

*Watson Ranch
Elementary Science*

Science in the Age of Reason
*Lab and Review
Book*

LEVEL 1

Property of:

Halley's Comet



1. The 3 phases of substances are _____, _____, and _____.

2. The process where a solid turns into a gas without first becoming a liquid is called _____.

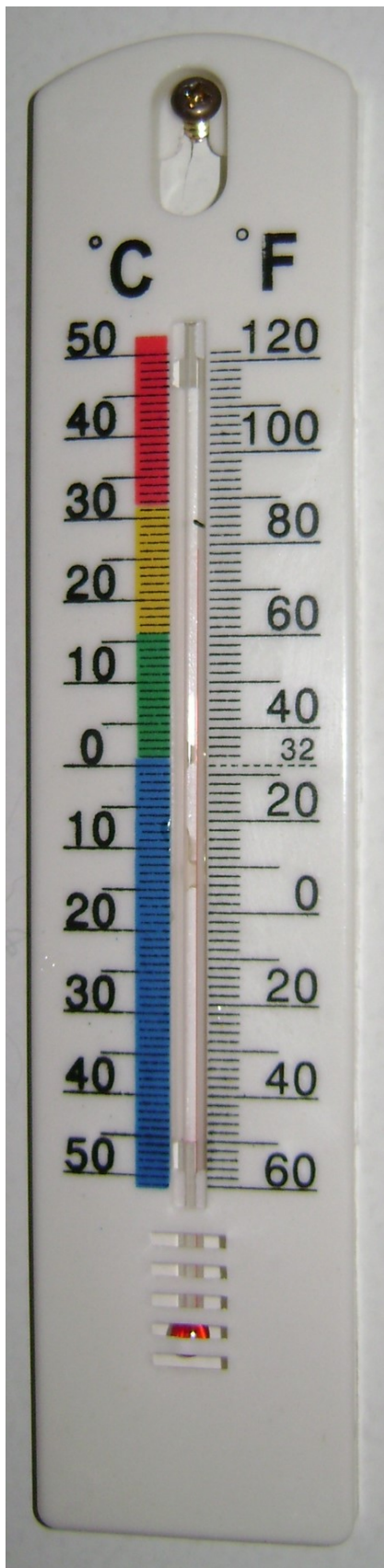
What does that process have to do with comets?

3. Comets have to get close to the _____ in order for us to see them.

Lesson 2

This is a challenge lesson, so I want to challenge you to make your own notebook page for it!

Lesson 3



1. What liquid gave Fahrenheit the best results in his thermometer?

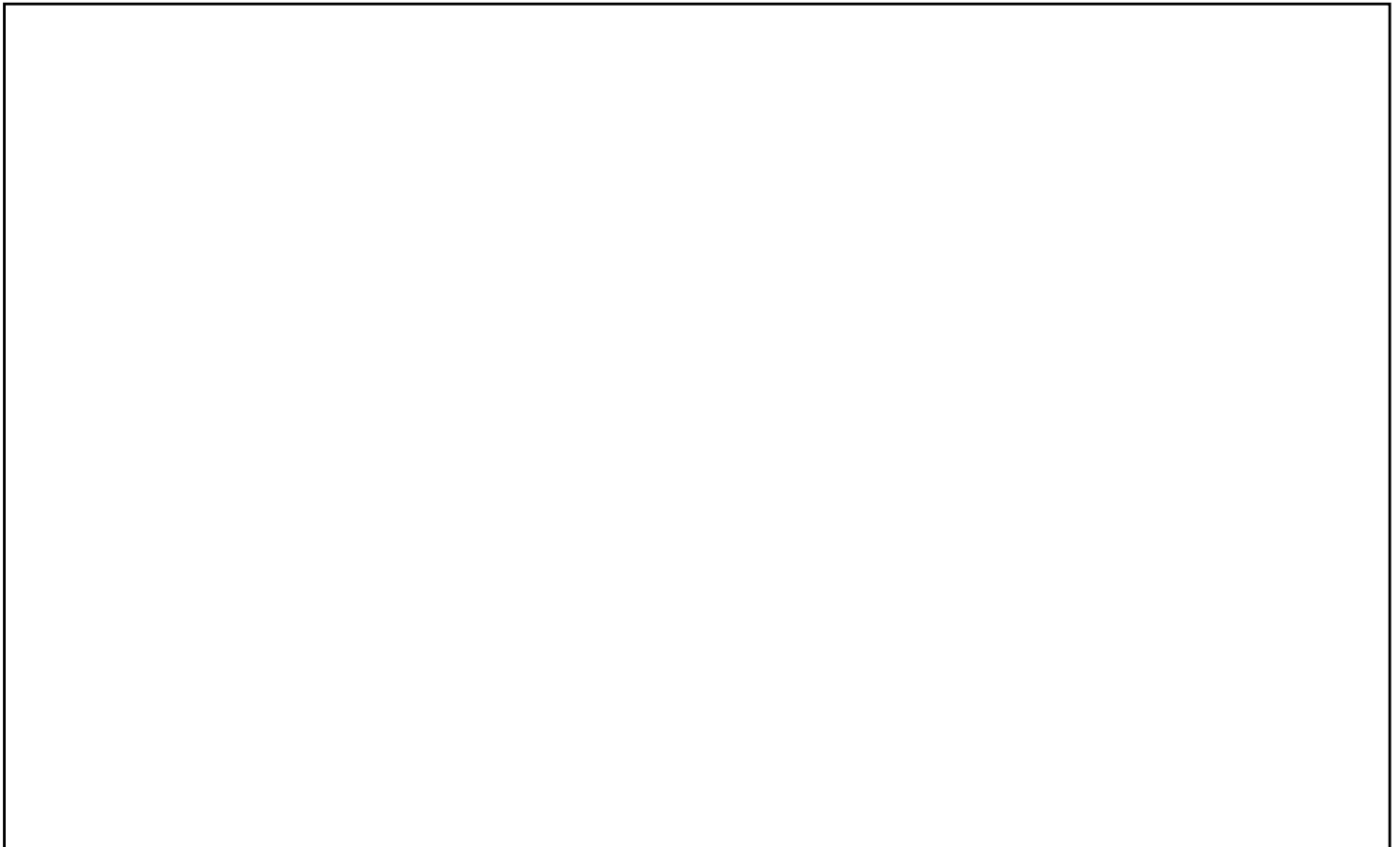
2. Soap expands dramatically in the microwave because it has a lot of _____ in it.

3. In the space below, draw a picture like the one in your book, illustrating how a Fahrenheit thermometer is made. Use the correct numbers for the Fahrenheit scale, which are different from the ones in the book, which illustrates how a Celsius thermometer is made.



Lesson 4

1. A hybrid results when members of two _____ species reproduce.
2. Thomas Fairchild made the first _____ hybrid. He did this by manually (with his hands) transferring _____ from the flower of one plant to the flower of a different plant.
3. In the box below, draw two completely different flowers. Show pollen (it looks like dust) blowing off one and onto the other to illustrate how a hybrid plant could form.



Lesson 5

1. Smallpox is a deadly disease the causes _____ on a person's skin.
2. Inoculation is when a person is exposed to a _____ on purpose with the goal of making it so the person will not catch a deadly case in the future.
3. Why was Lady Montagu important in making inoculation popular in England?



Inoculation eventually led to a safer method of protecting people from disease. It's called **vaccination**. Sometimes, people incorrectly call vaccination "inoculation." Although inoculation led to vaccination, they are not the same thing.

Lesson 6

1. Two thousand years ago, natural philosophers thought the earth was flat.

TRUE or FALSE

2. The earth is _____ at its poles and _____ around its middle.

3. In the boxes below, draw 2 pictures. In the box on the left, draw a picture of the contraption you built when it is still or spinning slowly. In the box on the right, draw a picture of the contraption when it is spinning fast. In the lines below the boxes, indicate how they relate to the shape of the earth.

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Lesson 7

1. The temperature at which water freezes is the same everywhere.

TRUE or FALSE

2. The lower the pressure, the _____ the temperature at which water boils.

3. In the Celsius temperature scale as it is used today, water freezes at _____ degrees and boils at _____ degrees at sea level and when the atmospheric pressure is at its average value. Why is it important to include the pressure and sea level?

