sentence describing what you see next to each arrow.



Name_____

Interpret the data:

Make a claim that answers the scientific question.

What evidence was used to write your claim? Reference specific parts of the table or graph.

Explain your reasoning and why the evidence supports your claim. Connect the data back to how warm water affects the mutualism between coral and algae.

Name_____

Did the data support Carly's hypothesis? Use evidence to explain why or why not. If you feel the data were inconclusive, explain why.

Your next steps as a scientist: Science is an ongoing process. What new question(s) should be investigated next to build on Carly's research? What future data should be collected to answer your question(s)?

Name_____

DATA Nugget

Dangerously bold

Featured scientist: Melissa Kjelvik from Michigan State University

Research Background:

Just as each person has her or his own personality, animals of the same species can behave very differently from one another! For example, pets, like dogs, have different personalities. Some have a lot of energy, some are cuddly, and some like to be alone. **Boldness** is a behavior that describes whether or not an individual takes risks. Bold individuals take risks while shy individuals do not. The risks animals take have a big impact on their survival and the habitats they choose to search for food.

Bluegill sunfish are a type of fish that lives in freshwater lakes and ponds across the world. Open water and cover are two habitat types where young bluegill are found. The **open water** habitat in the center of the pond is the best place for bluegill to eat a lot of food. However, the open water is risky and has very few plants or other places to hide. Predators, like large birds, can easily find and eat bluegill in the open water. The **cover** habitat at the edge of the pond has many plants and places to hide from predators, but it has less food that is best for bluegill to grow fast. Both habitats have costs and benefits—called a **tradeoff**.

A view of the experimental pond. The center of the pond is the open water habitat with no plants. At the edge of the pond is the cover habitat with plants. At the start of the experiment, 100 bold bluegill, 100 shy bluegill, and 2 largemouth bass predators were placed in the pond. Here, scientists are using a net to collect the surviving bluegill at the end of the experiment.

Name_____

Melissa is a scientist who is interested in whether differences in young bluegill behavior changes the habitats in which they choose to search for food. First, she looked at whether young bluegill have different personalities by bringing them into an aquarium lab and watching their behavior. Melissa observed that, just like in humans and dogs, bluegill sunfish have different personalities. She noticed that some bluegill took more risks and were bolder than others. Melissa wanted to know if these differences in behavior could also be observed in her experimental pond. She reasoned that being in open water is risky, but results in more access to food. Therefore, bold fish should take more risks and use the open water habitat more than shy fish, giving them more food, allowing them to grow faster and larger, but exposing them to more predation. Just the opposite should be true about shy fish: more time for them in the cover habitat of the pond exposing them to less predation, but also giving them less access to food and an overall smaller body size than bold fish. A tradeoff for both types of fish based on personality.

Melissa designed a study to test the growth and survival of bold and shy fish. When she was watching the fish's behavior in the lab, she determined if a fish was bold or shy. If a fish took the risk of leaving the safety of the vegetation in a tank so that it could eat food while there was a predator behind a mesh screen, it was called bold. If it did not eat, it was called shy. She marked each fish by clipping the right fin if it was bold or the left fin if it was shy. She placed 100 bold and 100 shy bluegill into an experimental pond with two largemouth bass (predators). The shy and bold fish started the experiment at similar lengths and weights. After two months, she drained the pond and found every bluegill that survived. She recorded whether each fish that survived was bold or shy and measured their growth (length and weight).

Scientific Questions: How does the boldness of bluegill affect their survival and growth? Is there a tradeoff in bold and shy behaviors?

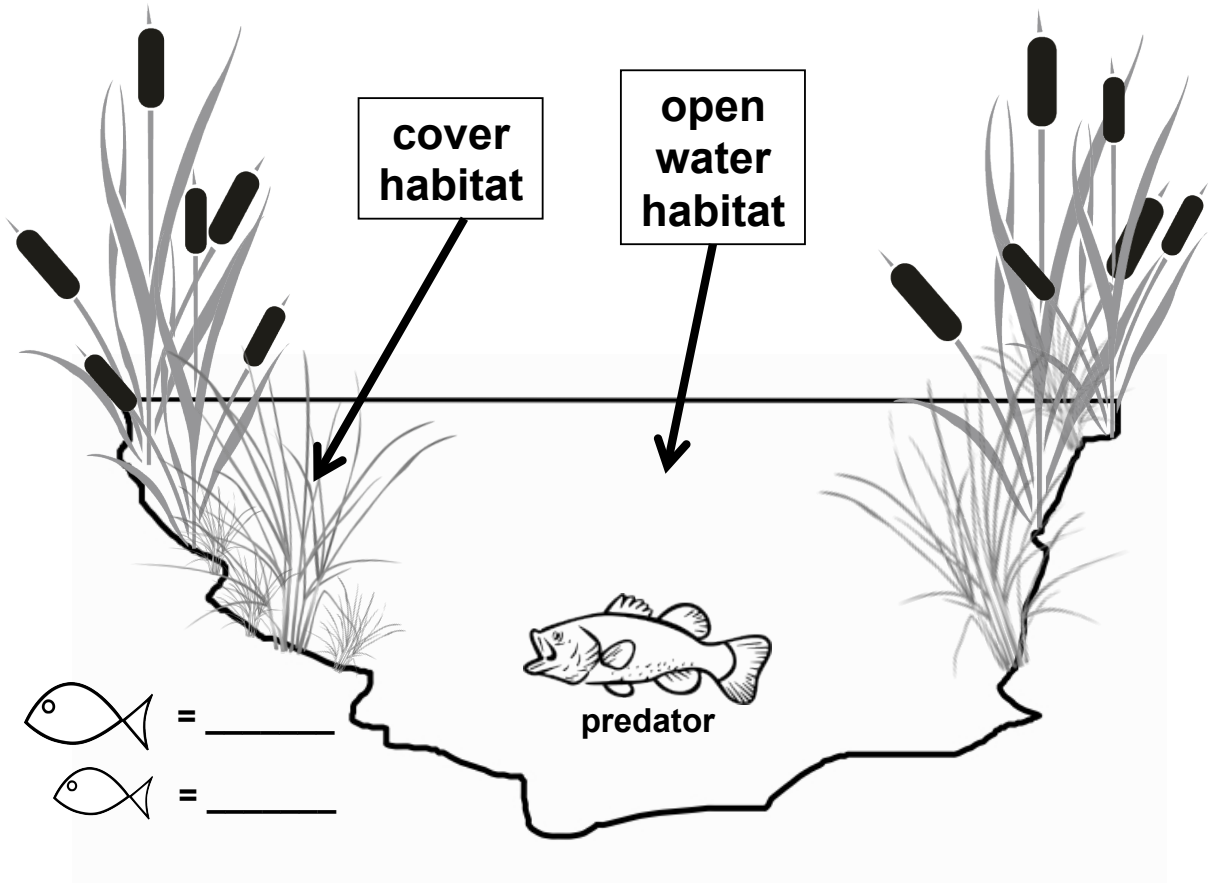
To determine their personality, Melissa observed young bluegill sunfish in the aquarium lab.

Name_____

What is the hypothesis? Find the hypothesis in the Research Background and underline it. A hypothesis is a proposed explanation for an observation, which can then be tested with experimentation or other types of studies.

Draw your predictions: Below is a diagram of a pond where you can draw your predictions. Think about how bold and shy fish might respond to a predator.

1. Start by looking at the legend. Do you predict bold or shy fish will grow larger? Label which fish is bold and which is shy and choose a color for each.
2. Now move to the pond diagram. Draw bold and shy fish in the habitats where you predict they will spend most of their time.
3. Draw your survival predictions. Do you predict there will be more bold or shy fish left at the end of the experiment? Add more fish to your diagram if necessary.



Name_____

Scientific Data:

Finish filling in the table below. Use the data to answer the scientific questions.

Bluegill Behavior	Proportion Survived	Percent Survival	Average Length (mm)	Length SE**	Average Weight (g)	Weight SE
Bold	66/100		68.6	0.8	5.5	0.2
Shy	74/100		65.6	0.8	4.8	0.2

*** Standard error (SE) tells us how confident we are in our estimate of the mean, and depends on the number of replicates in an experiment and the amount of variation in the data. A large SE means we are not very confident, while a small SE means we are more confident.*

What data will you graph to answer the questions?

Graph 1: Survival

Independent variable: _____

Dependent variable: _____

Graph 2: Length

Independent variable: _____

Dependent variable: _____

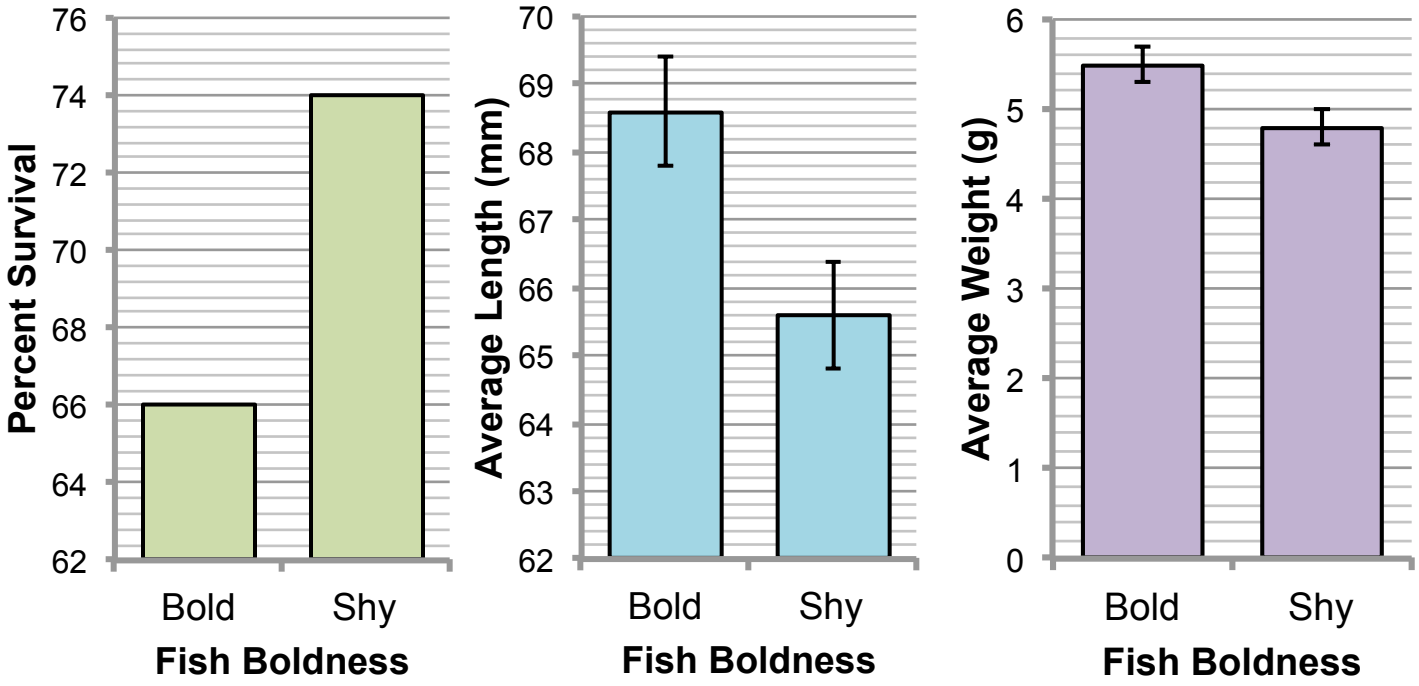
Graph 3: Weight

Independent variable: _____

Dependent variable: _____

Name_____

Below are graphs of the data: Identify any changes, trends, or differences you see in your graphs. Draw arrows pointing out what you see, and write one sentence describing what you see next to each arrow.



Interpret the data:

Make a claim that answers each of the scientific questions.

What evidence was used to write your claims? Reference specific parts of the table or graphs.

Name_____

Explain your reasoning and why the evidence supports your claims. Connect the data back to what you learned about the tradeoff for using the cover and open water habitats.

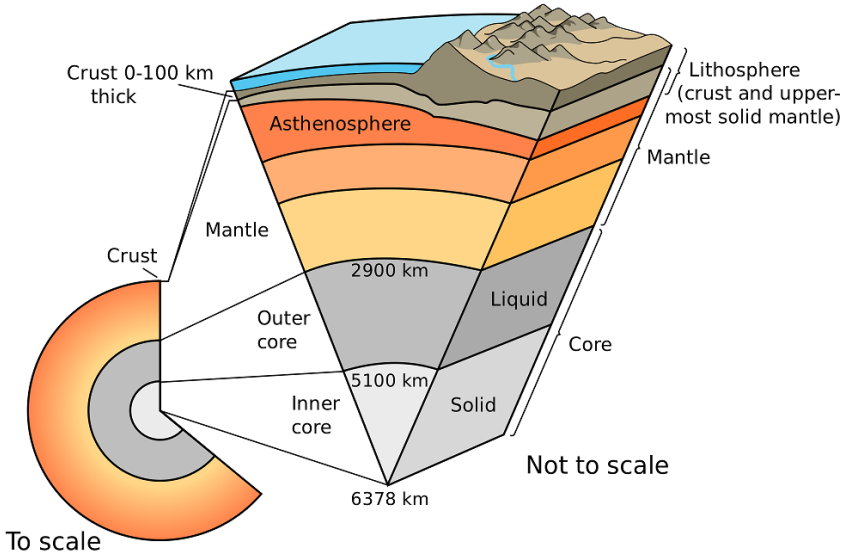
Did the data support Melissa's hypothesis? Use evidence to explain why or why not. If you feel the data were inconclusive, explain why.

Your next steps as a scientist: Science is an ongoing process. What new question(s) should be investigated to build on Melissa's research? What future data should be collected to answer your question(s)?

Name: _____ Date: _____ Period: _____

Earth's Layers: Coloring and Questions

The Earth has many layers within it, as shown in the graphic on the next page. The **Crust** is the exterior layer of Earth: it is the cool, hard layer on which all land life lives. The crust, which is part of the **lithosphere** (the layer of Earth that includes the crust and slightly molten layer just beneath it), is broken into several large pieces called *tectonic plates*. Further, there are two types of crust: *oceanic* and *continental*.



Oceanic crust – named because it is below the oceans – is old and dense, and tends to sink under **continental crust**, which is lite and fluffy – it tends to float, and makes up the continents.

Below the crust is the **Mantle**, a warm layer that can vary from rigid (where cooler) to plastic (where hotter). The Mantle has convection currents, which move hot magma from the outer core to the crust, and dropping cold magma back to the outer core – much like a lava lamp. This convection movement can push and pull tectonic plates, getting them to move and interact. The upper part of the Mantle is the **Asthenosphere**, the layer that the crust floats upon.

Below the Mantle is the **Outer Core**, which is liquid due to the extreme temperatures caused by extreme pressures. This liquid, metallic layer causes Earth's magnetic field.

The Earth's **Inner Core** is the innermost layer, and is solid: the extreme pressures at this depth overwhelm the temperatures that cause fluidity. As Earth slowly cools down, the Outer Core loses its temperature, growing the Inner Core.