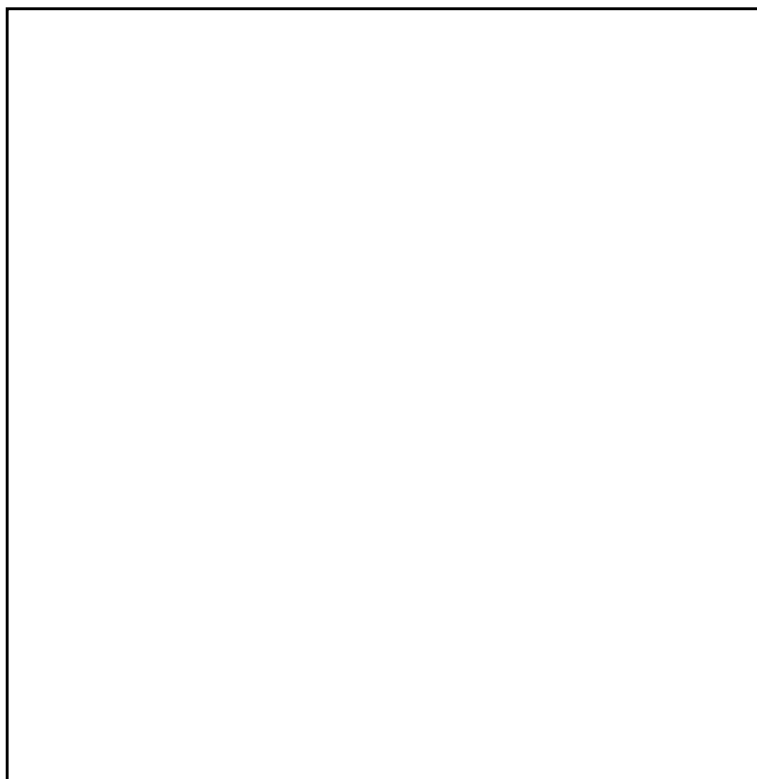


Remember, Celsius was an astronomer, too. He made an important conclusion about the Northern Lights (Aurora Borealis) being related to the earth's magnetic field.

Lesson 8

1. The process of water evaporating from inside the leaves of a plant is called _____.

2. In the box on the right, draw a stick of celery in a glass of water. The top needs to have some leaves. Use wavy lines to indicate water that is evaporating from the leaves. In the lines below, explain how that makes water travel up the plant.



Lesson 9

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Lesson 11

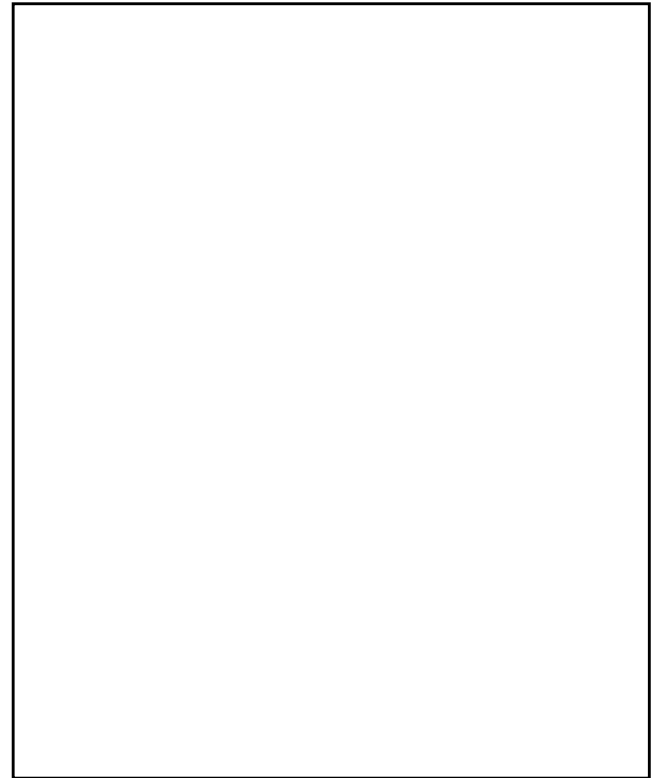
1. An electrical charge that doesn't move is called a

_____ charge

2. Materials that allow charges to move inside them are

called _____.

3. In the box on the right, draw a picture of what happened when you brought the charged foil ball near the stream of water. What did you do to charge the ball?



4. Look at the picture on the left. The girl's hair is sticking up because it has been electrically charged by the silver ball. Because each hair has the same charge,

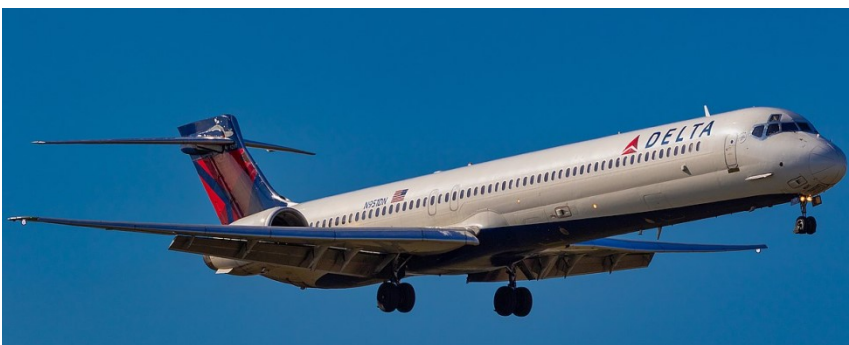
the hairs all _____ one another.

Lesson 12

1. The faster a fluid moves, the _____ the pressure it exerts. This is called the _____ Effect.

2. According to Bernoulli, the particles that make up a gas are in constant _____.

3. Explain why the water rose up the straw in your experiment.



Airplanes can fly because of the Bernoulli Effect.

Author: Nathan Coats from Seattle, WA
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Lesson 13

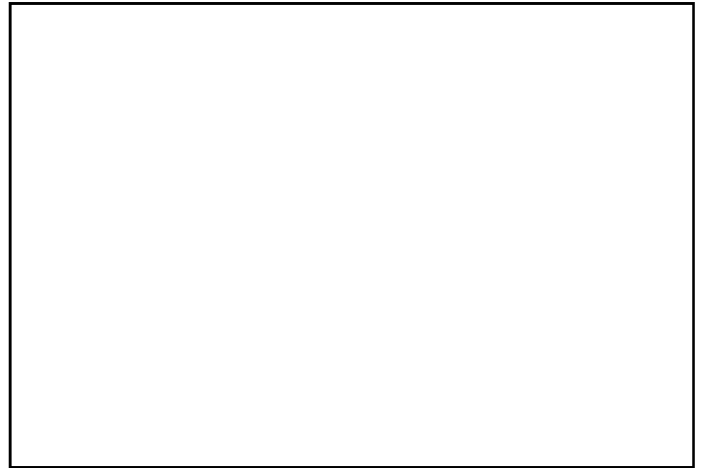
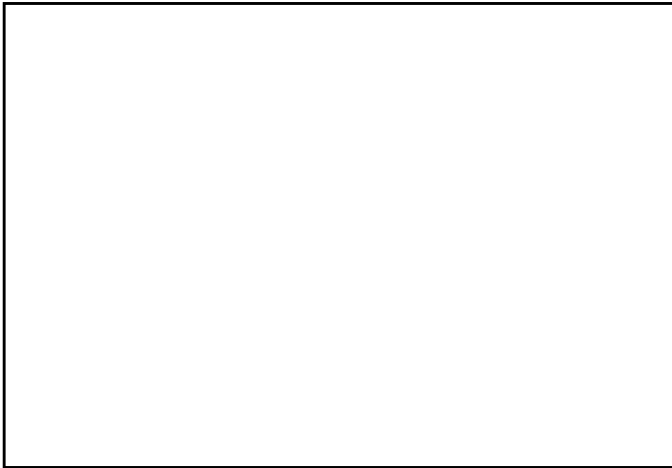
1. When a lens separates white light into colors, we call it

_____.

2. A lens that doesn't separate white light into colors is called an

_____.

3. Draw 2 pictures that represent your experiment. They should both have a magnifying glass with a black line. In the first it should be in the middle of the glass and the second should have the line at the edge. Be sure to add thin lines of color appropriately in the 2nd picture to demonstrate chromatic aberration.



The blue on the edge of this flower petal is not actually on the flower. It is a chromatic aberration.

Lesson 14

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Lesson 15

1. What was paper made from in the 1700s?

2. What is paper made from today?

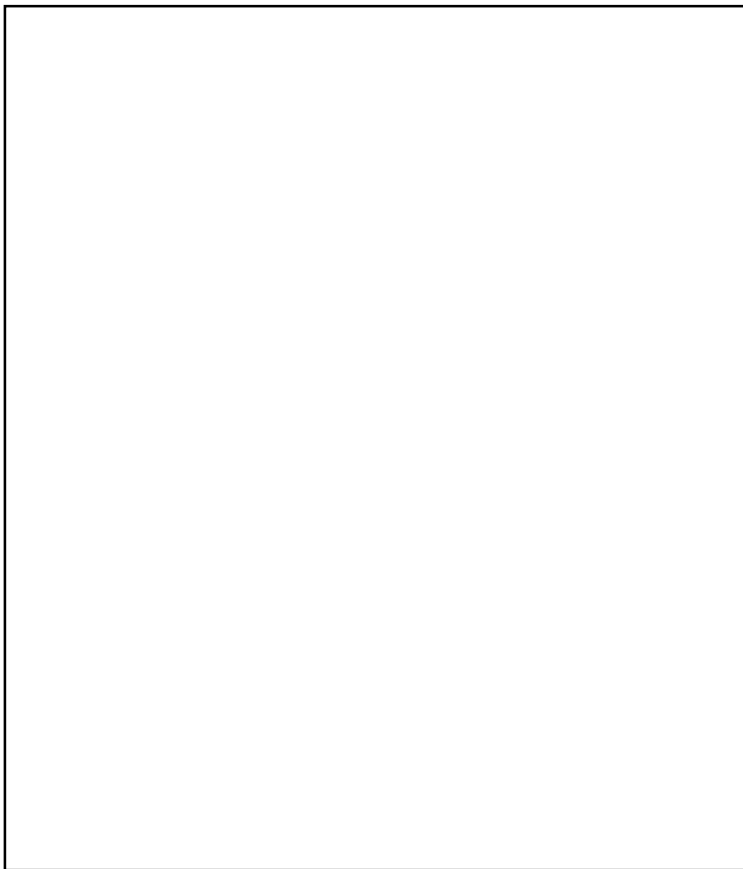
3. What inspired Réaumur to suggest that paper should be made the from the material we use today?

4. Once you are able to write something on the paper you made, tape it in the space on the right. If you have to cut it or fold it to make it fit, that's fine.

Lesson 16

1. What does a Leyden Jar store? _____

2. During van Musschenbrock's time in history, most scientists thought that electricity was some kind of _____.



3. In the box on the left, draw the Leyden jar you made in your experiment. What does it do?

4. What did van Musschenbrock think a Leyden jar stored?

Lesson 17

Record your observations from your experiment in the table below. You may use the terms “10”, “5” and “1” to describe the different stacks of pennies.

	Hottest	Mid-Temp	Coollest
15 sec			
30 sec			
45 sec			
60 sec			
1 min 15 sec			
1 min 30 sec			
1 min 45 sec			
2 min			

1. Which stack of pennies cooled off first? _____

Which cooled off last? _____

2. Buffon thought the earth was originally very hot because he thought the earth came from the _____.

3. Explain Buffon’s experiments to determine the age of the earth.

Lesson 18

1. The Law of Biogenesis states that _____ organisms only come from other _____ organisms.

2. Organisms that are too small to see with the unaided eye are called _____.

3. Organisms that we can see with the unaided eye are called _____.

4. What is abiogenesis?

5. Is it possible for both the Law of Biogenesis and abiogenesis to be true?

Lesson 19

1. The Law of Charge Conservation states that electrical _____ cannot be _____ or _____ it can only be _____ from one place to another.
2. Ben Franklin's kite experiment showed thunderstorms can produce a _____.
3. Lightning actually struck Ben Franklin's kite.

True OR False

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FRANKLIN'S EXPERIMENT, JUNE 1752.

Demonstrating the identity of Lightning and Electricity, from which he invented the Lightning Rod.

Lesson 20

1. What made the best sparks in the experiment?

The sharp end of the nail **OR** the side of the nail

2. Describe a lightning rod and how it protects a home or ship.

3. How does your experiment relate to the shape of a lightning rod?

1. The process of a liquid becoming a gas is called _____.

2. In your experiment, evaporation made both of your fingers feel cooler. But the finger dipped in alcohol felt colder. This is because alcohol

evaporates _____ than water.

3. Describe the experiment done by Franklin and Hadley and explain how it tells us why we sweat.



Lesson 22

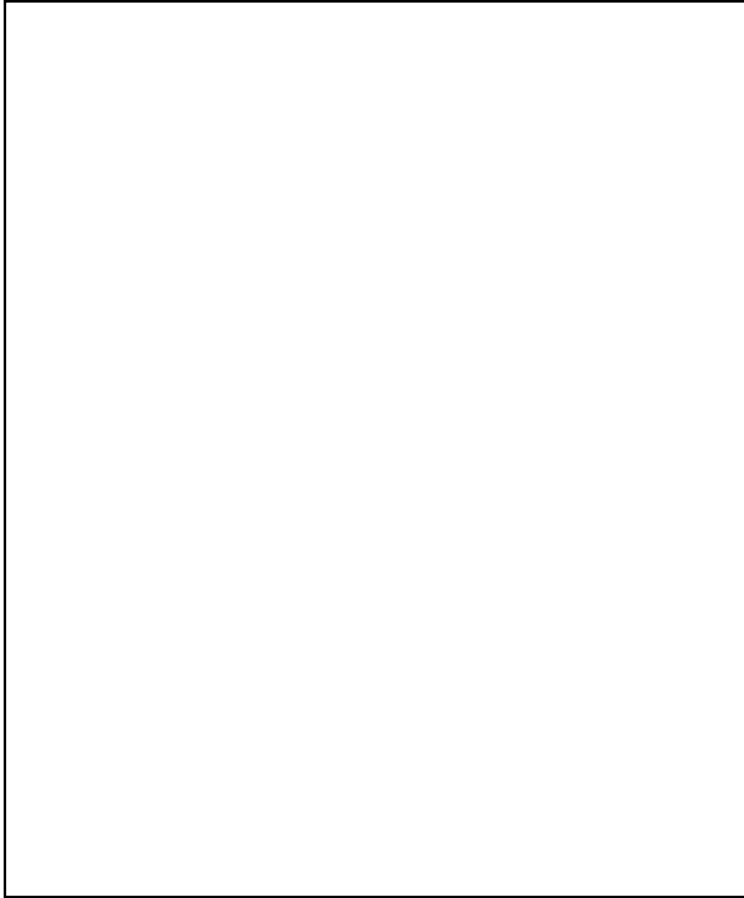
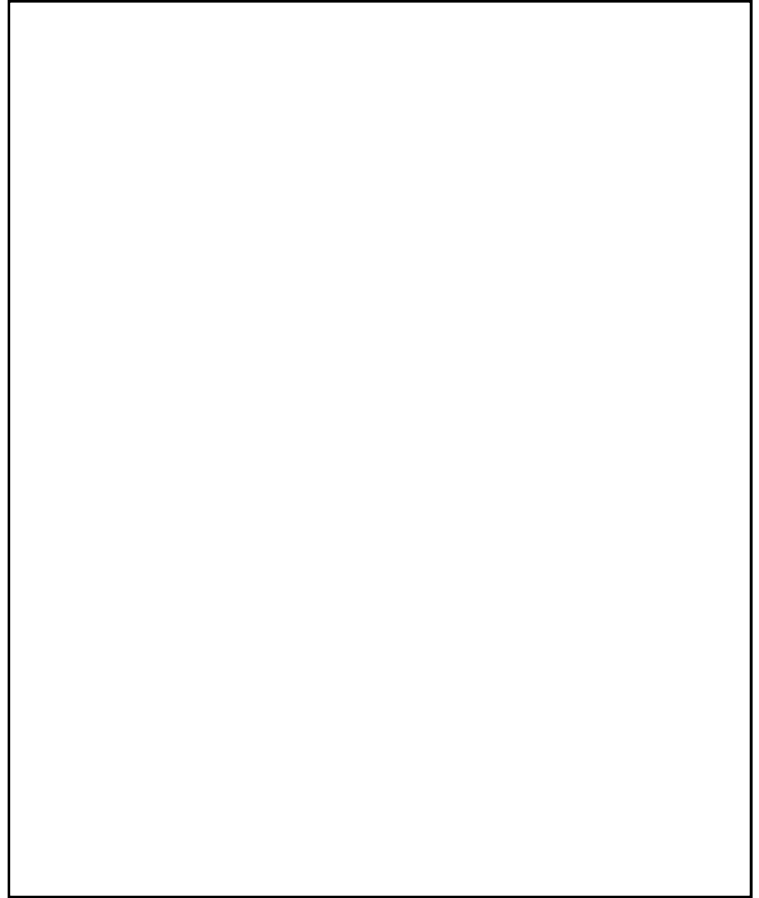
This is a challenge lesson, so I want to challenge you to make your own notebook page for it!

Lesson 23

This is a challenge lesson, so I want to challenge you to make your own notebook page for it!