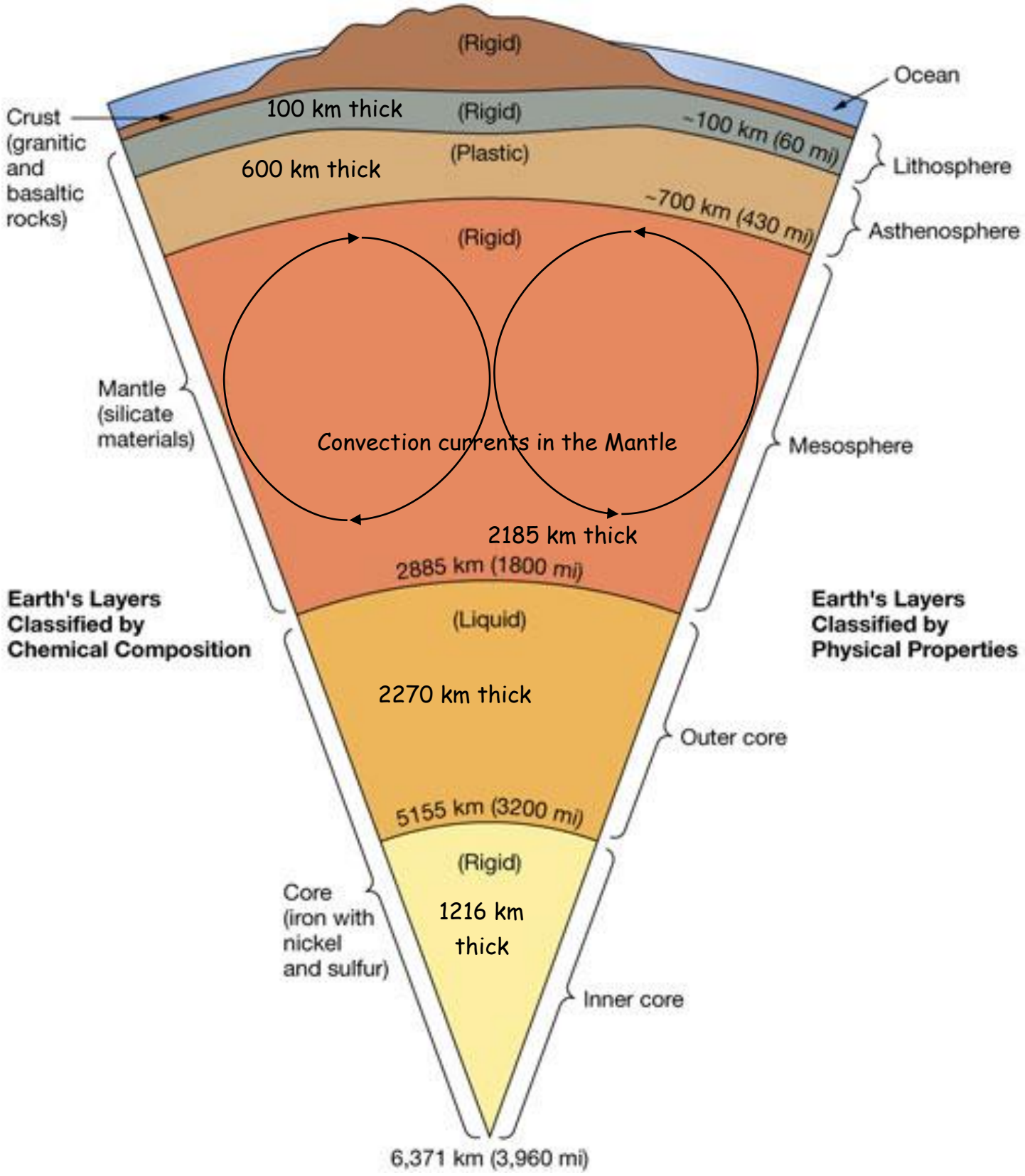
NOTE: Please follow the directions carefully!

1. On the 3rd Page, use the Layers Word Bank to place the layers of the Earth into the correct locations in the empty diagram. You can use the diagram on the 2nd page as a guide!
2. After you have labelled the layers, color them using this guide:

Ocean - blue	Asthenosphere – yellow-orange
Oceanic Crust - dark brown	Mantle – orange
Continental Crust - light brown	Outer Core - red-orange
Lithosphere – yellow	Inner Core – red

3. Fill out the small squares with the information for each of the main layers of the Earth, using the diagram on the second page or your textbook!
    a. Composition: Granitic (rich in silica) or Basaltic (silica-poor); iron with nickel and sulfur; silicate materials
    b. Thickness: shown in kilometers (km) depending upon the depth that each layer goes
    c. State of Matter: Rigid (solid), Plastic (like putty or clay), or Liquid (like syrup)

Name: _____ Date: _____ Period: _____

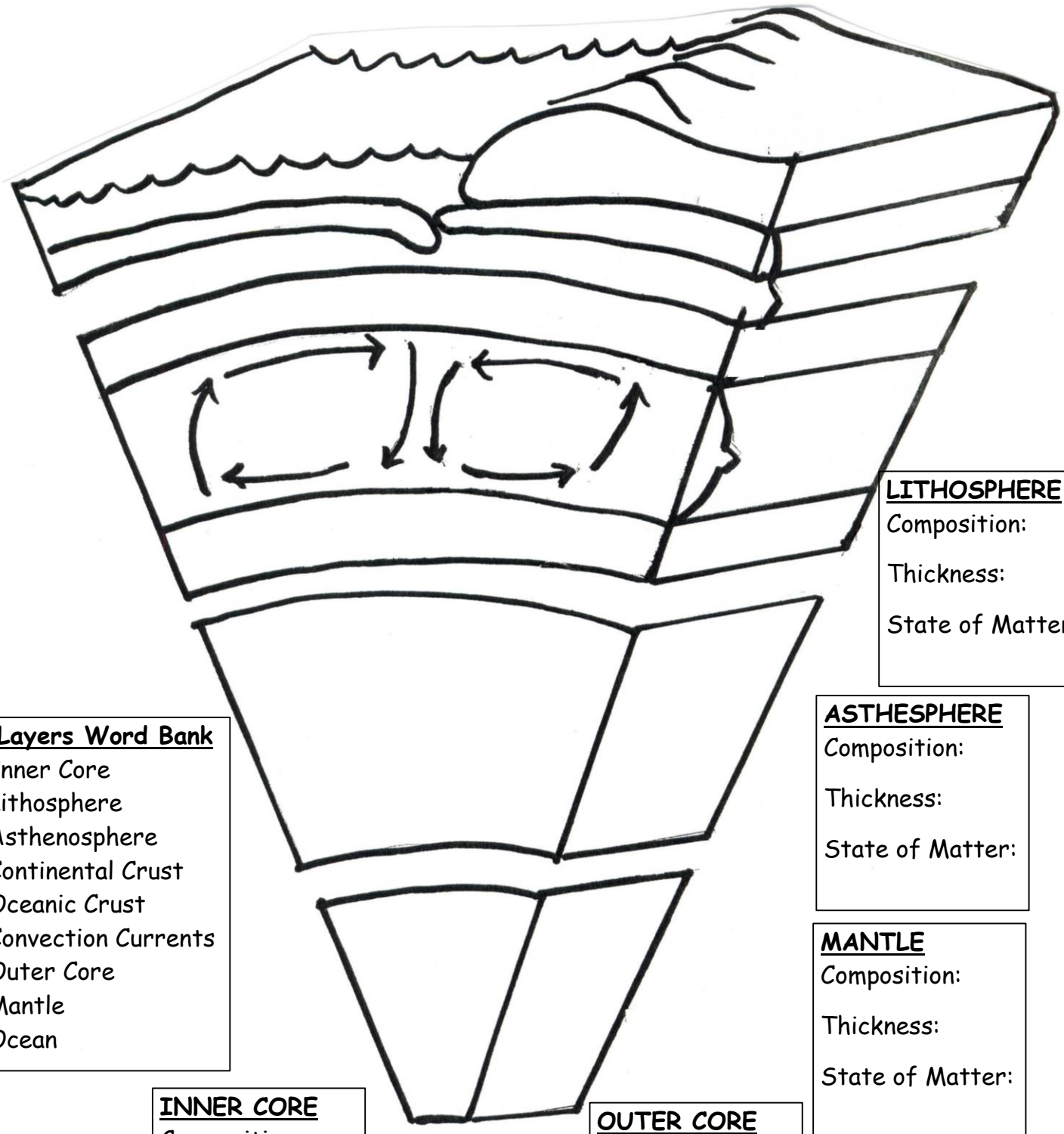


Rigid = solid
Plastic = semi-molten = semi-liquid
Liquid = molten

Granitic = felsic = silicate rich
Basaltic = mafic = silicate poor

Name: _____ Date: _____ Period: _____

The Earth's Layers



Layers Word Bank

Inner Core
Lithosphere
Asthenosphere
Continental Crust
Oceanic Crust
Convection Currents
Outer Core
Mantle
Ocean

LITHOSPHERE
Composition:

Thickness:

State of Matter:

ASTHESPHERE
Composition:

Thickness:

State of Matter:

MANTLE
Composition:

Thickness:

State of Matter:

INNER CORE
Composition:

Thickness:

State of Matter:

OUTER CORE
Composition:

Thickness:

State of Matter:

Name: _____ Date: _____ Period: _____

Earth Layer Questions

Use the information provided to you in the above diagrams and paragraphs on the first page to answer the following questions:

1. In which layer is there convection?

2. From what layer is this convection bringing heat from?

3. How do convection currents influence plate tectonics?

4. Tectonic plates are part of which layer?

5. What layer do tectonic plates move upon?

6. What are the differences between *oceanic* and *continental* crust?

7. Which layer is under the most pressure?

8. Which layer is liquid? Why is it liquid?

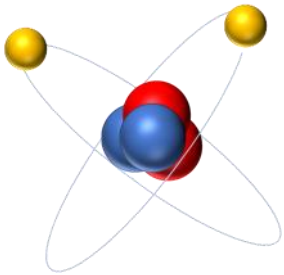
9. Name the order of layers from the top to the bottom:

Elements, Compounds, and the Language of Matter

Atoms make up every type of matter in the universe. But what makes one type atom different from another type of atom? Amazingly, it all depends on the number of protons.

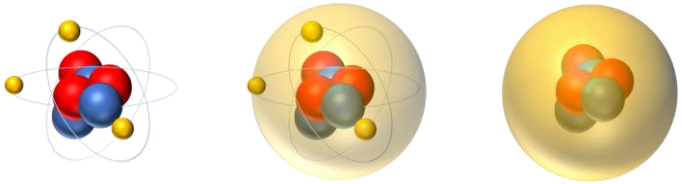
Atoms form everything. They're in the air we breathe, the food we eat, the screens we watch, and the stars we gaze on at night. They are the basic building blocks of matter. But if atoms make all matter, what makes one material different from another. Why is iron gray, while copper is reddish orange? Why does gallium melt at 29.8 °C, but gold will not melt until it reaches 1064.2 °C? To understand this, we must first understand the parts of an atom.

All atoms are made of three parts: protons, neutrons, and electrons. Protons and neutrons bond together in the center of an atom, called the nucleus.



In this figure, the red and blue spheres represent protons and neutrons in the nucleus. The yellow spheres outside the nucleus represent electrons.

The third part of an atom, electrons, move quickly around the nucleus. They move so quickly, in fact, that we can think of them as a cloud, rather than an orbit.

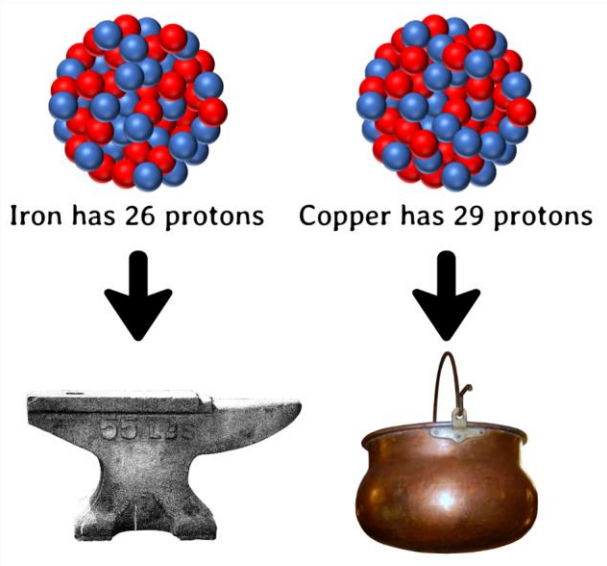


Electrons travel so fast around the nucleus of an atom that scientists think of them as a "cloud."

Different types of atoms have a different number of protons in their nucleus. This brings us back to why iron is gray, and copper is reddish orange. The only difference between these atoms is the number of protons in their nucleus. Iron has 26 protons in its nucleus, while copper has 29.

All the differences between iron and copper—color, density, melting point, and any other property—is because iron has three fewer atoms than copper. We call the different kinds of atoms *elements*.

Elements, Compounds, and the Language of Matter (continued)



A difference of three protons separates iron from copper.

Scientists use a tool called the periodic table to record, store, and look up the 118 known elements in the universe. Russian chemist Dmitri Mendeleev first developed the periodic table in 1869. Today it holds the key to unlocking how elements work. There are 94 elements that occur naturally, while scientists created 24 others in labs. These 24 are known as *synthetic* elements.

Two or more atoms bond together to form a *molecule*. When atoms of the same element bond together, we consider the

The Periodic Table of Elements

1 I. A.	2 II. A.	3 III. B.	4 IV. B.	5 V. B.	6 VI. B.	7 VII. B.	8	9 VIII. B.	10	11 I. B.	12 II. B.	13 III. A.	14 IV. A.	15 V. A.	16 VI. A.	17 VII. A.	18 VIII. A.
1 1,008* **H** hidrogén																	2 4,003 **He** hélium
3 6,94* **Li** lítium	4 9,012 **Be** berillium											5 10,81* **B** bór	6 12,01* **C** szén	7 14,01* **N** nitrogén	8 16,00* **O** oxigén	9 19,00 **F** fluor	10 20,18 **Ne** neon
11 22,99 **Na** nátrium	12 24,31* **Mg** magnézium											13 26,98 **Al** alumínium	14 28,09* **Si** szilícium	15 30,97 **P** foszfor	16 32,06* **S** kén	17 35,45* **Cl** klór	18 39,95 **Ar** argon
19 39,10 **K** kálium	20 40,08 **Ca** kalcium	21 44,96 **Sc** szkandium	22 47,87 **Ti** titán	23 50,94 **V** vanádium	24 52,00 **Cr** króm	25 54,94 **Mn** mangán	26 55,85 **Fe** vas	27 58,93 **Co** kobalt	28 58,69 **Ni** nikkel	29 63,55 **Cu** réz	30 65,38* **Zn** cink	31 69,72 **Ga** gallium	32 72,63 **Ge** germánium	33 74,92 **As** arzén	34 78,97* **Se** szelén	35 79,90* **Br** bróm	36 83,80 **Kr** kripton
37 85,47 **Rb** rubídium	38 87,62 **Sr** stroncium	39 88,91 **Y** ittrium	40 91,22 **Zr** cirkónium	41 92,91 **Nb** nióbium	42 95,95* **Mo** molibdén	43 [98] **Tc** technécium	44 101,1 **Ru** ruténium	45 102,9 **Rh** ródium	46 106,4 **Pd** palládium	47 107,9 **Ag** ezüst	48 112,4 **Cd** kadmium	49 114,8 **In** indium	50 118,7 **Sn** ón	51 121,8 **Sb** antimon	52 127,6 **Te** tellúr	53 126,9 **I** jód	54 131,3 **Xe** xenon
55 132,9 **Cs** cézium	56 137,3 **Ba** bárium	57-71	72 178,5 **Hf** hafnium	73 180,9 **Ta** tantál	74 183,8 **W** volfrám	75 186,2 **Re** rénium	76 190,2 **Os** ozmium	77 192,2 **Ir** irídium	78 195,1 **Pt** platina	79 197,0 **Au** arany	80 200,6 **Hg** higany	81 204,4* **Tl** tallium	82 207,2 **Pb** ólom	83 209,0 **Bi** bizmut	84 [209] **Po** polónium	85 [210] **At** asztácium	86 [222] **Rn** radon
87 [223] **Fr** francium	88 [226] **Ra** rádium	89-103	104 [267] **Rf** radzerfordium	105 [268] **Db** dubnium	106 [269] **Sg** sziborgium	107 [270] **Bh** borium	108 [277] **Hs** hasszium	109 [278] **Mt** meitnerium	110 [281] **Ds** darmstadtium	111 [282] **Rg** röntgenium	112 [285] **Cn** kopernícium	113 [286] **Nh** nihonium	114 [289] **Fl** flerovium	115 [290] **Mc** moszkovium	116 [293] **Lv** livermorium	117 [294] **Ts** tennesszin	118 [294] **Og** oganesszon

57 138,9 **La** lantán	58 140,1 **Ce** cérium	59 140,9 **Pr** prazeodímium	60 144,2 **Nd** neodímium	61 [145] **Pm** prométium	62 150,4 **Sm** szamárium	63 152,0 **Eu** európium	64 157,3 **Gd** gadolínium	65 158,9 **Tb** terbium	66 162,5 **Dy** diszprózium	67 164,9 **Ho** holmium	68 167,3 **Er** erbium	69 168,9 **Tm** túlium	70 173,0 **Yb** itterbium	71 175,0 **Lu** lutécium
89 [227] **Ac** aktínium	90 232,0 **Th** tórium	91 231,0 **Pa** protaktínium	92 238,0 **U** urán	93 [237] **Np** neptúnium	94 [244] **Pu** plutónium	95 [243] **Am** amerícium	96 [247] **Cm** kűrium	97 [247] **Bk** berkélium	98 [251] **Cf** kalifornium	99 [252] **Es** einsteinium	100 [257] **Fm** fermium	101 [258] **Md** mendelévium	102 [259] **No** nobélium	103 [266] **Lr** laurencium

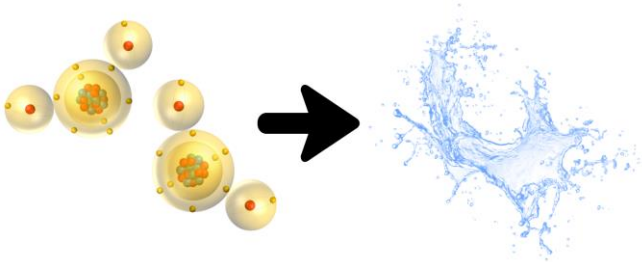
*H: [1,00784, 1,00811]
Li: [6,938, 6,997]
B: [10,806, 10,821]
C: [12,0096, 12,0116]
N: [14,00643, 14,00728]
O: [15,99903, 15,99977]
Mg: [24,304, 24,307]
Si: [26,084, 26,086]
S: [32,059, 32,076]
Cl: [35,446, 35,457]
Br: [79,901, 79,907]
Tl: [204,382, 204,385]
Zn: 65,38(2)
Se: 78,96(3)
Mo: 95,96(2)

group of atoms an element. This is because the group of atoms has the same properties as one atom. One atom of gold is the same as one million atoms of gold bonded together.