Lesson 24

1. Draw each flower in the boxes below. Include in each box how many petals each has. In addition, if you can find them, indicate the number of stamens and carpels in each, and which are taller.

Flower A**Flower B**

2. List the ranks in Linnaeus's classification system (in order)

(first) _____ (fourth) _____

(second) _____ (fifth) _____

(third) _____

3. Which rank has members that are most similar? _____

4. Which rank has members that are most different? _____

Lesson 25

Fingerprint Classification

1. After examining all your finger tips on one hand identify each fingerprint as a whorl, arch or loop. Use the illustrations on pg. 76 to help

Thumb

Finger 1

Finger 2

Finger 3

Finger 4

2. Now determine what specific kind of whorl, arch or loop it is. Use the illustrations on pg 76 to help.

Thumb

Finger 1

Finger 2

Finger 3

Finger 4

3. A _____ is composed of a genus name and a species name.

4. The members of a given species are all identical. True **OR** False

5. Give the binomial names of two animals and/or plants. Indicate what the genus is and what the species is for each one.

Name: _____

Genus: _____ Species: _____

Name: _____

Genus: _____ Species: _____

Lesson 26

1. Circle the citrus fruits: apples oranges lemons bananas

2. What disease did James Lind show that citrus fruits cured?

3. Describe what you did in your experiment and how it shows that a fruit is a citrus fruit.

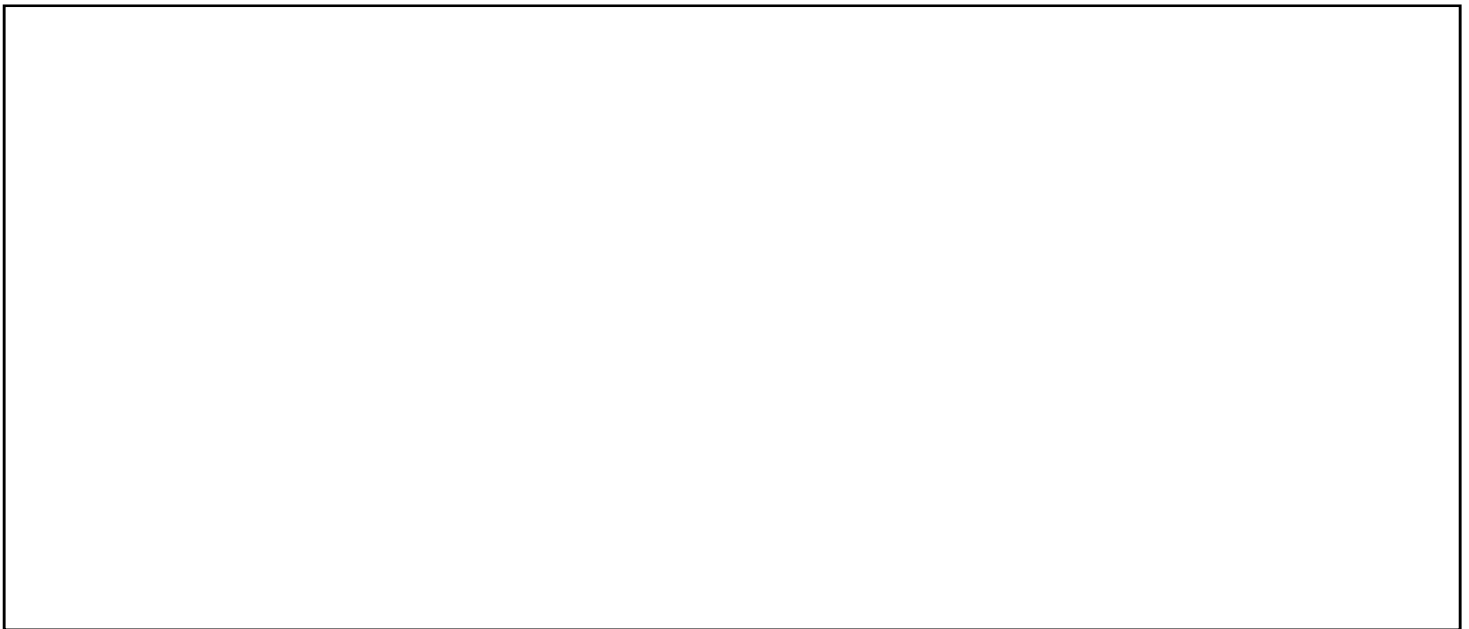


Lesson 27

1. _____ was another deadly disease that plagued sailors. It was transmitted by bacterium in insects like lice and ticks.

2. What is the name of the process that Lind suggested for turning ocean water into drinking water? _____

3. Draw a setup of that process as it would be seen in a chemistry lab.



4. What did James Lind suggest for fighting the disease you wrote in the blank for #1. Why did it work?

Lesson 29

1. A substance with a _____ specific heat will experience significant changes in temperature with the absorption of a *small* amount of energy.
2. A substance with a _____ specific heat will experience significant changes in temperature with the absorption of a *large* amount of heat energy.
3. Which has a higher specific heat?

Water **OR** Sand

4. Describe your experiment and the specific heats of water and the balloon to explain the results.

Lesson 30

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Lesson 32

This is a challenge lesson, so I want to challenge you to make your own notebook page for it!

Lesson 33

1. When charges travel from one charged object to another object, causing that other object to become charged, it is called charging by _____.

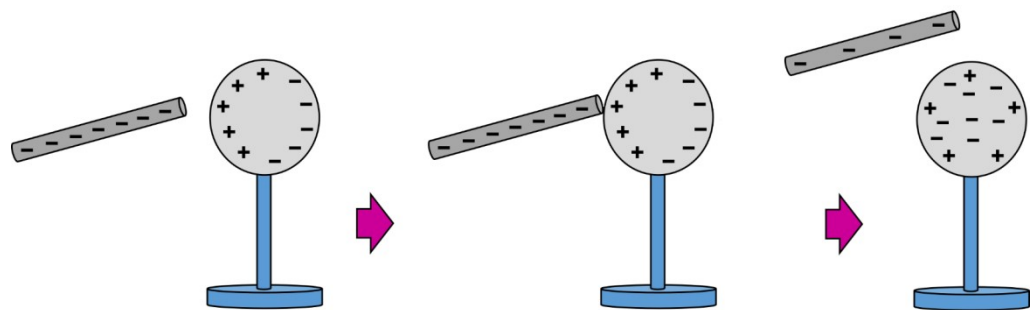
2. When the charges on a charged object don't go anywhere, but instead they force the charges in the other object to move away (through a finger, for example), resulting in the other object

becoming charged, it is called charging by _____.

3. Which of the 2 methods described above is the way the pie pan became charged in your experiment?

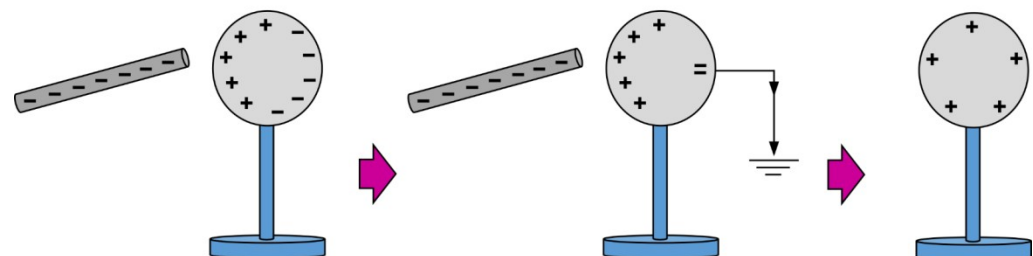
Charging by conduction:

The charged object you are using touches the object you are charging.



Charging by induction:

The charged object you are using never touches the object you are charging.



Lesson 34

1. What does “inflammable” mean?

2. What 2 elements combine to make water?

_____ and _____

3. *Draw a picture of your experiment, showing the bubbles coming from the battery and the bottle top collecting the gas.*



4. How did you find out that the hydrogen you collected was inflammable?

Lesson 35

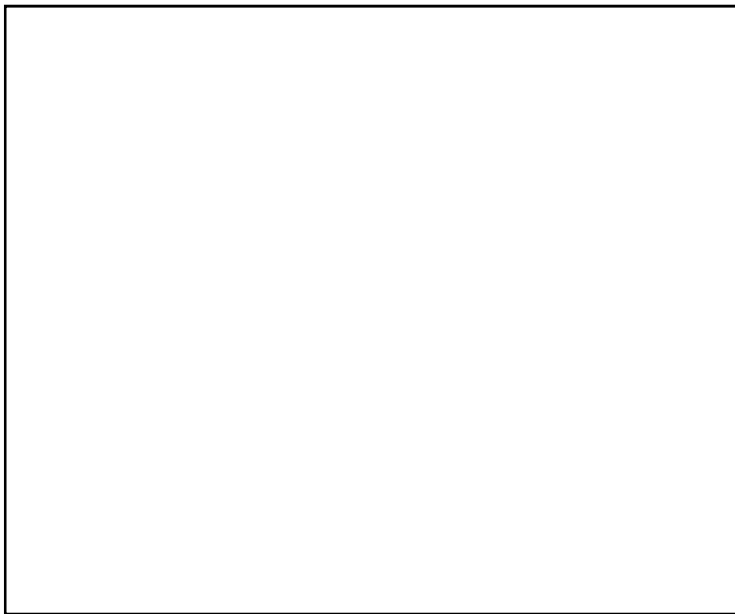
1. What two gases make up most of the air that we breathe?

_____ and _____

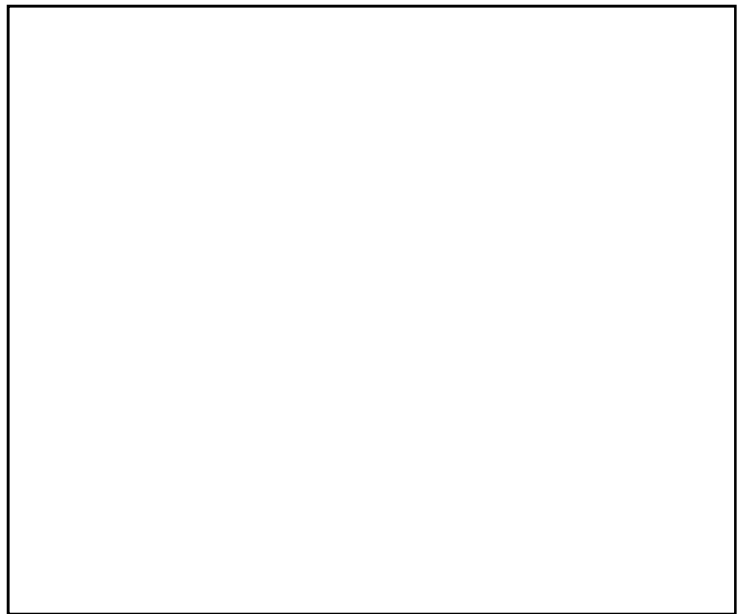
2. In order to rust, iron must react with water and _____.

3. Draw “before” and “after” versions of your experiment:

Before



After



4. Why did the bottle with steel wool have water pulled into it?

5. Would the bottle with steel wool ever fill up with water?

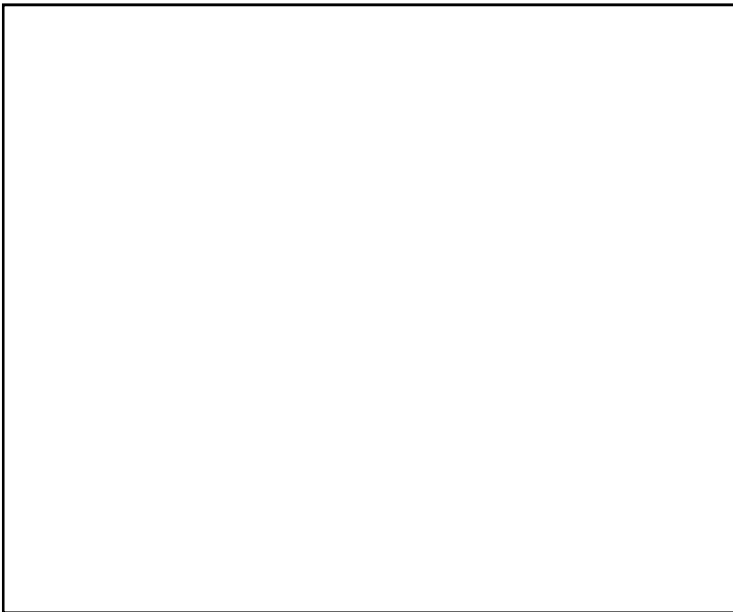
Lesson 36

1. What caused the balloon in your experiment to inflate?

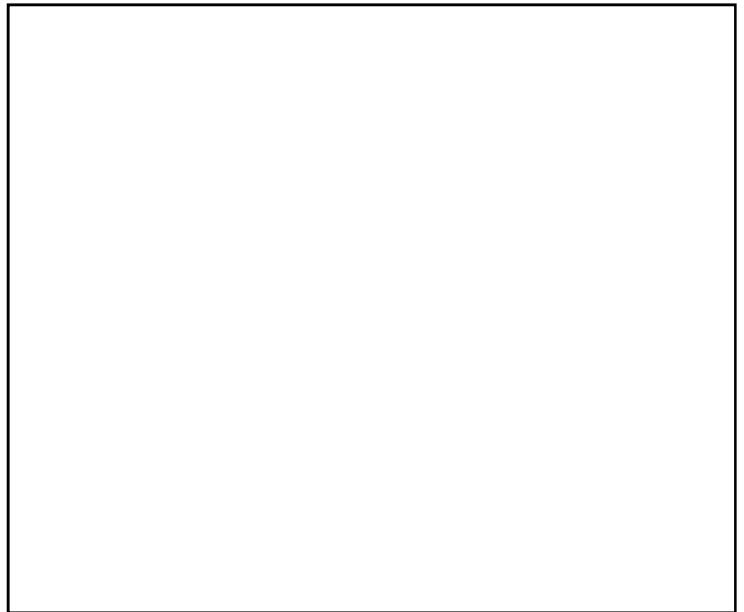
2. What caused the balloon in your experiment to deflate?

3. *Draw two pictures of your experiment. One should be of the bottle and balloon after they came out of the microwave, and the other should be after the bottle was submerged in the ice.*

After Microwave



After Ice



4. The experiment caused _____ energy to be converted into _____ energy.

Lesson 37

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Lesson 38

This is a challenge lesson, so I want to challenge you to make your own notebook page for it!

Lesson 39



Did you enjoy the “fizzy lemonade” you made in your experiment? _____

1. The process in which yeast converts some chemicals into alcohol is called _____. As a part of this process, _____ is released.

2. What did Priestly do with carbon dioxide to spawn a new industry?

3. Where did he get that carbon dioxide?

4. What term do we use to refer to the drinks made by the industry Priestly spawned? _____

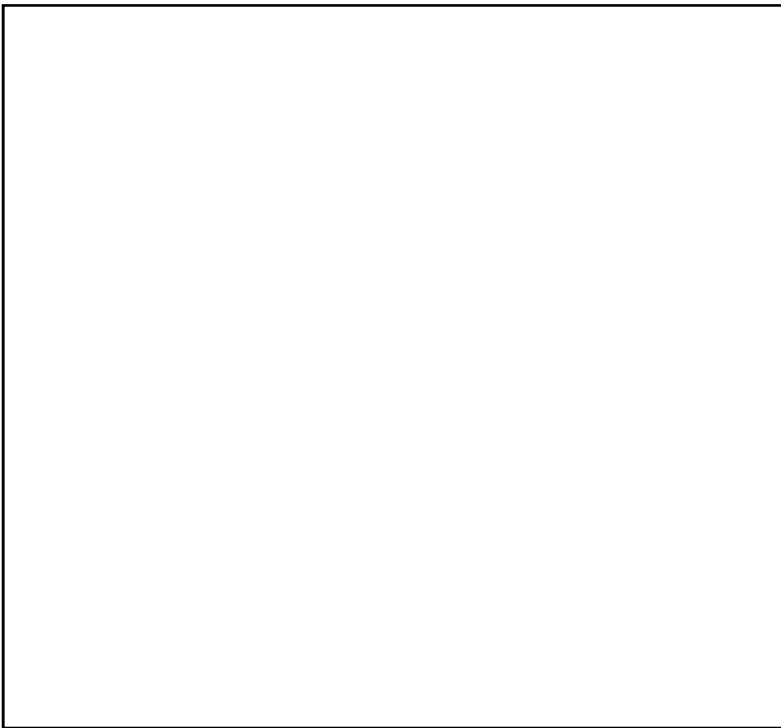
Lesson 40

1. Plants take in carbon dioxide, water, and sunlight to make glucose and _____.

2. Organisms that use oxygen need plants, and plants need the organisms that use oxygen.

True OR False

3. Draw a picture and use it to explain photosynthesis.



Lesson 42

1. The law known as The Conservation of Mass says:

2. Matter is anything that takes up _____ and has _____.

3. _____ is a measure of how much matter is in something.