One atom of gold and many, many atoms of gold bonded together are both considered elements.

However, when atoms of different types—different elements—bond together, this forms a different type of molecule. This type of molecule is known as a *compound*.

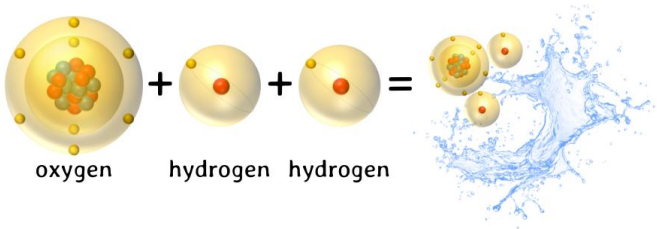
When two hydrogen atoms bond with one oxygen atom, they form an entirely new material: water. This new compound has specific properties that are unlike both oxygen and hydrogen. It is liquid at room temperature. It is clear. It freezes at 0° C and turns into gas at 100° C. Water is one of the most important compounds to life on earth.



Two hydrogen atoms bond with one oxygen atom to form the compound H_2O, otherwise known as water. Water is one of the most important compounds to life on earth.

It is common to compare elements to letters. Just as we can combine 26 letters in English to form countless words, the elements of the periodic table combine to form countless compounds in the universe.

b + e + e = bee



Elements are like letters forming the language of the universe. They combine to form every type of matter that exists.

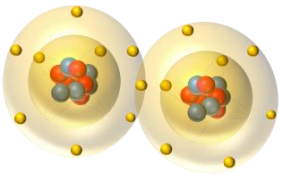
Elements and compounds are the building blocks of every known material, from the salt you put on your food to the oxygen we breathe to the water we drink.

Molecules, Elements, and Compounds

A molecule is a group of atoms bonded together in one unit. A molecule has specific properties. The properties of the molecules depend on the types of atoms bonded together.

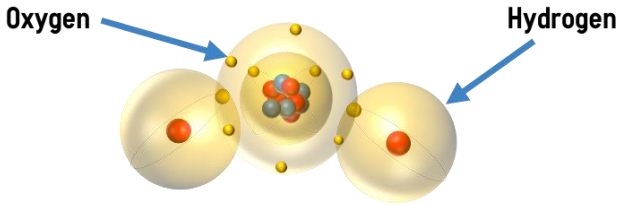
A molecule can be an element or a compound.

When the same type of atoms bond together, they are an element.



These oxygen atoms form an O_2 molecule. Since they are both oxygen atoms, O_2 is an element.

When atoms of more than one type bond together, they form a compound.



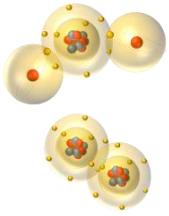
Two hydrogen atoms bond with one oxygen atom to form H_2O, also known as water. H_2O is a compound since two types of atoms join together to form the molecule.

What about a particle?

A particle is a very small piece of matter. A particle can be an electron, atom, molecule, or even a grain of sand or dust.

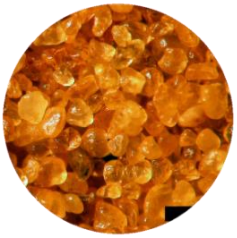
Electron

Atom



Molecule

Dust



Grains of sand

Name: _____ Date: _____

Elements and Compounds: Main Idea and Supporting Details

Directions: Read the main idea of the passage in the middle of the graphic organizer and find three details that support this main idea.

Supporting Detail 1

Supporting Detail 2

Main Idea

The number of protons in an atom determine the element, or type of atom. Different elements combine to form compounds, which have properties that make them unique.

Supporting Detail 3

Name: _____ Date: _____

Elements and Compounds: Cause and Effect

Directions: Complete the cause or effect for each statement.

Cause	Effect
An atom has 29 protons.	
	A water molecule is formed.
Water reaches 100° C.	

Name: _____ Date: _____

Elements and Compounds: Fact and Opinion

Directions: List at least five facts and five opinions *in or about* the article.

Facts	**Opinions**

Name: _____ Date: _____

Elements and Compounds: Questioning

Directions: Write at least five questions about the article.

Name: _____ Date: _____

Elements and Compounds: Word Study

1. In the last paragraph of the passage, the author compares elements to letters and compounds to words. This is a type of figurative language called a *metaphor. A metaphor* is when an author uses an object or idea in place of another object or idea in order to highlight their similarities. How does comparing elements to letters help the reader understand how elements can form new materials by creating compounds?

2. The word *bond* can be a noun or a verb. Read the definitions for each part of speech below. For each sentence, circle the part of speech for the word *bond* based on how it is used in the sentence.

   Bond

   verb : to hold together or make solid; to bind atoms or groups of atoms in a molecule

   noun : something that binds; a material or device that binds

   a. As glue dries, it forms a bond between two pieces of wood.

      noun verb

   b. Protons bond with neutrons in the nucleus of an atom.

      noun verb

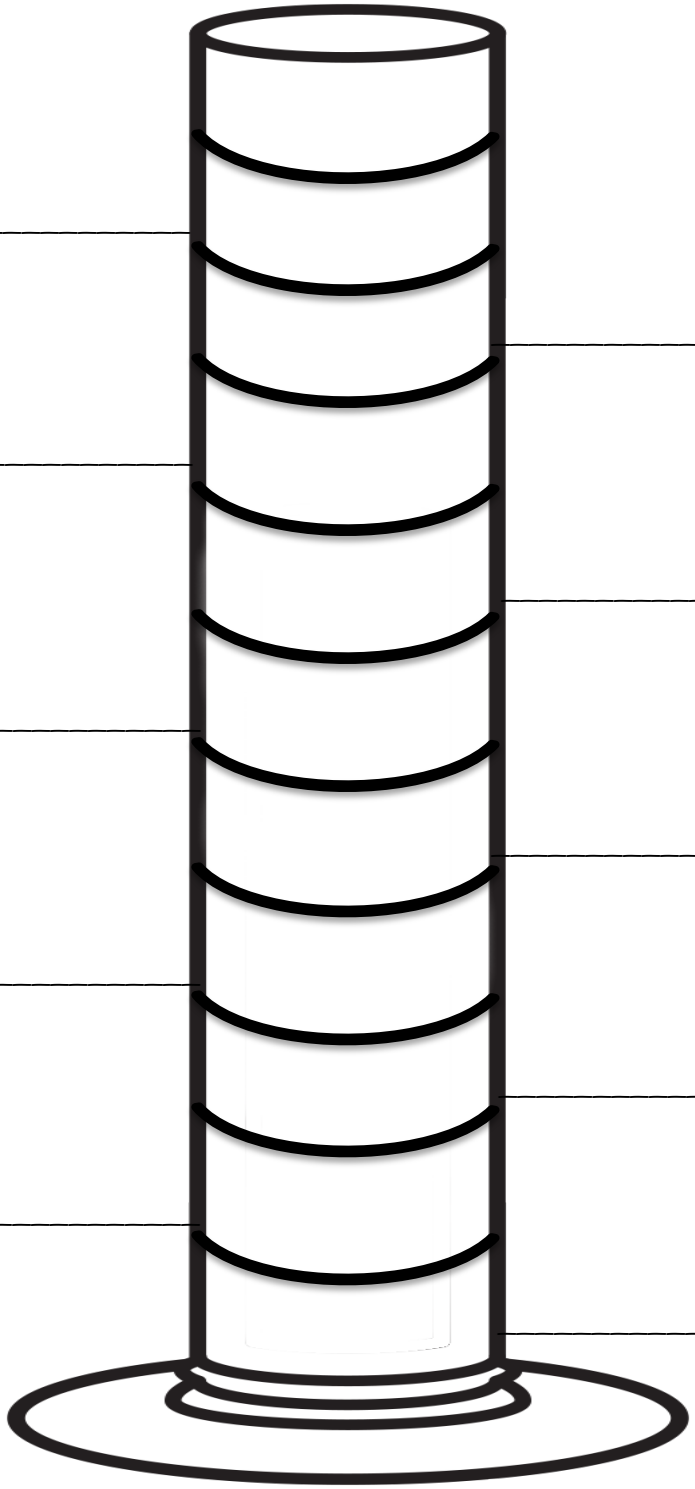
   c. The girls formed a strong bond of friendship during fifth grade.

      noun verb

Name _____ Date _____ Section _____

Exploring Density

Directions: A student wants to create a Density Column using some common household materials. First, calculate the density of each substance listed on the back of this paper. Second, identify its position in the column based on its density.



11. _____

12. _____

13. _____

14. _____

15. _____

16. _____

17. _____

18. _____

19. _____

20. _____

Calculate the density of each substance. Make sure to show your work and don't forget to include units!

$$D = \frac{\text{Mass}}{\text{Volume}}$$

1. Water
M: 6.8 g V: 6.8 mL
Density: _____

2. Lamp Oil
M: 3.2 g V: 4.0 mL
Density: _____

3. Maple Syrup
M: 8.22 g V: 6.0 mL
Density: _____

4. Rubbing Alcohol
M: 2.37 g V: 3.0 mL
Density: _____

5. Milk
M: 5.15 g V: 5.0 mL
Density: _____

6. Baby Oil
M: 3.32 g V: 4.0 mL
Density: _____

7. Dish Soap
M: 5.3 g V: 5.0 mL
Density: _____

8. Vegetable Oil
M: 6.44 g V: 7.0 mL
Density: _____

9. Honey
M: 7.1 g V: 5.0 mL
Density: _____

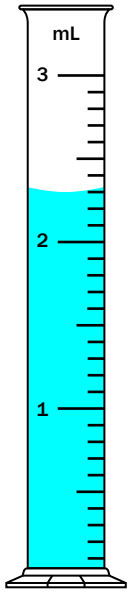
10. Corn Syrup
M: 7.98 g V: 6.0 mL
Density: _____

Name: _____

Graduated Cylinders

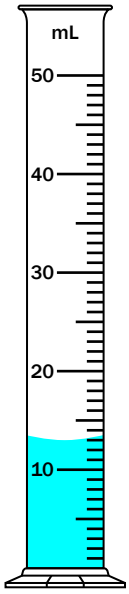
Read each graduated cylinder and write the amount. Be sure to include **mL** in your answer.

a.



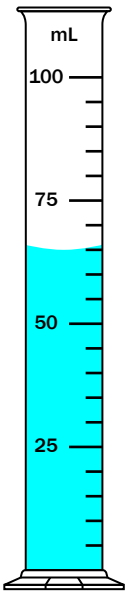
2.3 mL

b.



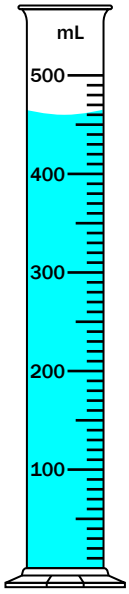
_____

c.



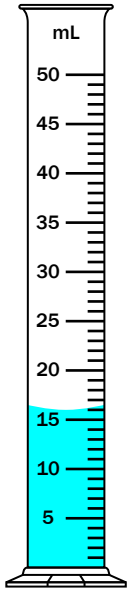
_____

d.



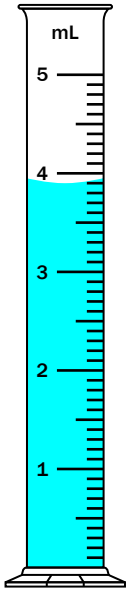
_____

e.



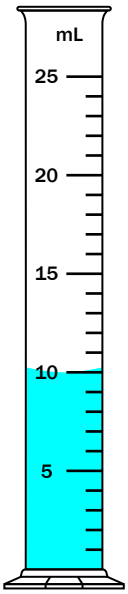
_____

f.



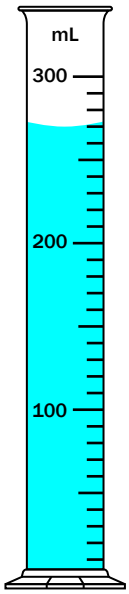
_____

g.



_____

h.



_____

Name: _____

Graduated Cylinders

John poured some water into a graduated cylinder (illustration a).
Karen added some water (illustration b).
How much water did Karen add?

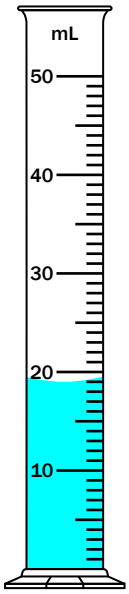


illustration a

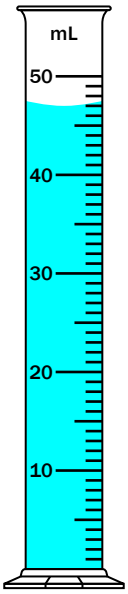


illustration b

answer: _____

Susan poured water into a graduated cylinder (illustration c).
She then dropped a rock into the graduated cylinder (illustration d).
How much did the measurement change after she added the rock?

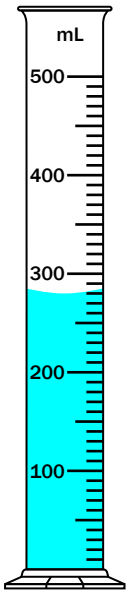


illustration c

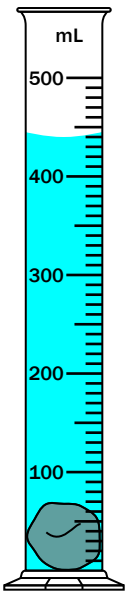


illustration d

answer: _____

Name: _____

Immune Troops! Move In!

by Shauna Hutton

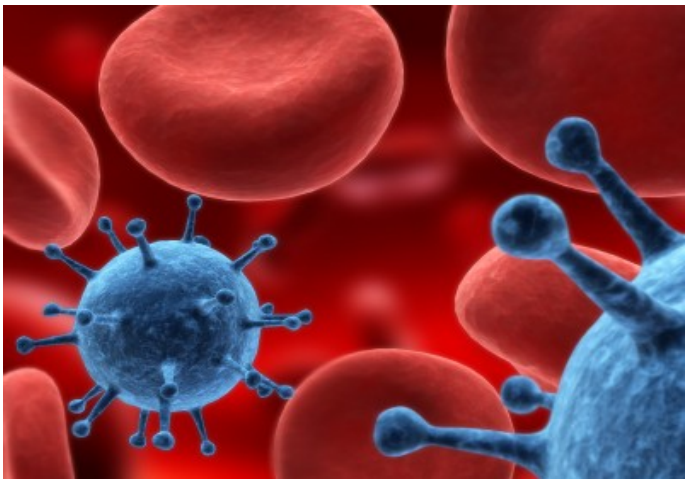
Your body has a very special system that protects you from illness and disease. It's called the immune system and it knows when there is something inside your body that should not be there.

All the cells in your body have a way to tell the immune system, "I belong here. I'm not going to do any harm." And so the immune system leaves those cells alone. Think about the cells in your body wearing name tags that say "self". Anything with a "self" name tag is a good guy. But things like bacteria, viruses, and parasites wear name tags that say "nonself". When the immune system sees a "nonself" name tag, it jumps into action and attacks those foreign invaders. Any foreign substance in your body that makes the immune system attack it, is called an antigen. These anitgen invaders can be pollen from the air, a virus, or certain types of bacteria.

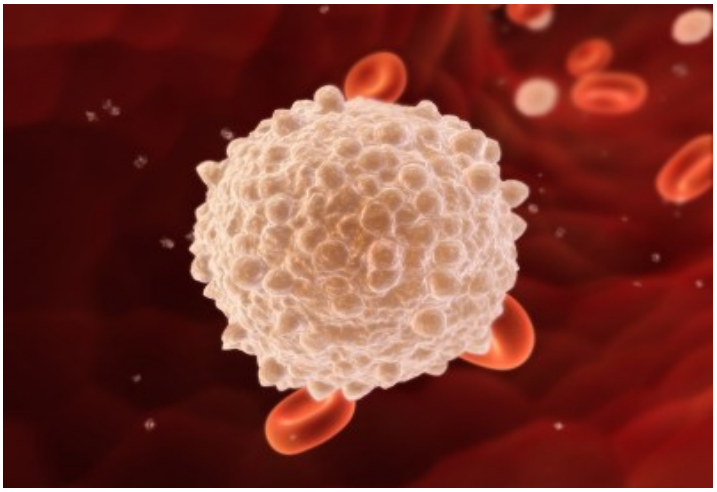
There are many different kinds of immune cells helping to keep you from getting sick. They can be grouped into phagocytes (pronounced fag-*uh*-sahyt) and lymphocytes (pronounced lim-*fuh*-sahyt).