4. Mass is the same as weight. True **OR** False

5. Pounds are a unit for measuring _____. Grams are a unit for measuring _____.

I like you just the weigh you are!



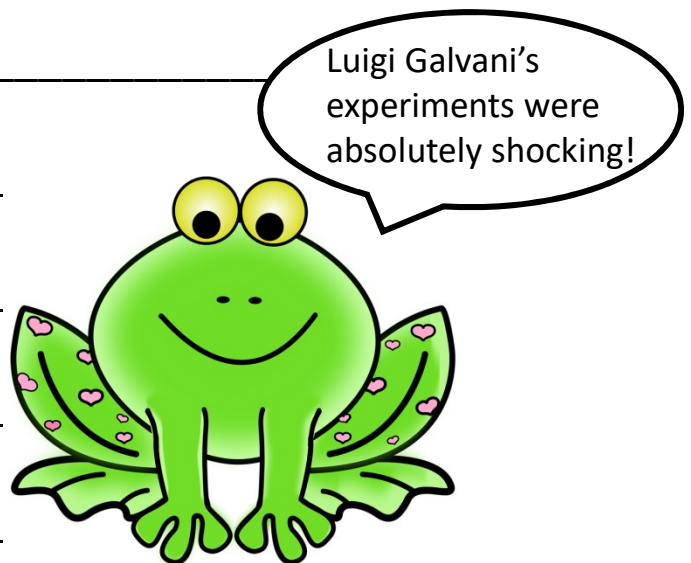
Lesson 44

1. _____ travel along nerves and control muscles.
2. Galvani's frog legs produced their own electricity, even though the frog was dead.

True **OR** False

3. What happened to dead frog legs when Luigi Galvani applied an electrical shock to them?

4. Why did Galvani think the frog's legs made their own electricity?



Lesson 45

1. _____ is the main component (part) of natural gas.

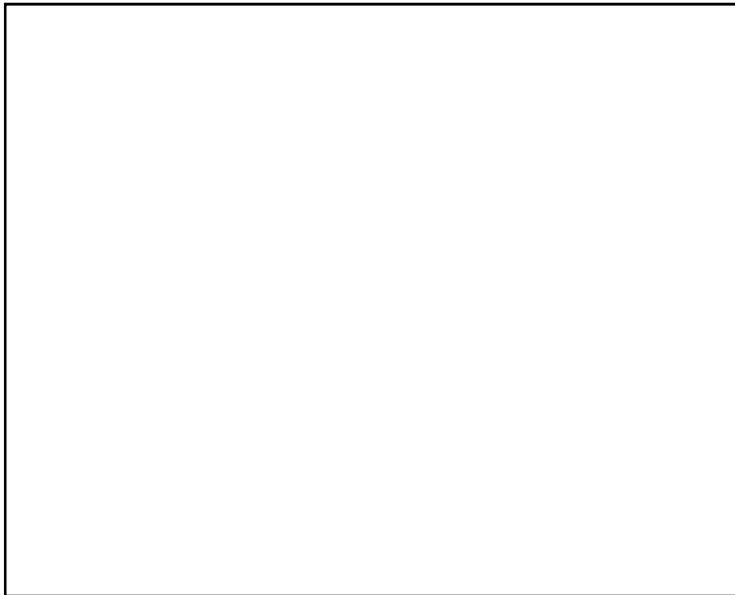
Name 2 ways to get methane (HINT: Your experiment was one way)

I. _____

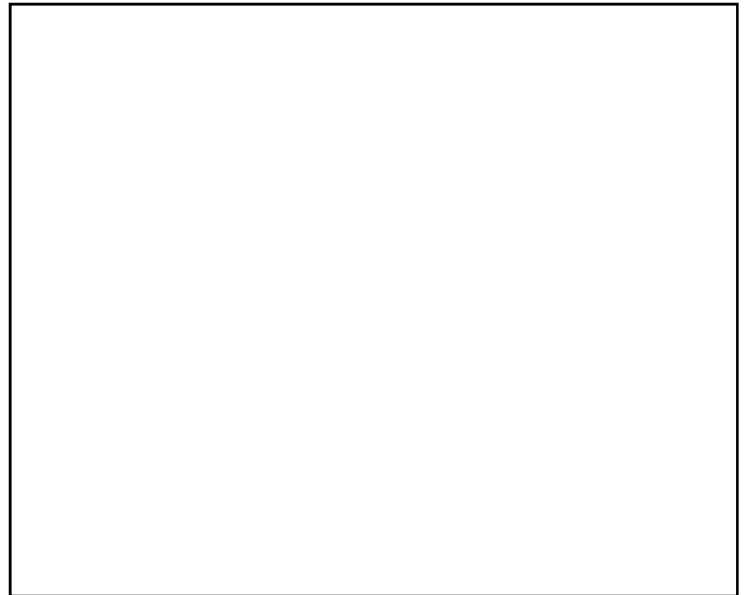
II. _____

2. *Draw two pictures of your experiment. The first one should be of the initial setup. The other should depict what you saw four days later.*