Phagocytes are a type of white blood cell, and one of their jobs is to gobble up and digest antigens. They are always swimming around in your blood stream, always on the look-out for antigens. And when they see one, *GULP!*

Lymphocytes are also white blood cells and the main types are B cells, T helper cells, and T killer cells. Many antigens can be very sneaky (like viruses) and can hide from phagocytes, so it's the job of the lymphocytes to find them and get rid of them.



Viruses will kill healthy cells in the body.



White blood cells, like the one pictured above, attack the harmful bacteria, viruses, and parasites that enter your body.

B cells secrete (produce) substances, called antibodies, which stick to the antigen. When that happens, it alerts the T helper cells to come over and either:

1. help the B cells destroy the antigen, or
2. call the phagocytes or T killer cells to move in for the kill

T killer cells are really good at finding and killing cells that have been infected by a virus.

Once a B cell or T cell attacks an antigen, they create cells to "remember" it. Those "memory cells" hang out in your blood and if they see that same antigen again, they quickly recognize it so your immune system can act faster at killing it.

The "B" in B cells stands for **b**one marrow, which is where B cells, and all immune cells originate from. The "T" in T cells stands for **t**hymus. Young T cells start out in bone marrow, but they travel to the thymus to continue growing into mature T cells. The thymus is an immune organ located in the middle of your chest, near your heart. Its job is to produce mature T cells.

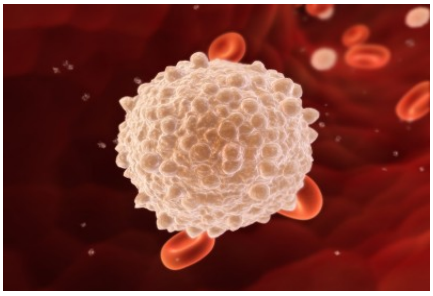
You have your own little army of cells inside you, always fighting to keep you healthy. And you can be a part of that army too! By getting plenty of sleep at night and eating nutritious foods, you'll help keep your immune system strong and ready to fight.

Go immune troops! Go!

Name: _____

Immune Troops! Move In!

by Shauna Hutton



1. What does your immune system do?

a. makes you sick
b. keep your brain sharp
c. protect your from illness
d. make energy for your body

2. Define the word *antigen*. Give 3 examples of antigens.

_____

_____

_____

3. According to this article, your immune system works much like...

a. the ocean
b. an army
c. an engine in a car
d. a computer

4. Where are white blood cells made?

a. in your bones
b. in your thymus
c. in your brain
d. in your heart

5. B and T cells are both...

a. phagocytes
b. bacteria
c. antigens
d. lymphocytes

5. What can you do to keep your immune system strong?

_____

_____

Now try this: Draw a comic strip that shows white blood cells attacking a virus in the bloodstream.

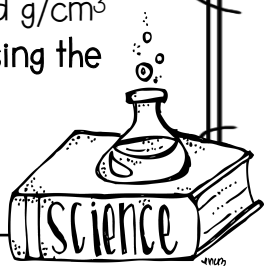
Name _____ Date _____ Section _____

Introduction to Density

Density is defined as a measure of how much mass is contained in a given volume. A rock, for example, has a high density. Its particles are packed very tightly together, and it will sink if you drop it into a container of water. A cork, on the other hand, has a very low density. Its particles are further apart, and it will float in water.

Density is expressed as a combination of two units, mass and volume. Two commonly used units are g/mL (grams per milliter) and g/cm^3 (grams per cubic centimeter) **Density can be calculated using the following formula:**

$$\text{Density} = \frac{\text{Mass}}{\text{Volume}}$$



True or False

If the answer is true, write "true" on the line. If the answer is false, replace the underlined word or phrase with one that will make the sentence correct. Write the new word(s) on the line.

1. _____ Since ice is less dense than water, it will float on the surface.

2. _____ Density is a measure of how much weight is in a given volume.

3. _____ An object that is more dense will sink below an object that is less dense.

4. _____ Density can be calculated by dividing the volume by mass.

5. _____ The density of an object does not change depending upon the size of the sample.

Calculate It

Solve the following density calculations. Make sure to show your work for <u>each</u> problem, and don't forget to include the units in your answer!

6. An unknown substance has a mass of 10.5 g and a volume of 5.0 mL. What is the density?

$$D = \frac{\text{Mass}}{\text{Volume}}$$

= _____

7. A wooden cube has a mass of 1.5 g and a volume of 3.0 cm^3. What is the density?

$$D = \frac{\text{Mass}}{\text{Volume}}$$

= _____

8. A student places a gold nugget on a triple-beam-balance and finds that it has a mass of 77.28 g. Using a graduated cylinder and the volume displacement method, they also find that the nugget has a volume of 4.0 mL. What is the density?

$$D = \frac{\text{Mass}}{\text{Volume}}$$

= _____

9. A sample of water has a volume of 20.0 mL and a mass of 20.0 g. What is the density?

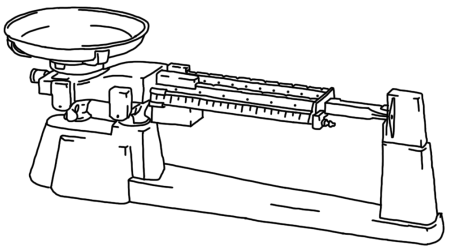
$$D = \frac{\text{Mass}}{\text{Volume}}$$

= _____

10. An ice cube has a mass of 18 g and a volume of 20 cm^3. What is the density?

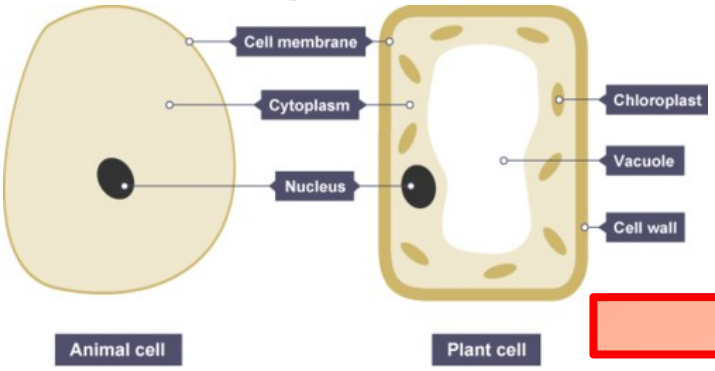
$$D = \frac{\text{Mass}}{\text{Volume}}$$

= _____



Making a Model Cell

Specification Link:
Home School Project



Task:
Imagine the Science Museum has asked you to make a model cell for a display.

- Make a model of a plant or animal cell.
- Make an information card, perhaps using a key, to describe what cells are.

Highlight key points below

Write up a brief plan of how you are going to complete this, noting key things you need to remember:

_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____

Cells are the basic building blocks of all animals and plants. Inside cells are various structures that are specialised to carry out a particular function. Both animal and plant cells have these components:

Cell membrane – this surrounds the cell and allows nutrients to enter and waste to leave it.

Nucleus – this controls what happens in the cell. It contains DNA, the genetic information that cells need to grow and reproduce.

Cytoplasm – this is a jelly-like substance in which chemical reactions happen.

Mitochondria – these are the powerhouse of the cell. They are structures where respiration takes place.

Plant cells have all the parts in the list above, plus a few extra structures:

Cell wall - this is an outer structure that surrounds the cell and gives it support.

Vacuole - this is a space within the cytoplasm of plant cells that contains sap.

Chloroplasts - these contain chlorophyll and are the site of photosynthesis.

Done	You might have:
	• Made a simple model of a plant or animal cell. • Identified a part of the cell correctly. • Stated some simple facts about cells, e.g. how you see them, what they do, what they are like.
	• Made a model plant or animal cell and have labelled most parts correctly using correct key words. • Described what cells are like and what they do. • Matched some parts of the cell to their job correctly.
	• Made an accurate model plant or animal cell and have labelled all parts correctly. • Described what cells are like and what they do. • Described the job of each part of the cell correctly.
	• Make a model of a plant or animal cell or a specialised cell, labelling all parts correctly. • Explained the jobs of each part of the cell correctly. • Explain simply why the cell is good at its job.

Questions that you should ask yourself while completing this

What should I do first?

Is something confusing me?

Could I explain this to someone else?

Where can I look for help?

Have I double checked what I need to include?

How can I do it better?

Name: _____

Is That Mammal a Carnivore, Herbivore or Omnivore?

by Guy Belleranti

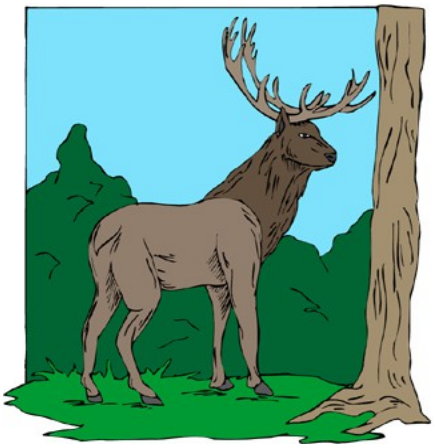
A mammal can be a carnivore (meat eater), herbivore (plant eater) or omnivore (meat and plant eater). By looking at the teeth, eye position and feet you can usually identify which of the three it is.

First let's look at teeth. If the mammal has long, sharp canine teeth next to the front (incisor) teeth and also has sharp cheek teeth (carnassials) it is a carnivore. The canines are for seizing and stabbing prey. The carnassials help cut up meat in the mouth.

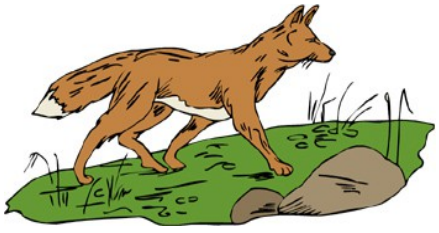
If the mammal has either blunt canines or no canines, and has big flat side and back teeth (premolars and molars) it is a herbivore. Herbivores use their molars for crushing and grinding plants.

But what about herbivores that do have large front teeth? Beavers, for example, have huge front incisors. And river hippos have two huge lower canines. Well, beavers use their incisors for chewing through bark, branches and even trees. And hippos use their canine tusks for defense and fighting, not for chewing. But both beavers and hippos have large flat molars that they use for grinding up plant matter.

If the mammal has a variety of all kinds of teeth (canines, incisors, premolars and molars) it is an omnivore. It has a variety of teeth because it eats a variety of foods, both meat and plants.



What kind of teeth do you think this deer has?



How are the fox's teeth different from a deer's?

How are a beaver's teeth

Now let's talk about eye position. Carnivorous and omnivorous mammals have eyes in front to help them spot and judge the distance of prey. Think of the rhyme "eyes in front, help them hunt".

Herbivores' eyes are located more on the side of their head. This gives them a wider view, helping them to spot predators sooner so they can flee. Think of the rhyme "eyes on side, help them hide".

And, finally, there are the differences in feet. Carnivores almost always have claws to hold prey, climb trees, dig for food and fight. They also have soft pads on their feet so they can sneak up on prey. Omnivorous mammals may have claws (like bears), or hands (like primates) for grabbing food. Herbivores, meanwhile, often have hooves to help them run away. Or, like the beaver and capybara, some or all of their feet may be webbed to help them swim away.

similar to a fox's? How are the similar to a deer's?

Where are the eyes positioned on this wild boar? How does the location of the boar's eyes help it to survive?

About the Author

Guy Belleranti works as a docent at Reid Park Zoo in Tucson, Arizona. He enjoys spending time with animals, and teaching others about them. Guy also enjoys writing stories and articles for children and adults.

Name: _____

Is That Mammal a Carnivore, Herbivore or Omnivore?

by Guy Belleranti

1. Why do carnivores usually have sharp canines and carnassials?

_____

_____

2. Why do herbivores usually have large, flat teeth?

_____

_____

3. Do omnivores have sharp teeth like carnivores, or flat teeth like herbivores? Explain.

_____

_____

4. Which sentence best describes a carnivore's feet?

- **a.** Carnivores usually have hooves on their feet.
- **b.** Carnivores usually have webbed feet.
- **c.** Carnivores usually have soft pads on their feet and claws.
- **d.** Carnivores usually have large, flat feet.

5. Tell whether each mammal is a carnivore, omnivore, or herbivore.

lion - _____ bear - _____

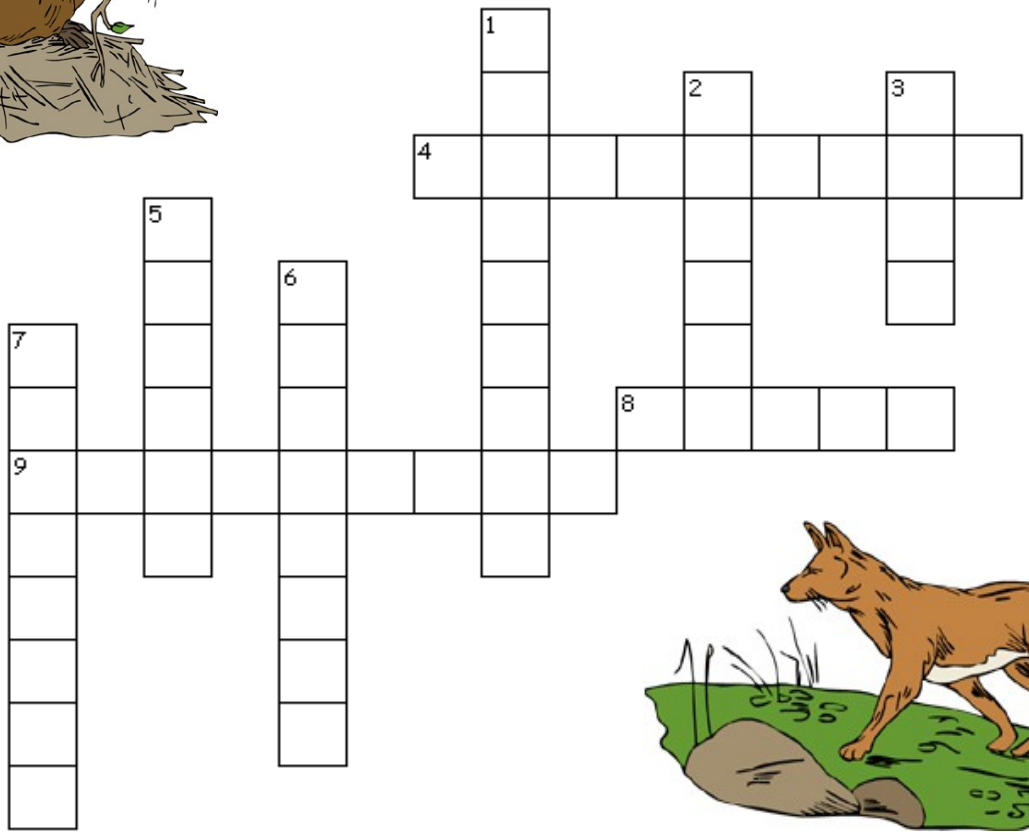
wolf - _____ bison - _____

horse - _____ human - _____

Name: _____

Is That Mammal a Carnivore, Herbivore or Omnivore?

Vocabulary Crossword



Use information from the article to help you answer the crossword clues.

Across

4. animals who hunts other animals

8. sharp, curved nails on an animal's foot

9. animal that eats only meat

Down

1. animal that eats only plants

2. group of warm-blooded animals with hair or fur

3. animal that is hunted and eaten

5. back teeth

6. animal that eats meat and plants

7. front teeth

Name: _____

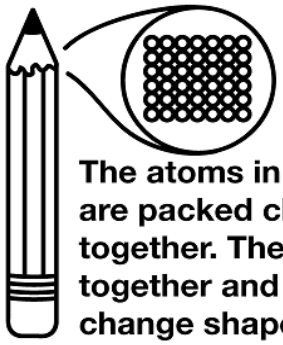
Why Does Matter Matter?

by Kelly Hashway

What do trees, air, and water have in common? They all have matter. That means they take up space. You might be wondering why these things look so different if they all have matter. Everything found on Earth can be grouped into one of three states of matter: solid, liquid, or gas. In order to figure out which state of matter an object fits in, we have to examine its properties. The properties we look at are shape, mass, and volume. Mass is the amount of matter an object has, and volume is the amount of space the matter takes up.

Solid

Solids are easy to recognize. They have definite shape, mass, and volume. Trees are solids. They are made up of tiny particles called atoms. These atoms are packed closely together, and they hold the solid in a definite shape that does not change. If you look around your house, you will see lots of solids. Televisions, beds, tables, chairs, and even the food you eat.

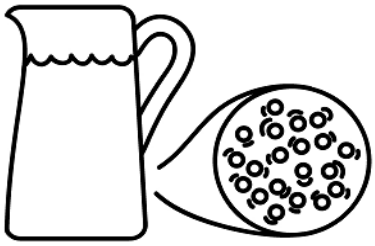


The atoms in a solid are packed closely together. They bond together and do not change shape.

Liquid

Liquids do not have definite shape, but they do have definite mass and volume. Liquids are similar to solids because their atoms are close together, but what makes a liquid different is that those atoms can move around. Liquids can change shape by flowing. If you've ever spilled a glass of milk, then you know it spreads out across the floor. It does this because the milk is taking the shape of the floor. Since liquids do not have a definite shape of their own, they will take the shape of their containers. This is why the same amount of milk can look different in a tall glass, a wide mug, or spread out on your kitchen floor.

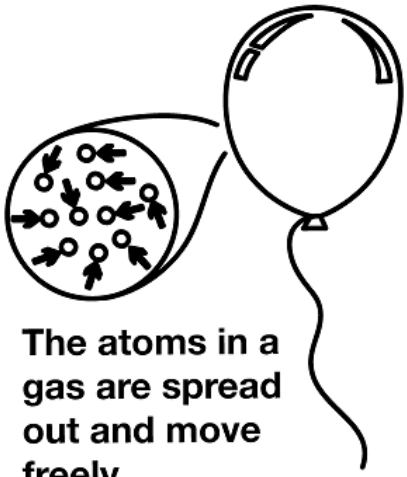
The atoms in a liquid are close together. They slide around.



Gases do not have definite shape or volume. Like liquids, gasses will take the shape of their containers. If a gas is not in a container, it will spread out indefinitely. This is because the atoms in a gas are spaced farther apart than in a solid or a liquid. And being spread out like this allows them to move around freely. Think about the air you breathe everyday. That air is spread across the empty space around the earth. You've probably also noticed that you usually cannot see the air. This is another property of gases. Even though we cannot see them, you come in contact with them everyday. There's air in the tires of your family car and your bicycle. There are many different types of gas in the earth's atmosphere, such as oxygen, carbon dioxide, nitrogen, water vapor, and helium.

When trying to remember the three states of matter, think about water. If it freezes into a solid, it becomes ice. Its atoms are packed together keeping its shape. Of course, we know water can also be a liquid. It flows in rivers or it can be poured from a glass. When water evaporates it becomes water vapor, a type of gas in the air. Try a little experiment of your own by placing an ice cube in a covered glass or container. You will be able to observe the ice first in its solid form and then watch as it melts into a liquid to become water. Eventually the water will turn to water vapor and your glass or container will be filled with this gas.

Gas



The atoms in a gas are spread out and move freely.

You can see three different states of matter in this picture. The pot is made of solid matter. The water inside the pot is liquid. When the liquid is heated it becomes water vapor, which is a gas.

Matter is everywhere! Can you find a solid, a liquid, and a gas around you right now?

Name: _____

Why Does Matter Matter?

by Kelly Hashway

solids	volume	container	matter	ice	juice
gases	mass	atoms	chair	oxygen	melting
liquids	shape	space	milk	helium	

Choose a word from the box to complete each sentence.

1. The three basic properties of matter are _____,

_____, and _____.

2. All matter is made up of tiny particles called _____.

3. Volume is the amount of _____ that matter takes up.

4. Mass is the amount of _____ an object has.

5. Liquids take the shape of their _____.

6. _____ do not have a definite shape or volume.

7. _____ do not have a definite shape, but they do have a definite volume.

8. _____ have a definite shape and volume.

9. A _____ and _____ are examples of solids.

10. _____ and _____ are examples of liquids.

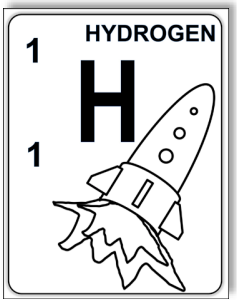
11. _____ and _____ are examples of gas.

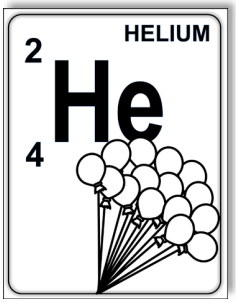
12. Solid ice is _____ when it is changing into a liquid.

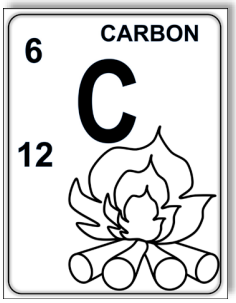
Name: _____ Date: _____

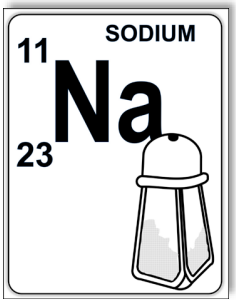
What are simple substances?

Vocabulary Words:
Element: a simple substance that cannot be broken down into simpler substances









The Elements. Some substances can be broken down into other substances. Water can be broken down into hydrogen and oxygen. Sugar can be broken down into carbon, hydrogen and oxygen. Salt can be broken down into sodium and chlorine. Hydrogen, oxygen, carbon, sodium and chlorine cannot be broken down. These substances are called elements. Elements are substances that cannot be broken down into anything else.

What is an element?

All substances are made of elements. There are over one hundred elements that we know of. Every substance on earth is made of one or more of these elements. Elements are simple substances. They are the building blocks of all other substances.

What are substances made of?

Elements can be solids, liquids, or gases. Most elements are solid at ordinary temperatures. Some elements are gases. A few elements are liquids.

In what phase of matter are most elements found?

Some substances are composed of only one element. An iron nail contains only the element iron. Aluminum foil is composed of only the element aluminum. The "lead" in the

pencil you write with is not really lead at all. It is graphite. Graphite is composed of the element carbon.

What are some things that are composed of only one element?

Some substances contain more than one element. Water is composed of the two elements of hydrogen and oxygen. Sugar contains carbon, hydrogen, and oxygen. Brass is a mixture of the elements copper and zinc. Mercuric oxide contains the elements mercury and oxygen.

It is not hard to break mercuric oxide into its two elements. Heat some mercuric oxide in a test tube. At first it turns black. If you keep heating it, drops of silver-colored liquid form on the inside of the test tube. This liquid is the element mercury. If you then put a glowing wood splint into the test tube, the splint would burst into flame. This shows that the test tube also contains invisible gas oxygen. Oxygen can make a glowing wood splint burst into flame.

What elements is mercuric oxide composed of?

What You Learned:

1. All substances are composed of elements.
2. An element is a simple substance that cannot be broken down into other substances.
3. There are more than 100 known elements.

Answer These:

1. Which of the following substances are elements? Circle them.

water oxygen iron salt hydrogen

mercury sugar carbon wood nitrogen

2. The number of known elements is _____.

____ 3. An element that is a silver-colored liquid is
a. hydrogen b. mercury c. silver d. carbon

____ 4. An element that is an invisible gas is
a. gold b. copper c. iron d. oxygen

Name: _____ Date: _____

Dimitri Mendeleev

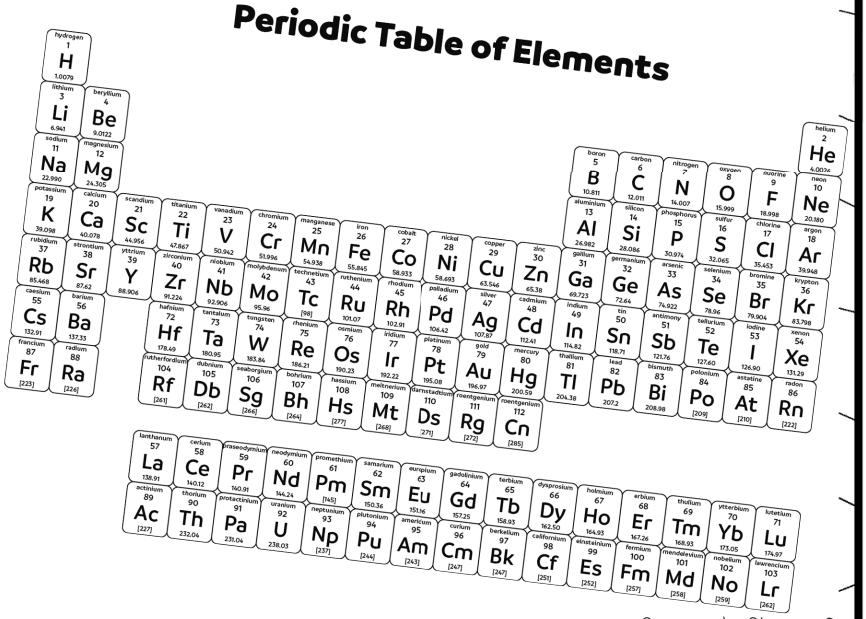
Vocabulary Words:
Atomic mass: total number of protons and neutrons in the nucleus of an atom
Periodic table: table that organizes the elements based on their atomic number
Group: family of elements going DOWN the periodic table
Period: family of elements going ACROSS the periodic table

Dimitri Mendeleev. Scientists have been studying elements for many years. In 1869, 63 elements had been discovered. Most of the elements were solid metals but there were some liquids and a few gases. Dimitri Mendeleev was a Russian chemist who began studying elements during this time period.

As Mendeleev was studying the elements, he began to notice that they had certain characteristics in common with one another. Mendeleev began examining these similarities to see if there was a pattern. Like a true scientist, Mendeleev began recording data about each element. He started to record the melting point, density, color, and atomic mass. The atomic mass is the total number of protons and neutrons an element has in its nucleus. Each of these recordings were written on a card and Dimitri began to try to organize them into a pattern.

While organizing them based upon their properties, Mendeleev noticed that in his arrangements, the elements were being organized in order by their atomic mass. Arranging them by their atomic mass, he also noticed that the elements shared the same properties. He grouped these elements together and began to notice a pattern among the atomic mass and the properties the elements shared.

What properties did Mendeleev record to organize the elements?



The periodic table. In 1869, Mendeleev created the first periodic table of elements. The word periodic means "in a regular, repeated pattern". The periodic table is a table that organizes the elements based on shared properties. As time went on and more scientists began studying elements, the original periodic table was tweaked as more information was learned.

When organizing the table, Mendeleev left blank spaces in it. Based on his organization of the elements, he predicted that there were elements on earth that had not yet been discovered. As new elements were discovered, scientists were able to fit them into the blank spaces on the table. Scientists were able to predict how the element would react because of what they already knew about the periodic table.

Today, scientists have realized that the periodic table is organized by an element's atomic number. The atomic number is the number of protons in the nucleus. Modern periodic tables are organized in this fashion. The atomic number determines chemical properties of an element.

How has the periodic table changed over time?

Comprehension Questions:

_____ 1. How is the modern periodic table organized?

a. by atomic number b. by atomic mass c. by amu

_____ 2. How did Dimitri Mendeleev organize the periodic table?

a. by atomic number b. by atomic mass c. by amu

3. How is the periodic table useful?

_____

_____

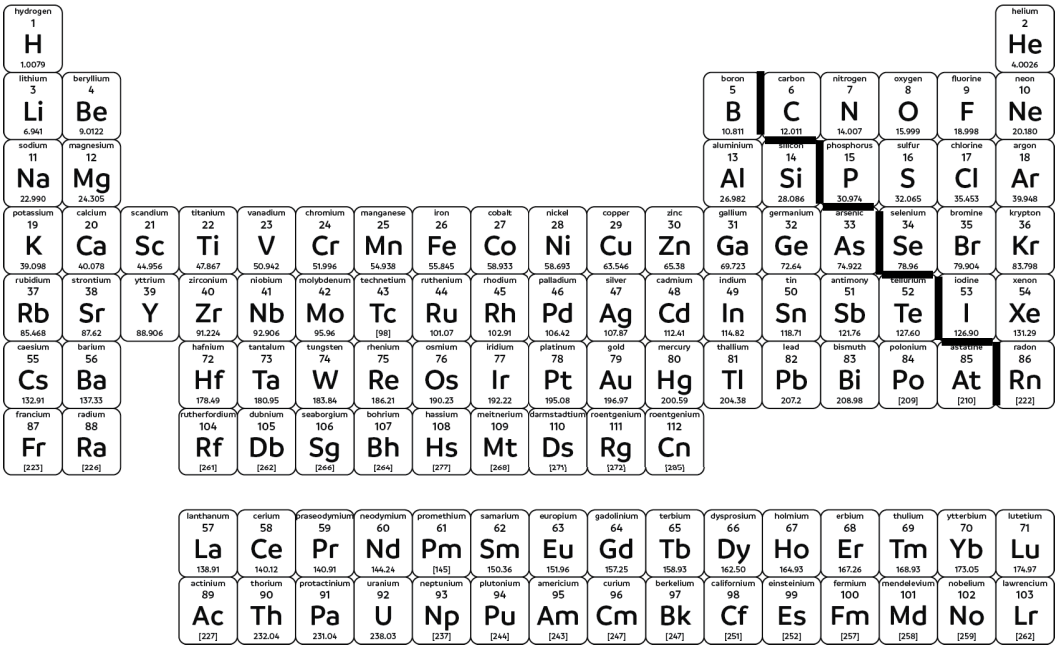
_____

Name: _____ Date: _____

What is the periodic table of elements?

Vocabulary Words:
Atomic number: number used to identify an element and show its place in the periodic table
Group: family of elements going DOWN the periodic table
Period: family of elements going ACROSS the periodic table

Periodic Table of Elements



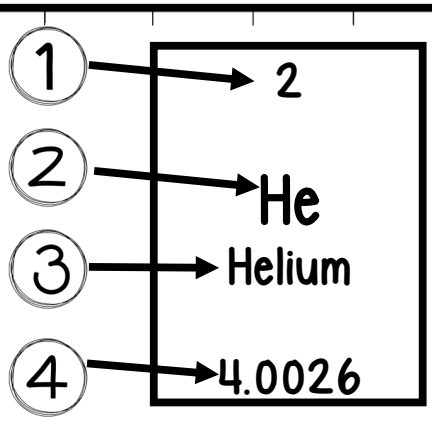
An element is a simple substance that cannot be broken down into a simpler substance. Elements are arranged in a table called the periodic table of elements. The periodic table of elements contains information about each of the elements. Most tables will include the atomic number, chemical symbol, name, and atomic mass for each element.

What information can be found on the periodic table of elements?

Information found on the periodic table. The periodic table tells us information about the elements that scientists have discovered. The periodic table has a dark zig-zag line. This line separates the metals from the nonmetals. The elements to the left of the line are all metals. The elements to the right are nonmetals.

Are there more metals or nonmetals on the periodic table?

A close look at the periodic table.



1. Atomic number: The periodic table of elements is organized by the atomic number. Elements are organized in order according to their atomic number. The atomic number also tells us the number of protons in an element.

2. Element symbol: Underneath the atomic number is the element symbol. Each element has a symbol that simplifies the name. Symbols can be one to three letters, newer manmade elements tend to have three symbols, all others are one to two letters. Symbols all start with a capital letter. If a symbol has more than one letter, the first letter is capital and the second letter is lowercase. You may notice that some elements have symbols that don't appear to make any sense. An example of this is Tin. The symbol for tin is Sn. Some elements have symbols that relate to an abbreviation of their name in Latin.

3. Element Name: This is the actual name of the element. While scientists might refer to elements through their symbol, it is important to understand what the symbol stands for.

4. Atomic Mass: The atomic mass is measured in amu (atomic mass units). It is an average because most elements consist of a mixture of isotopes. Isotopes are atoms that contain the same number of protons and electrons, but have a different number of neutrons. Some periodic tables may round the atomic mass to the nearest whole number while others have a decimal point to give a more exact answer.

Fill in the information below using the knowledge you just learned of the periodic table.

24
Cr
Chromium
51.996

1. What is the name of this element? _____

2. What is the atomic number of this element? _____

3. What is the atomic mass of this element? _____

4. What is the symbol for this element? _____

5. According to what you know about the periodic table, do you think there is another element with this symbol on the table? Why or why not? _____

_____

_____

Why do scientists use the periodic table?

The periodic table is more than a pretty table that includes all the elements. The periodic table can tell us a lot about an element. From the position an element is on the periodic table, you can predict the properties of an element and how they might change.

Periods.