Initial



Four Days Later

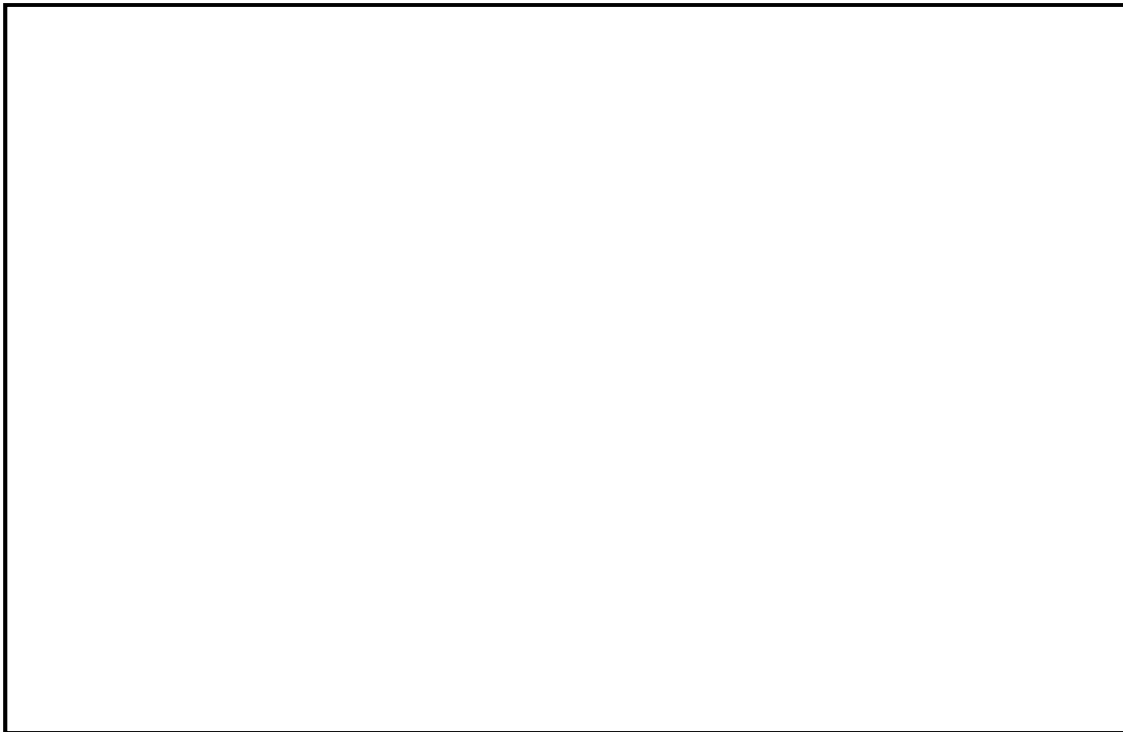


3. Why was the balloon partially inflated four days later?

1. When Galvani thought the frogs' legs were making electricity, where was it really coming from?

2. The voltaic pile was improved to make what we call a _____ today.

3. *Draw the voltaic pile you made in your experiment*



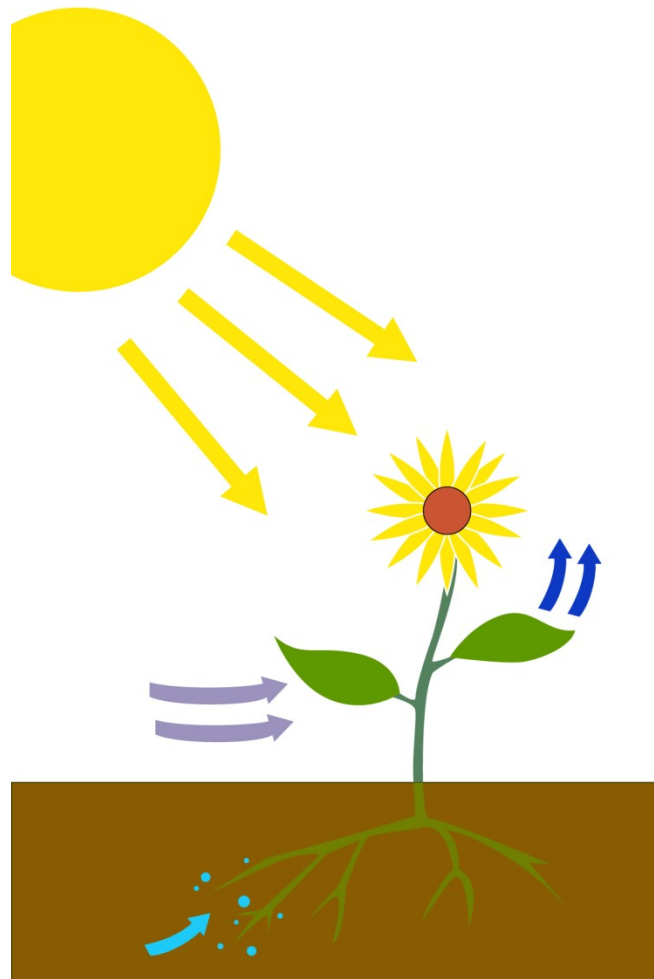
Lesson 47

1. Photosynthesis requires water, carbon dioxide, and

_____.

2. Why do plants need chlorophyll to do photosynthesis?

In the drawing on the right, the arrows pointed towards the plant represent things needed for photosynthesis. The arrows pointing away from the plant represent something made by photosynthesis. Can you label what each set of arrows represent? HINT: There are no arrows that represent glucose.

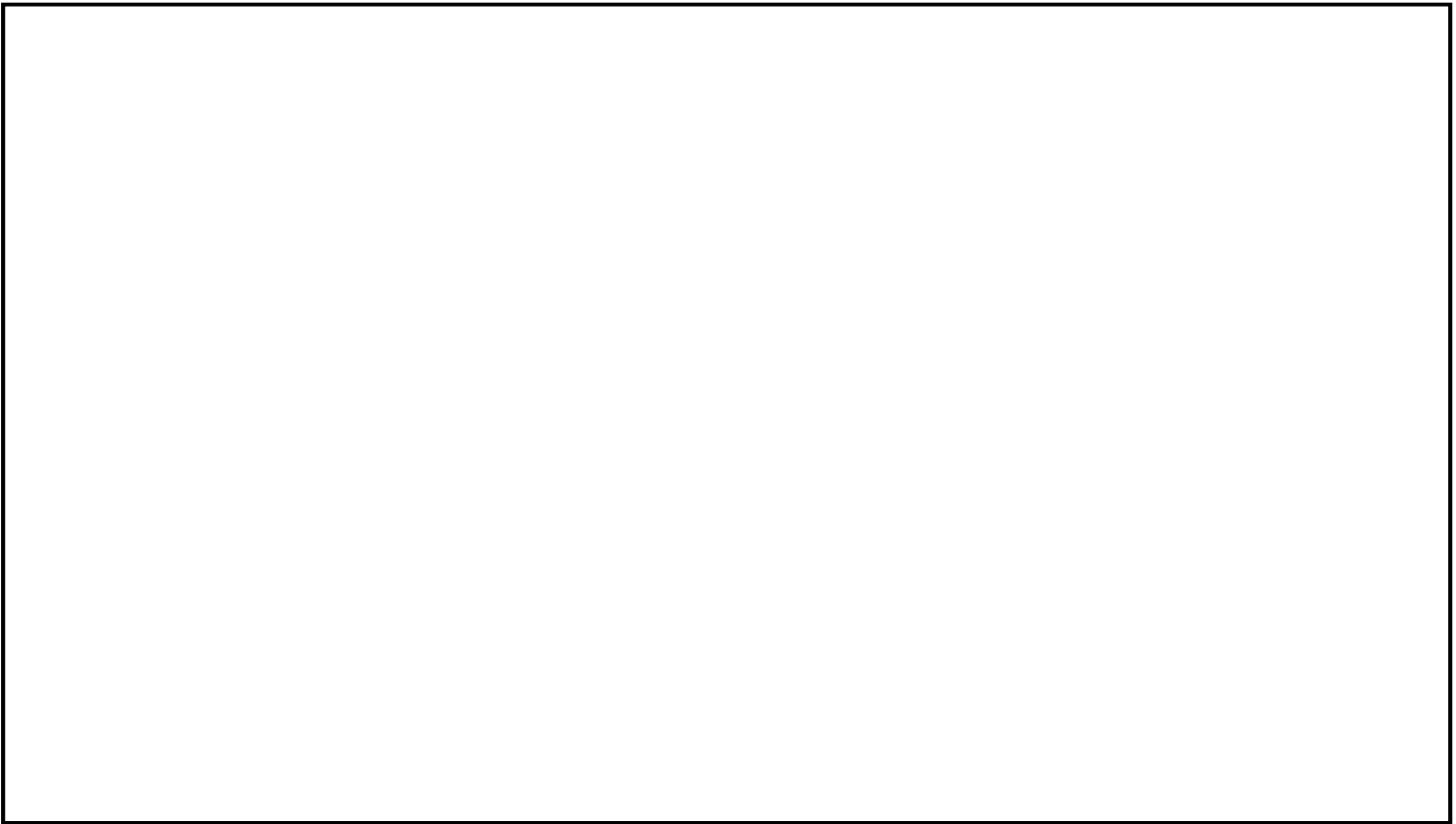


Author: At09kg
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1. What do scientists call the “mouths” of a leaf?

2. When a leaf’s “mouths” are open, it can do photosynthesis, but it loses

3. *Make a drawing like the picture on page 149. Point out the stomata.*



4. Why do stomata open and close?

1. The collection of gases that surround the earth is called the

_____.

2. What happens to the temperature of a gas as it expands **without** being heated (like in your experiment)?

3. How do clouds form?



Lesson 50

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Lesson 51

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1. When two stars orbit one another we call it a _____
_____.

2. When three stars orbit one another we call it a _____
_____.

3. When more than three stars orbit one another we call it a
_____.

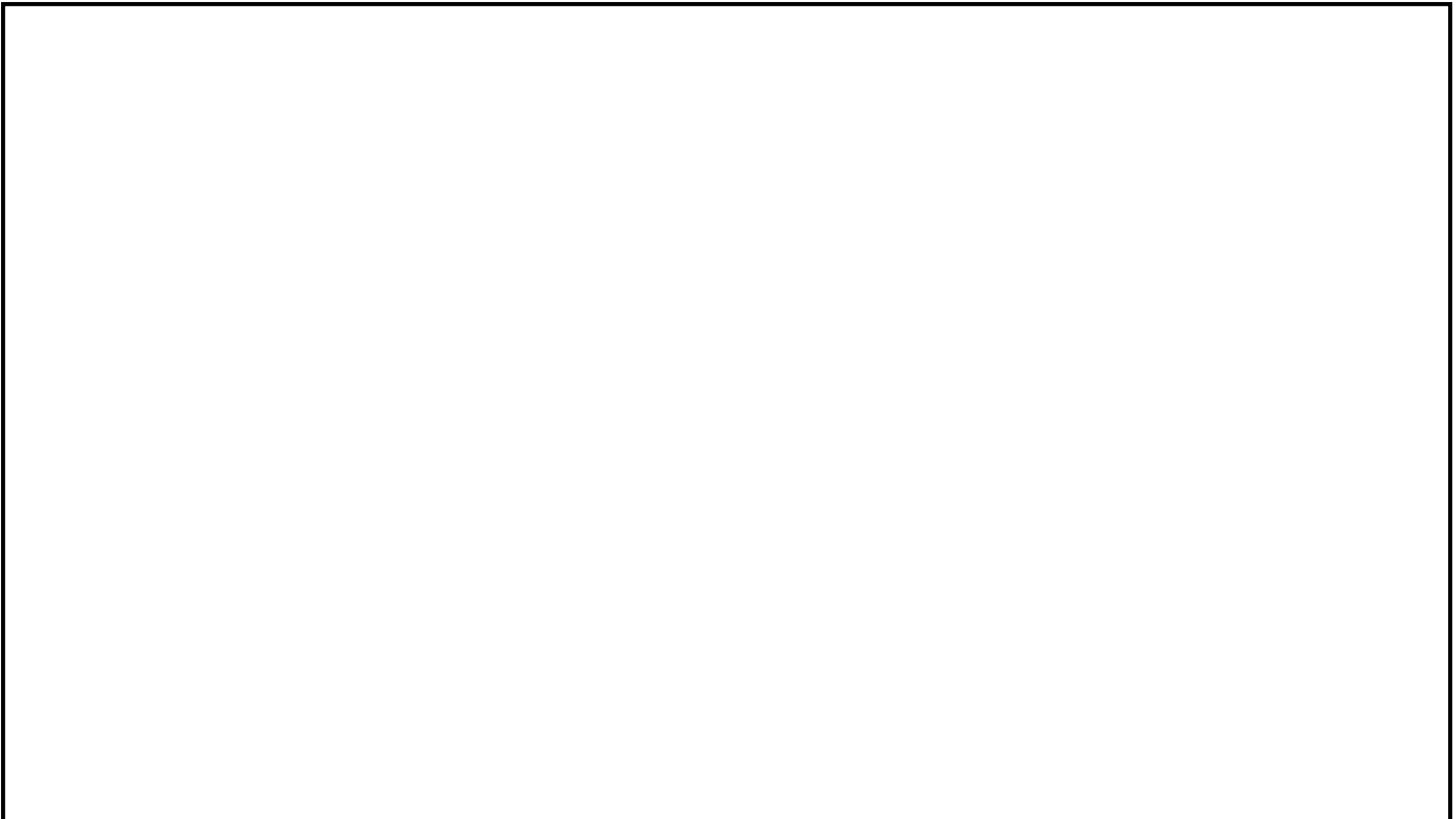
4. What planet did William and Caroline Herschel discover?