Rows on the periodic table are called periods. A period is a line of elements that goes ACROSS the periodic table. There are seven rows on the periodic table. Looking from left to right, the properties of the elements will change in a pattern. One example of this is that the metals are on the left side of the table and the nonmetals are on the right side.

Which direction can you find periods on the periodic table?

Groups.

Columns on the periodic table are called groups. A group is a line of elements that goes UP and DOWN the periodic table. There are eighteen groups on the periodic table. Groups are known as families. Each group has similar characteristics. Group 18 consists of gases. Group 1, except for hydrogen, are metals that react violently with water.

Which direction can you find groups on the periodic table?

What You Learned:

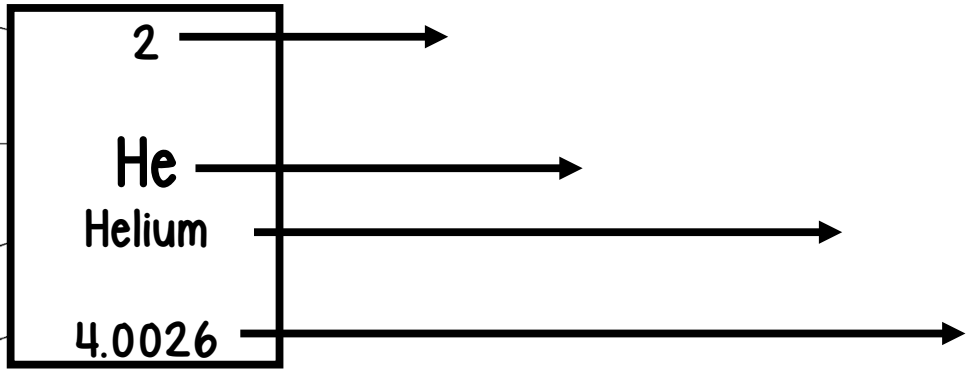
1. The periodic table is a chart that organizes the elements by their atomic number.
2. The periodic table tells the element name, symbol, atomic number and atomic mass.
3. Periods are rows across the periodic table. There are seven of them.
4. Groups are columns that run up and down the periodic table. Elements in a group share certain characteristics with one another.
5. An element's placement on the periodic table can tell us about that element and how it could change.

Answer These. Answer the following questions based on your understanding of the periodic table of elements.

1. Using your periodic table of elements, search for the atomic number. Write down the element symbol to figure out the following words.

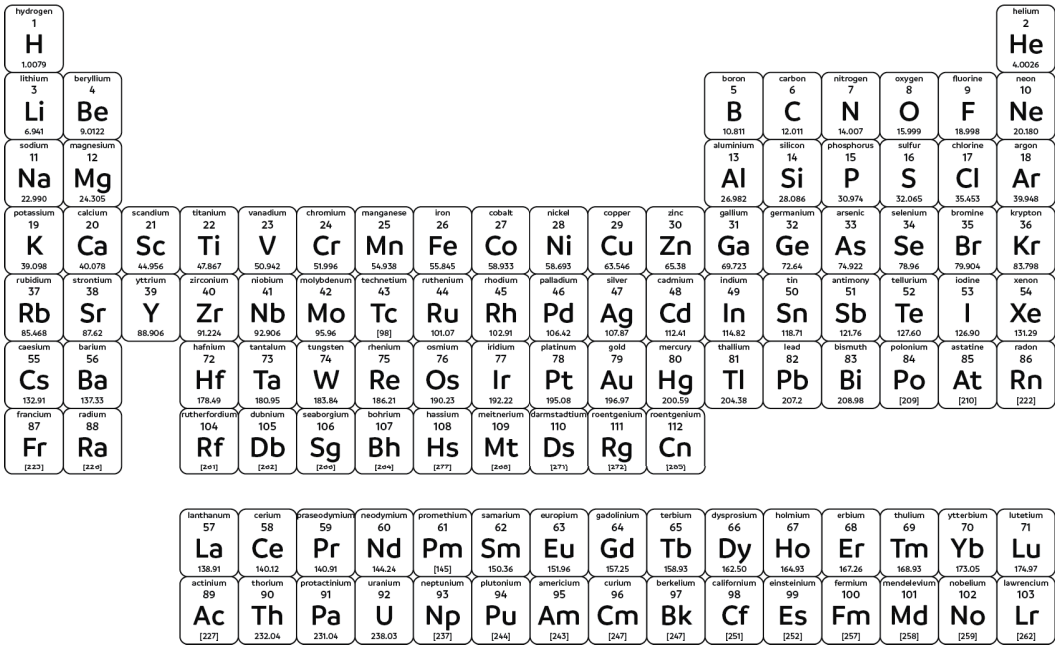
1.	_____	_____	_____	_____	_____
	6	18	28	23	13
2.	_____	_____	_____	_____	
	5	8	54	16	

2. Label the parts of the element; element name, symbol, atomic mass, atomic number.



3. Number the periods and groups on the periodic table then answer the questions below.

Periodic Table of Elements



a. _____ are found in rows ACROSS. There are _____ of them.

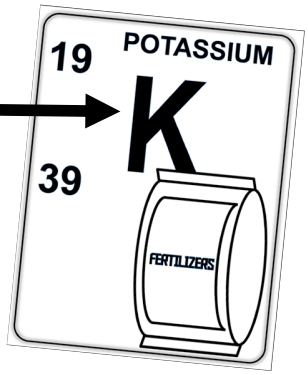
b. _____ are found in columns UP and DOWN. There are _____ of them.

c. _____ make up families on the periodic table. They have similar characteristics.

Name: _____ Date: _____

What are chemical symbols?

Vocabulary Words:
Chemical symbol: short way of writing the names of the elements
Universal: worldwide, the same all over the world.



Chemical symbol

How chemists write. Chemical symbols are a short cut that scientists use when writing out the name of the element. This allows scientists to write down information very quickly. Each element has a specific symbol to use when writing its name. These symbols are called chemical symbols.

What is a chemical symbol?

Chemistry talk. All over the world, chemists use the same exact symbols for the elements. Scientists do this to make it easier to read and interpret data. It doesn't matter which continent in the world the scientists are from, they will all use the same symbol. The symbol for calcium is Ca. No matter where the scientists live either in the United States, Australia or Europe, Ca will always represent calcium.

What does Ca stand for in Italy?

How to write a chemical symbol. We know that everyone uses the same chemical symbols. Did you also know they must be written in a specific way? There are three rules you must remember when writing a chemical symbol.

1. The symbol is always either one or two letters.
2. If it is one letter, it is a capital letter.
3. If there are two letters; the first is capital and the second is a lowercase letter.

What is the most amount of letters a chemical symbol can have?

How do I learn the symbols? There is really only one way to learn the chemical symbols. You need to memorize them. Looking and using the periodic table will help you to memorize them quicker. Aside from using the periodic table, you can write down each element and its symbol one million times. After the one millionth time, you should have it memorized. ☺

Look at the list below. These are some basic elements you should start to memorize.

Important Elements to Know

Oxygen	O	Helium	H
Hydrogen	He	Sodium	Na
Chlorine	Cl	Aluminum	Al

What You Learned:

1. Chemists use symbols for the names of the elements.
2. The symbol for the elements is the same all over the world.
3. Chemical symbols contain one or two letters. The first letter is always a capital and the second is a lower-case letter.

Answer These: Using your periodic table, match the element with its chemical symbol.

Element	Chemical Symbol
Copper	C
Magnesium	B
Carbon	Cl
Silver	Ag
Boron	Mg
Chlorine	Cu

Name: _____ Date: _____

Metals

Vocabulary Words:
Metals: elements that are good conductors of electric current and heat
Malleable: easy to shape

There are more than 110 elements in the world. The periodic table organizes these elements based on their atomic number. Elements near each other on the periodic table have properties in common with one another. Most of the elements on the periodic table are metals. Metals are listed on the left side of the table. Metals are all around us. Gold, silver and aluminum are examples of metals.

Physical properties of metals.

All metals have some things in common. They are all shiny. Light bounces off their surfaces and makes them gleam. For this reason, metals are often used for decoration.

Metals conduct heat. Heat passes easily through metal and into other objects. That is why pots for cooking are made of metals.

Metals also conduct electricity. Electricity passes through metal easily. In addition, metals are ductile, or easily shaped into something else. This means that they can be pulled into a thin wire. Since metals are ductile and conduct electricity, wire made of metals such as copper is used to carry electricity.

Many metals are malleable or easy to shape. They can be made into jewelry. Aluminum can be made into thin sheets of aluminum foil. Gold can be made into thin sheets of gold leaf. The torch of the Statue of Liberty is covered with gold leaf.

There are even metals in your body. Calcium and magnesium are metals that help make your bones. Sodium is a metal that your body needs to work properly. There is sodium in table salt.

Chemical properties of metals.

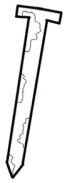
Metals can be reactive. This means that they easily combine with other substances. They do this by losing an electron to other atoms. Some metals like sodium will react with water while gold and platinum do not react with water.

Some metals are corrosive. This means that the metal deteriorates from a chemical reaction. The metal may start to look brown, red, or green. Rust is an example of what happens to a corrosive metal like iron.

Metal in our lives.

People have found thousands of uses for metals. We buy things with coins which are also made of metal. We travel in cars, trains, and planes made of metal. We use tools and machines made of metal. Metals are part of our daily lives.

Comprehension Questions.



_____ 1. What type of change occurs when rust develops on a nail?

a. chemical change b. physical change

2. Look at the periodic table of elements. What is another metal that has similar properties to gold? _____

_____ 3. True or false: There are more metals than nonmetals on the periodic table.

4. Malleable refers to the ability to shape something. Identify a metal that is malleable.

_____

5. Metals can conduct heat and electricity. Why do you think it is necessary to use cooking mitts when handling pots on the stove while cooking?

_____

_____

_____

Name: _____ Date: _____

Nonmetals

Vocabulary Words:
Nonmetal: an element that lacks the characteristics of a metal
Malleable: easy to shape

While most of the periodic table is made up of elements that are metals, it also contains nonmetals. Nonmetals are elements that do not share the same characteristics as metals. Nonmetals have similarities that they share. Nonmetals can be found on the right side of the periodic table of elements.

Physical properties of nonmetals.

Nonmetals are poor conductors of heat and electricity. Solid nonmetals are dull and brittle. They can easily break when hit with a hammer. Many nonmetals are gases at room temperature. Examples include oxygen and nitrogen. Bromine is the only nonmetal that is a liquid at room temperature.

What are the physical properties of nonmetals?

Chemical properties of nonmetals.

When nonmetals react with other elements, they gain an electron. This is why nonmetals form compounds with other elements. When two or more atoms bond, they form a molecule. This is how water is formed. It is two atoms of hydrogen and one atom of oxygen.

What happens when nonmetals react with other elements?

Nonmetal Families.

Groups of elements are called families because they have similar characteristics. Nonmetals in the same family share many things in common. Read to learn about the carbon family, nitrogen family, oxygen family, halogen family, noble gases, and hydrogen.

The Carbon Family: Group 14 contains carbon, which is the only nonmetal in the group. Carbon is needed for life to exist. It can be found in protein, DNA, and fats. Coal and gasoline are also made from carbon. Diamonds are another example of a substance made from carbon.

The Nitrogen Family: Group 15 consists of the nonmetals, nitrogen and phosphorus. Seventy-eight percent of the atmosphere is made of nitrogen. Phosphorus has many uses. It is needed for strong bones and teeth. It is also used in fertilizers.

The Oxygen Family: Group 16 is made up of three nonmetals, oxygen, sulfur, and selenium. Oxygen is needed for the survival of mammals and other living things. Sulfur is usually detected by its rotten egg smell. It is used in fertilizers and creating rubber. Selenium helps to protect cells from damage.

The Halogen Family: Group 17 is made of four nonmetals, fluorine, chlorine, bromine, and iodine. The nonmetals in this group were named "halogen" because it means salt-forming. Halogens are reactive and can be dangerous however when formed in a compound, they can be very useful. Fluorine can be dangerous on its own but can be used in toothpaste and cookware when combined with other elements.

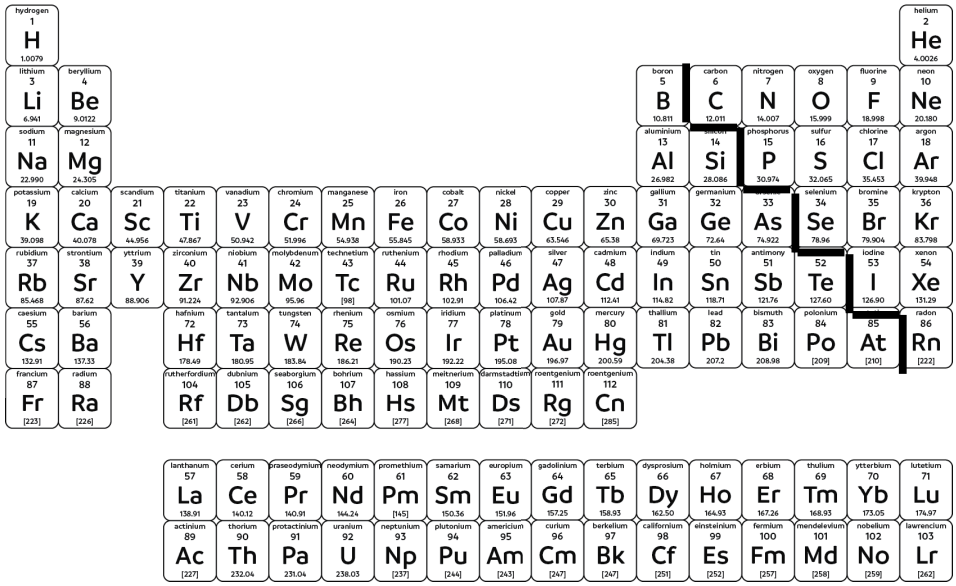
The Noble Gases: Group 18 is made up of all gases which is why it is called the noble gases. This group contains nonreactive gases that do not normally form compounds with other elements. Helium and neon are examples of noble gases.

Hydrogen: Hydrogen is all alone in this family and is found on the left side of the periodic table. It is the simplest element and has chemical properties that are very different from all other elements which is why it makes up its very own family. Hydrogen is rarely found on its own on earth. It is found as water when combined with oxygen.

Metalloids.

There is a third category on the periodic table between metals and nonmetals. They are called metalloids. Metalloids are elements that have some properties of metals and nonmetals. All metalloids are solid at room temperature, brittle, hard, and a bit reactive. One useful property is its ability to conduct electricity. Silicon, boron, and arsenic are examples of metalloids.

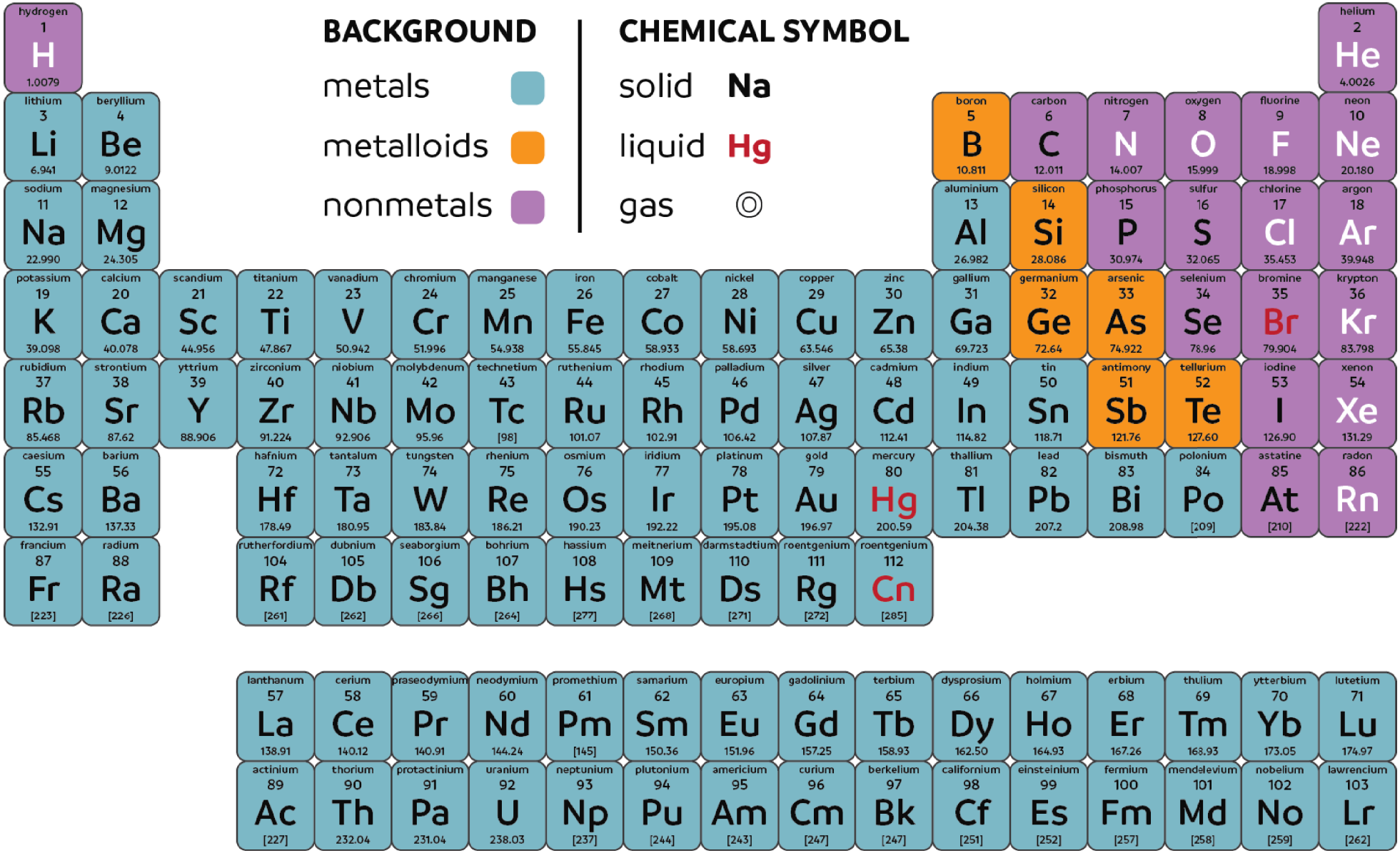
Comprehension Activities: **Periodic Table of Elements**



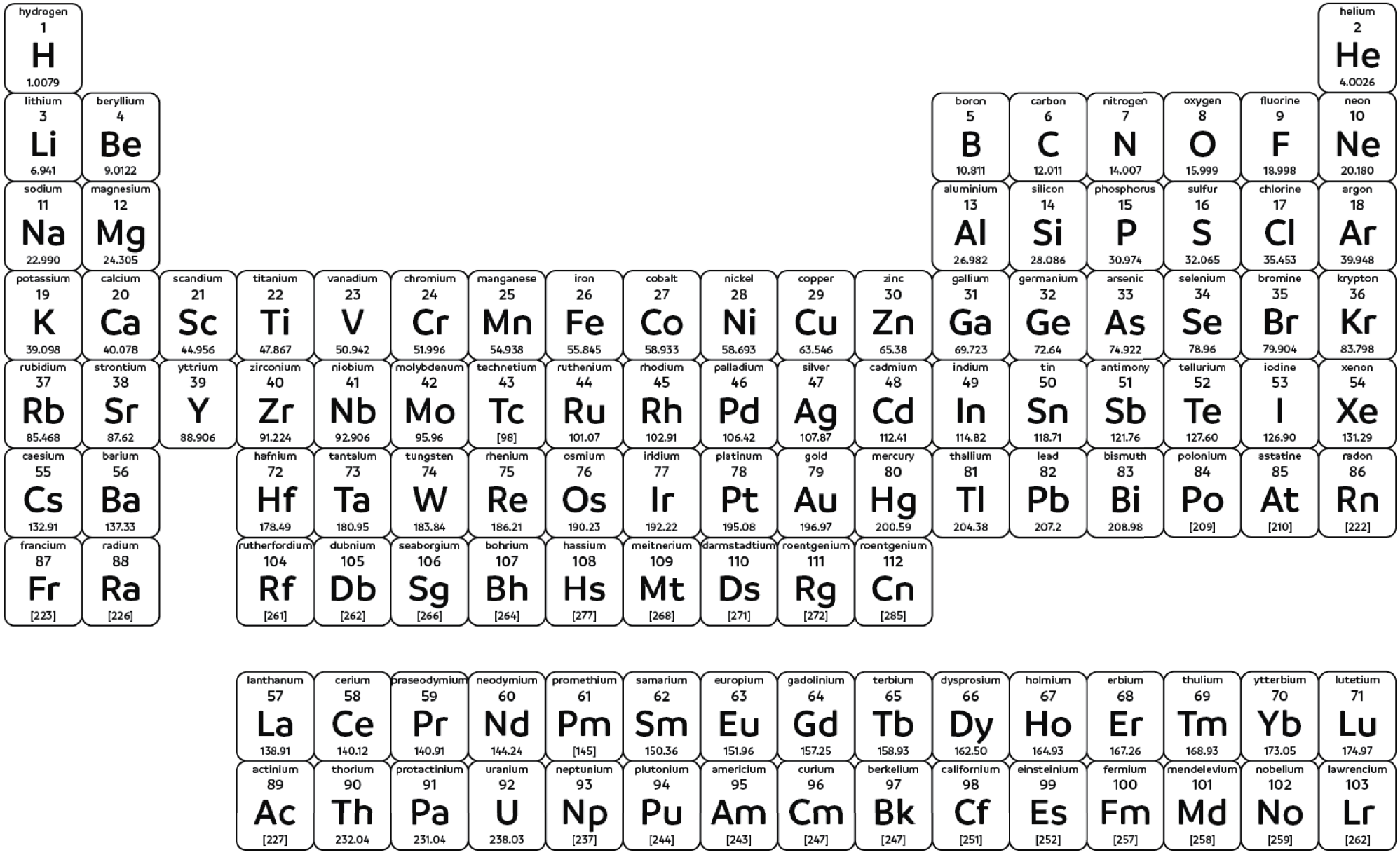
1. Using your knowledge of the reading, label and color in groups 14-18 and hydrogen on the periodic table.
2. On the table below, list the properties of nonmetals and metalloids.

Properties of Metals	Properties of Nonmetals	Properties of Metalloids
Shiny		
Malleable		
Good conductor of electric current		
Good conductor of heat		
Loses an electron during reaction		

Periodic Table of Elements



Periodic Table of Elements



The Respiratory System and the Cardiovascular/Circulatory System

In the human body, there are numerous different types of cell, each highly specialized and adapted for a particular function. All these cells work together to achieve 'health'. Each cell requires an enough oxygen and other nutrients and needs to get rid of waste products. The fluid environment in which cells exist is called tissue fluid and makes up the internal environment. The temperature, pressure and pH of this internal environment also need to remain within relatively narrow limits in order for cells to function in a healthy and efficient manner. When cells function together to maintain this relatively stable internal environment, a state of **homeostasis** is achieved- this is comparable with a state of health. **Homeostasis** means that the body systems are working together to be balanced and healthy.

The cells which form the organs and tissues of the **respiratory system** have a number of roles including the exchange of **carbon dioxide and oxygen**. Breathing involves inhaling air containing oxygen and exhaling air with increased amounts of carbon dioxide, a waste product. The **cardiovascular/circulatory system** is responsible for the transport of blood and oxygen throughout the body. The two systems are closely integrated and work together! The respiratory bring system brings oxygen into the body and the cardiovascular system transports oxygen throughout the body. If one responds to a change in the body then this will also be manifested in the other.

A variety of physiological needs have to be met in order to remain healthy and these include maintaining the right amounts of oxygen and carbon dioxide in the internal environment and maintaining the right volume of fluids which contribute to sustaining blood pressure. So when the body carries out an activity where the muscles need more oxygen and nutrients to function efficiently then the cardiovascular system responds to increase the flow of blood and heart rate increases. The respiratory system needs to ensure sufficient oxygen is provided so respiration rate increases. Both systems also ensure the removal of waste products.

When the needs of the body are not met then problems may occur. Have you ever experienced cramp in your legs after physical exertion, this is due to a build up of a waste product called lactic acid which is produced when there is too little oxygen available to cells. Observations of breathing rate, pulse rate and blood pressure can provide information about a patient's state of health.

Components of the Respiratory System

The respiratory system consists of the lungs, a group of passages connecting them to the outside environment and structures in the chest or thorax involved with moving air in and out of the lungs. The organs outside the thorax comprise the upper respiratory tract and those within the thorax the lower respiratory tract.

The components of the respiratory system are responsible for the following key functions:

- Filter, warm and humidify incoming air.

- Transport air from outside the body to the lungs.
- Exchange of gases between the lungs and blood.

Air enters the respiratory system through the mouth and the nose. The air then passes through the larynx (where speech sounds are produced) and the trachea which is a tube that enters the thorax. In the thorax, the trachea splits into two smaller tubes called the bronchi. Each bronchus then divides again forming the bronchial tubes. The bronchial tubes lead directly into the lungs where they divide into many smaller tubes which connect to tiny sacs called alveoli.

Body cells require a constant supply of oxygen, water and nutrients as well as a means of removing waste products. To maintain homeostasis hormones also need transporting to tissues where they exert control. Finally heat needs distributing around the body. To achieve this the transport system must be rapid, direct and able to achieve a two way exchange. This is exactly what the **cardiovascular system** achieves by transporting a fluid containing cells, gases, nutrients, waste products, hormones and heat.

Reading Comprehension and Analysis Questions

1. From the first paragraph, what are the needs of each cell? Enough _____ and _____ to get rid of _____.

2. How is Homeostasis achieved? (2+ sentences)

3. What exactly is Homeostasis?

4. Your respiratory system helps you breath in _____ and breath out _____.

5. What is the cardiovascular/circulatory system responsible for?

6. How are the respiratory system and the cardiovascular/circulatory system related?

7. What physiological needs have to be met in order for the human body to be happy and healthy? (2+ sentences)

8. What does your body do when it carries out an activity that requires more oxygen?

9. Provide specific examples from the reading passage of what happens if your body needs are not met. (2+ sentences)

10. What are the three key functions your respiratory system is responsible for?

1.
2.
3.

11. What body system are your lungs part of?

12. How does air enter the respiratory system?

13. Why do you think the respiratory system is made of so many tubes? (2+ sentences)

14. From the last paragraph, what do body cells require? (2+ sentences)

15. How does the cardiovascular/circulatory system help the body maintain homeostasis?

Name_____

DATA Nugget

Springing forward

Featured scientists: Shaun Davis, Mark Hammond, Elizabeth Schultheis, and Jen Lau from Michigan State University

Research Background:

Scientists collecting data in the climate change experiment. They are recording the date that dame's rocket, a leafy plant, makes its first flower of the year.

Every day people burn fossil fuels like oil, natural gas, and coal. This adds more and more greenhouse gasses to our air. Greenhouse gasses trap more of the sun's heat, causing the Earth to heat up!

Plants are very important for almost all life found on Earth. They make the oxygen that we breathe and are food for people and animals. Because plants are so important, we need to find out how climate change will affect them. How will higher temperatures affect the Earth's plants? One good place to start is by looking at *flowering* plants. Many flowering plants produce their flowers when the weather gets warm in spring, and the date that flowers first come out may depend directly on what the spring temperatures are like. It is possible that warmer and earlier springs generated by climate change cause flowers to bloom earlier and earlier. If flowers start blooming earlier each year, this could cause problems for pollinators (like bees and butterflies). They count on plants flowering around the same date each year.

Scientists Shaun, Mark, Elizabeth, and Jen wanted to know if higher temperatures lead to earlier flowering dates for plants. They chose to look at flowers of dame's rocket, a leafy plant that is related to the plants we use to make mustard! Mark planted dame's rocket in eight plots of land. Half of the plots were left at normal temperature. The other four plots were heated 3°C above normal temperature. Scientists think 3°C is about how much warmer Michigan will be by the year 2100. Mark, Elizabeth, and Jen measured the date that each plant grew its first flower, and the survival of each plant. The scientists predicted that the dame's rocket growing in the heated plots would flower earlier than those in the normal plots.

Name_____

One of the heated plots shown from above. The silver boxes are electric heaters that raised the temperature inside the ring.

Dame's rocket growing in the field. This species of mustard was introduced to the U.S. from Europe and Asia.

Scientific Question: How does temperature affect the flowering time of dame's rocket?

What is the hypothesis? Find the hypothesis in the Research Background and underline it. A hypothesis is a proposed explanation for an observation, which can then be tested with experimentation or other types of studies.

Scientific Data:

Use the data below to answer the scientific question:

Treatment	# of plants surviving to flower	calendar date when first flower appeared	average # of days until first flower (since start of experiment)
Normal	28	May 20, 2013	16.11
Heated	25	May 10, 2013	6.08

What data will you graph to answer the question?

Independent variable: _____

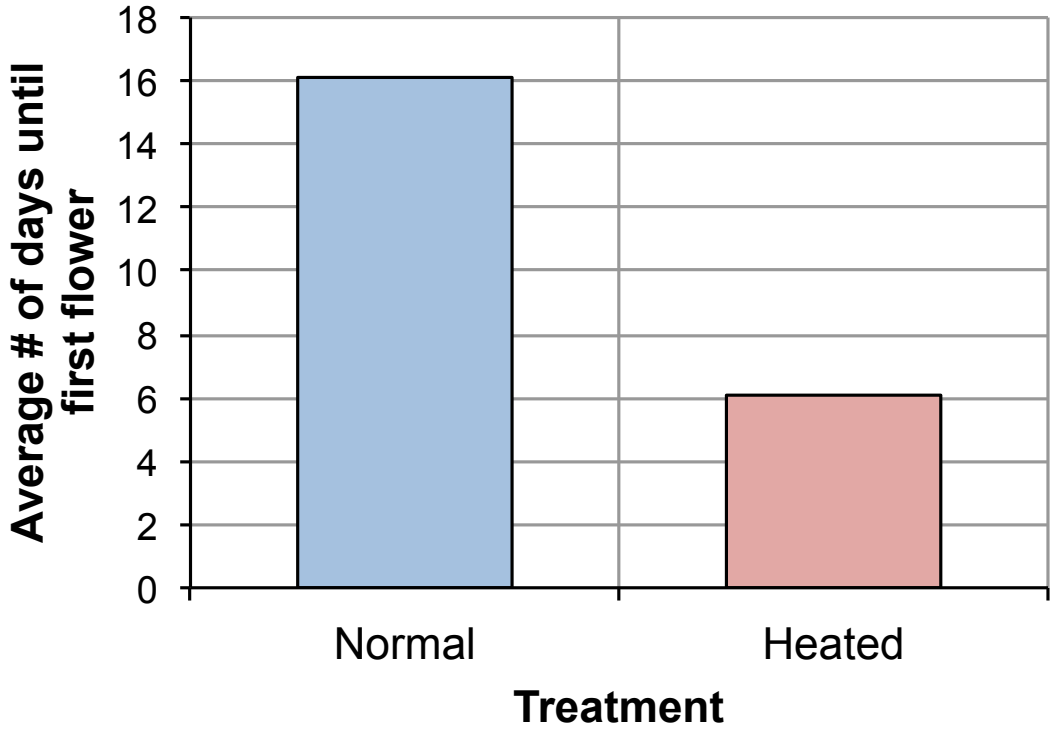
_____

Dependent variable: _____

_____

Name_____

Below is a graph of the data: Identify any changes, trends, or differences you see in your graph. Draw arrows pointing out what you see, and write one sentence describing what you see next to each arrow.



Interpret the data:

Make a claim that answers the scientific question.

What evidence was used to write your claim? Reference specific parts of the table or graph.

Name_____

Explain your reasoning and why the evidence supports your claim. Connect the data back to what you learned about climate change and how this could affect flowering time.

Did the data support the scientists' hypothesis? Use evidence to explain why or why not. If you feel the data did not give a clear answer, explain why.

Your next steps as a scientist: Science is an ongoing process. What new question(s) should be investigated to build on Shaun, Mark, Elizabeth, and Jen's research? What future data should be collected to answer your question(s)?

Name: _____

Terrifying Tsunamis

by Lydia Lukidis

Trust me, you don't want to get caught under a tsunami! Tsunamis are one of the world's most powerful natural forces. They can swallow up islands in minutes. They can flood and destroy villages. They can create huge amounts of damage.

But do you know exactly what a tsunami (pronounced soo-NAH-mee) is? They are huge, mighty waves in the ocean that grow as they reach the shore. Most tsunamis are actually caused by earthquakes. An earthquake happens when a big piece of the Earth's crust suddenly shifts. Basically, the Earth's crust is made up of large pieces called tectonic plates. These plates usually grind together. But sometimes, the plates get stuck. The pressure builds and they suddenly get slammed and are pushed into a new position. When the ocean floor moves, it creates big holes. The water floods in to fill these holes. When the water moves that quickly, it creates a huge wave. This is how tsunamis are born!

Other natural disasters like landslides, volcanic eruptions, and glaciers breaking off can also cause tsunamis. Once the water starts moving because of the force of the disaster, large waves begin to ripple out. These waves can move very fast. They have been recorded at speeds up to 500 miles per hour! They can also move across very long distances.

At first, the waves of the tsunami may not seem that tall. That's because when the waves travel through the deep parts of the ocean, the top of each wave is very short. But as that wave approaches shallower water, it grows in height. Remember, the tsunami travels quickly. If you are sitting on a beach, you may not see the wave coming at first. But when the wave arrives, it will be like a towering wall of water. Some waves are as tall as 100 feet high.

This wave will rush in and flood the area within minutes. It may be followed by other waves as well.

Though tsunamis can happen anywhere, they usually occur in specific areas like the Pacific Ocean. The countries along the coastline like Japan, Chile, or even the United States are more at risk. The biggest tsunami ever recorded happened in 1958 in Lituya Bay, Alaska. The massive wave was over 1,720 feet tall, and it wiped out trees, vegetation, and everything else in its way.

To increase public safety, scientists can detect when earthquakes are coming. They created the Pacific Tsunami Warning System, based in Hawaii. The detectors can track the earthquakes that may cause tsunamis. If the tsunami is detected early enough, people can be warned and can leave the coastline.

As scary as tsunamis can be, you don't need to worry too much about them. They don't happen that often. Only about two tsunamis happen every year. And it is said that massive, really destructive tsunamis only happen about every fifteen years. So don't worry, you will probably never experience one!

About the Author

Lydia Lukidis is a published children's author with a multi-disciplinary background that spans the fields of literature, theater, and puppetry. Lydia's picture book, *Gerbs in the House: The Dilly Dally Bedtime Routine*, is now available. Find out if Mocha will ever get his silly son to sleep!

Lukidis, Lydia. *Gerbs in the House: The Dilly Dally Bedtime Routine* ISBN: 978-0-9917402-7-7

Name: _____

Terrifying Tsunamis

by Lydia Lukidis

1. Based on the information in the article, which natural disaster is ***not*** responsible for causing a tsunami?

a. tornado
b. volcanic eruption
c. earthquake
d. glacial movement

2. Which of the following is true about tectonic plates?

a. Tectonic plates are solid pieces of the Earth's crust that cannot move or shift.
b. Tectonic plates sometimes cause earthquakes, but they cannot cause tsunamis.
c. Tectonic plates can get stuck until they slam past each other, releasing pressure.
d. Tectonic plates are special instruments used to tell scientists when a tsunami is coming toward land.

3. According to the information in the article, would you be more likely to notice a tsunami forming in the deep ocean or near the coast? Why is this the case?

_____

_____

4. Where would a tsunami be most likely to occur?

a. Cuba
b. New York City
c. coast of Ireland
d. Indonesia

5. A tsunami forms in the deep ocean, 1,500 miles off the cost of Sri Lanka. If the tsunami is traveling at 500 miles an hour, how long will it take the tsunami to reach the coast of Sri Lanka?

a. 2 hours
b. 3 hours
c. 4 hours
d. 5 hours

Name: _____

Terrifying Tsunamis

by Lydia Lukidis

The scrambled words below are vocabulary words from the article. Unscramble each word and write it on the line. Please be sure each word is spelled correctly.

1. _____ g v t i a e n e o t
hint: all the plants in a particular area

2. _____ s e g i l a r c
hint: a slowly moving mass of ice

3. _____ r q e k e u a h a t
hint: sudden, violent shaking of the ground that is caused by shifting in the Earth's crust

4. _____ r s c u t
hint: the outermost layer of the Earth

5. _____ c t i o c e t n l e p t a s
hint: pieces of the Earth's crust that can move and shift, sometimes causing earthquakes and tsunamis

6. _____ s m s a v e i
hint: extremely large in size or scale

7. _____ s l n a i d e d l s
hint: natural disasters in which large amounts of falling rock or earth tumble down a mountain or cliff

8. _____ u L y t i a a B y
hint: site of the largest tsunami ever recorded

9. _____ p a p c e h s o a r
hint: moves closer; comes toward

10. _____ c t e r o d e t s
hint: devices designed to recognize when a tsunami forms and emit a response that acts as an alert

Name: _____

Terrifying Tsunamis

by Lydia Lukidis

In the article, "Terrifying Tsunamis," you learned that tectonic plates are responsible for causing earthquakes and tsunamis.

Using a science text book as a reference, describe another natural disaster that is caused by the activity of the Earth's tectonic plates. In your answer, be sure to explain how tectonic plates are responsible for that natural disaster, and what happens during the event.

Name_____

DATA Nugget

Won't you be my urchin?

Featured scientist: Sarah W. Davies from University of Texas at Austin

Research Background:

Imagine you are snorkeling on a coral reef where you can see many species living together. Some animals, like sharks, are predators that eat other animals. Other species, like anemones and the fish that live in them, are mutualists and protect each other from predators. There are also herbivores, like **urchins**, that eat plants and algae on the reef. All of these species, and many more, need the coral reef to survive.

Corals are the animals that build coral reefs. They are very sensitive and can be hurt by human activity, like boating and pollution. Corals reef ecosystems are also in danger from warming waters due to climate change. Sadly, today many coral reefs around the world are dying because the places they grow are changing. Sarah is a marine biologist who is determined to figure out ways to save coral reefs. Sarah wants to understand how to help the dying corals so they can keep building the important and diverse coral reef habitats.

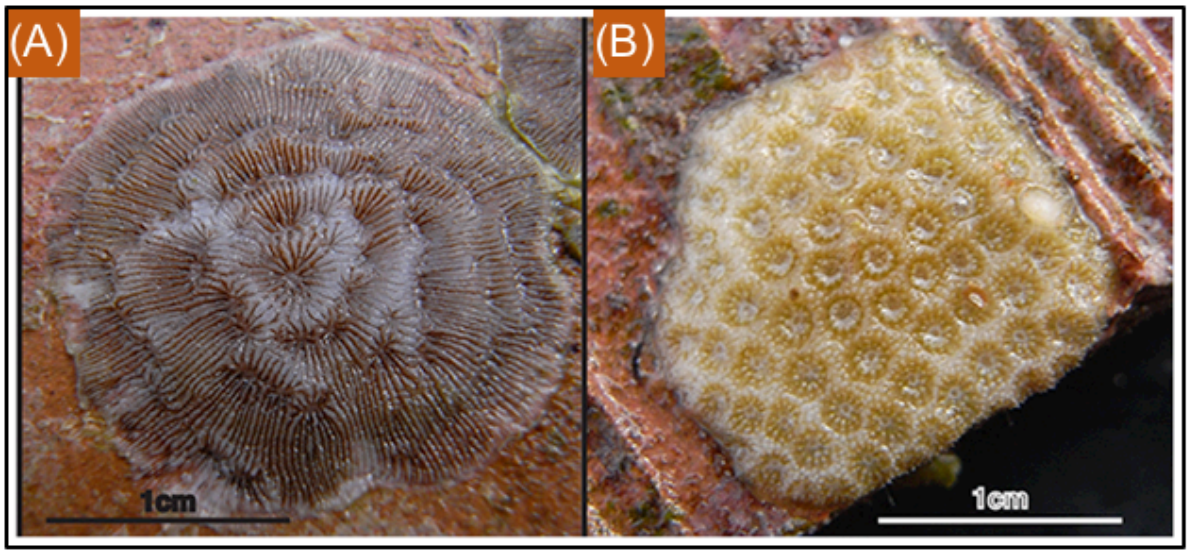
Corals compete with large types of **algae**, like seaweed, for space to grow on the reef. Corals are picky and only like to live in certain places. If there is too much algae, corals will have no place to attach and grow. Sea urchins are important herbivores and one of the species that like to eat algae. Sarah thought that when urchins are present on the reef, corals will have less competition from algae for space, and thus more room to grow. Maybe adding urchins to a coral reef is a way to help corals!

Experimental setup with tiles in bins. Some bins have sea urchins and some do not.

Scientist Sarah scuba diving on the coral reef for fieldwork.

Name_____

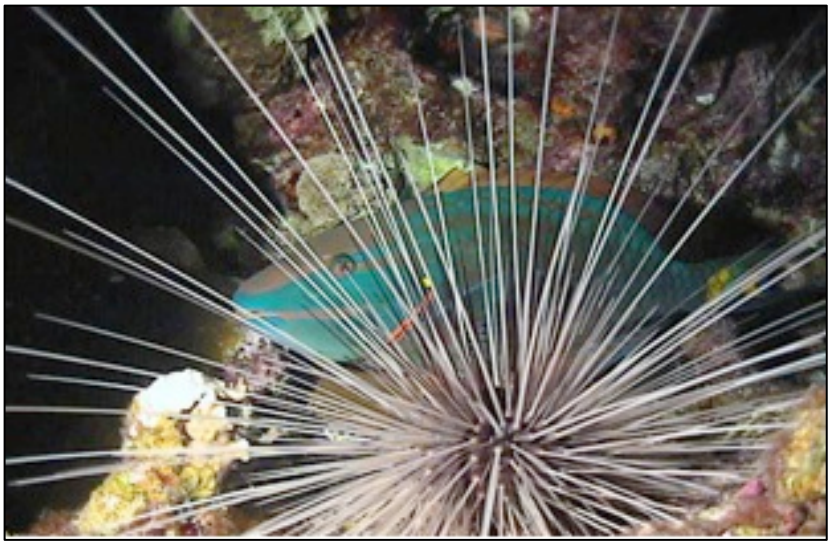
To test her idea Sarah set up an experiment. She set 8 bins out on the reef. Into half of the bins, Sarah added urchins. Into the other half she left without urchins as a control. Sarah put tiles into all of the bins. Tiles gave an empty space for coral and algae to compete and grow. After a few months, Sarah looked at the tiles. She counted how many corals were growing on each tile. Sarah predicted that more corals would grow on the tiles in bins with sea urchins compared to the control bins with no sea urchins.



(A) Coral species *Agaricia* juvenile on experimental tile.
(B) Coral species *Porites* juvenile on experimental tile.

Scientific Question: How does the presence of urchins affect corals?

What is the hypothesis? Find the hypothesis in the Research Background and underline it. A hypothesis is a proposed explanation for an observation, which can then be tested with experimentation or other types of studies.



The vegetarian sea urchin *Diadema antillarum.*

Name_____

Draw a food web for the coral reef ecosystem:

1. Include **corals**, **urchins**, **and algae** in your food web. Write out the name of each species and put a box around it.
2. Add arrows to connect the boxes. Arrows represent the interactions between the species in the ecosystem. For example, you can use arrows to show who eats whom, or to show competition between different species. Use the direction of the arrow to show the direction of energy flow or other relationships.
3. Once you have drawn your arrows, label them with the type of interaction. For example, label an arrow with the words “eaten by” if the arrow connects a species to the species that consumes it.

Name_____

Scientific Data:

Complete the table and use the data below to answer the scientific question:

Treatment in the bin	**Bin #**	**Number of corals on tile**
Sea urchins present	1	8
Sea urchins present	2	12
Sea urchins present	3	10
Sea urchins present	4	25
No sea urchins	5	1
No sea urchins	6	3
No sea urchins	7	6
No sea urchins	8	11
Average number of corals on tile when urchins present		
Average number of corals on tile when there are no sea urchins		

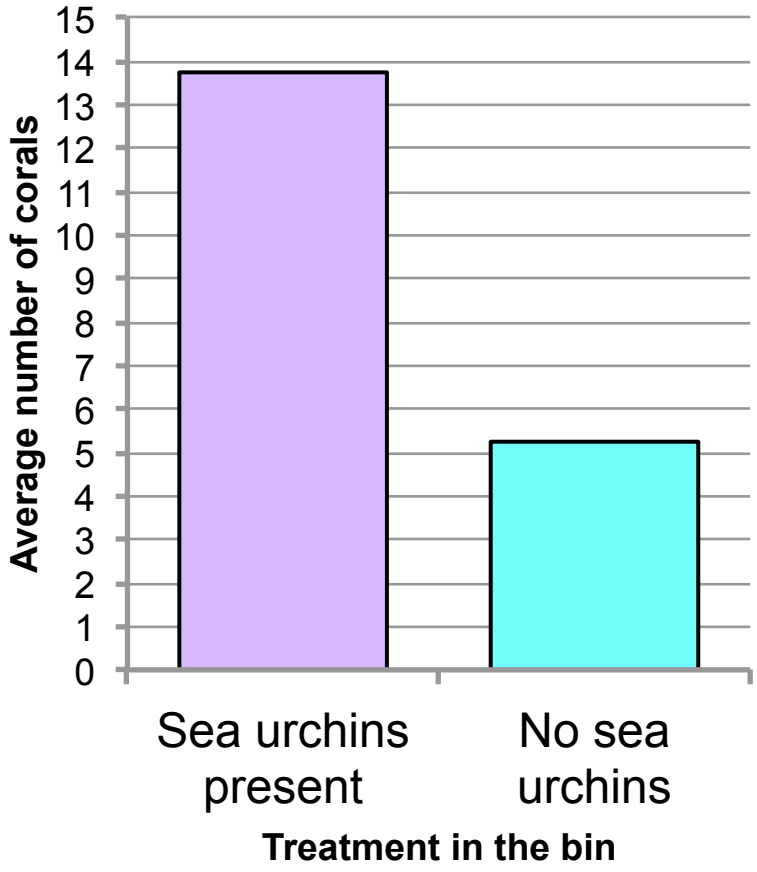
What data will you graph to answer the question?

Independent variable: _____

Dependent variable: _____

Name_____

Below is a graph of the data: Identify any changes, trends, or differences you see in your graph. Draw arrows pointing out what you see, and write one sentence describing what you see next to each arrow.



Interpret the data:

Make a claim that answers the scientific question.

Name_____

What evidence was used to write your claim? Reference specific parts of the table or graph.

Explain your reasoning and why the evidence supports your claim. Connect the data back to what you learned about the relationships between coral, algae, and urchins.

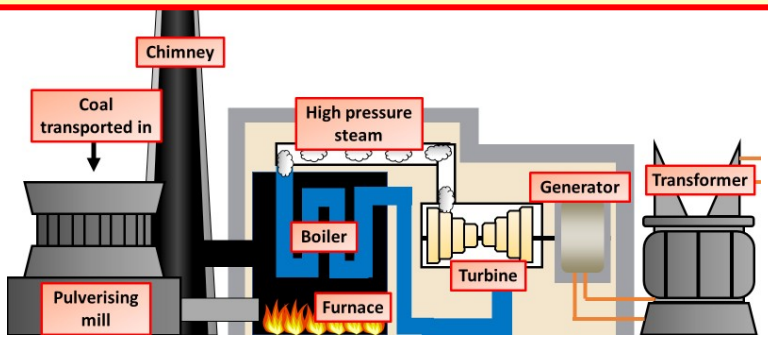
Did the data support Sarah's hypothesis? Use evidence to explain why or why not. If you feel the data were inconclusive, explain why.

Your next steps as a scientist: Science is an ongoing process. What new question(s) should be investigated to build on Sarah's research? What future data should be collected to answer your question?

WHERE DOES ELECTRICITY COME FROM?

Specification Link:
Home School Project

Task:
Make a poster that shows where electricity comes from. Write a step-by-step description of how electricity is generated using coal and wind. Make a chain that shows the steps for generating electricity. Try to identify energy transfers



Done	You might have:
	• Draw a diagram to describe how electricity can be generated using coal. • Draw a diagram to describe how electricity can be generated using wind turbines. • Identify the renewable and the non-renewable resource. • State the original source of energy for both coal and wind. • Classify a few other resources as renewable or non-renewable.
	• Draw a diagram to explain how electricity can be generated using coal. • Draw a diagram to explain how electricity can be generated using wind. • Describe the difference between renewable and non-renewable resources. • Explain the original source of energy for both coal and wind. • On the diagrams, label some useful energy transfers.
	• On the diagrams, identify useful and non-useful energy transfers. • Describe some advantages and disadvantages of using each energy resource.
	• Draw a detailed diagram to explain how electricity can be generated using coal. • Draw a detailed diagram to explain how electricity can be generated using geothermal energy. • Explain the difference between renewable and non-renewable resources. • Explain the original source of energy for both coal and geothermal energy. • On the diagrams, accurately label useful and non-useful energy transfers. • Explain, in detail, the advantages and disadvantages of using each energy resource.

Highlight key points below

Crude oil, coal and gas are fossil fuels. They were formed over millions of years, from the remains of dead organisms:

- coal was formed from dead trees and other plant material
- crude oil and gas were formed from dead marine organisms

Generators in a power stations produce electricity when a coil of wire is in a changing magnetic field. This changing magnetic field is caused by spinning a magnet inside the coil.

Fossil fuel and nuclear power stations use the energy store to heat water and produce steam to turn a turbine which is connected to the magnet, causing it to spin.

Renewable energy is energy that is collected from renewable resources, which are naturally replenished on a human timescale, such as sunlight, wind, rain, tides, waves, and geothermal heat.

Questions that you should ask yourself while completing this

What should I do first?

Is something confusing me?

Could I explain this to someone else?

Could I have used more scientific terms?

Where can I look for help?

Have I double checked what I need to include?

How can I do it better?