5. How was it determined that Uranus is a planet?

1. We cannot see infrared light. True **OR** False

2. In your experiment, why was the hand wrapped in foil warmer than the one wrapped in plastic?

3. Draw a rainbow in the box below. Then indicate where the infrared light would be by writing the letters “IR” (infrared) in the appropriate location.



Lesson 56

This is a challenge lesson, so I want to challenge you to make your own notebook page for it!


1. The bubble in your experiment didn't have an overall charge.

True **OR** False

2. Which charges in the bubble were closer to the balloon?

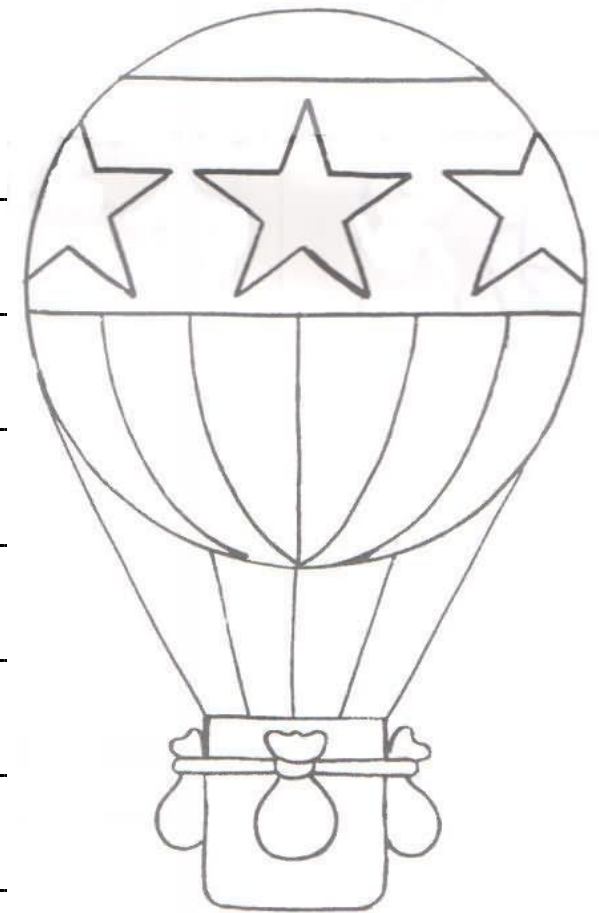
The Positive Ones **OR** The Negative Ones

3. Draw a diagram like the one on page 176 to show what happened in your experiment.

A large, empty rectangular box with a black border, intended for the student to draw a diagram illustrating the results of their experiment.

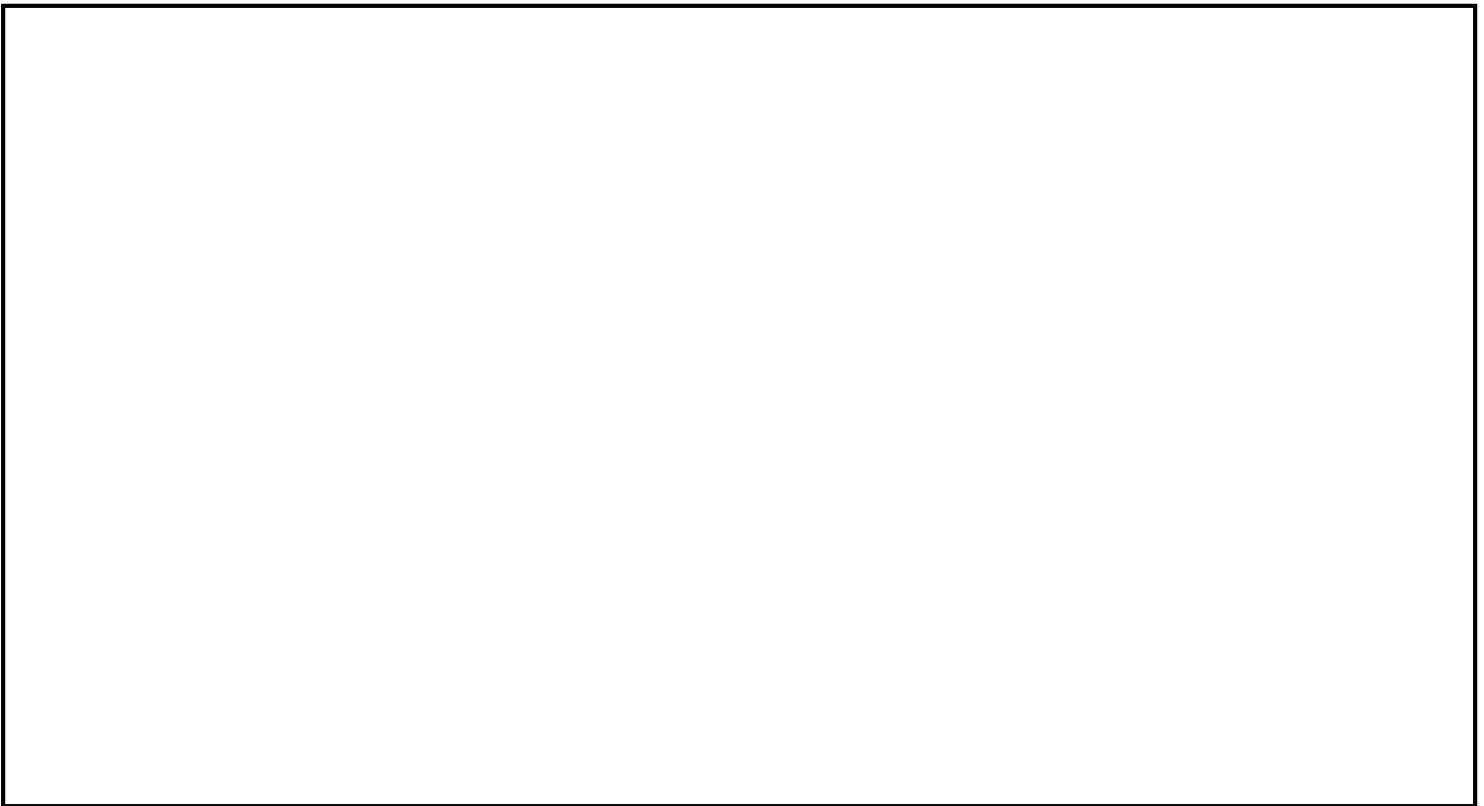
1. Write down Charles's Law in your own words, being sure to make it as precise as possible.

2. What was Charles known for in his day?



Hot air balloons are often brightly colored. Color this one any way you wish.

1. Heat only flows from hot things to cold things. True **OR** False
2. If an object loses more heat than it gains, it gets _____.
3. Draw a picture like the one on page 181, and use it to explain why the man in the drawing gets warm. Don't use the term "caloric fluid," however, since heat isn't actually a fluid. Also explain what will happen to the temperature of the fire, unless more fuel is added.



1. From a chemical standpoint, what is the opposite of an acid?

2. What is neutralization?

3. Explain the experiment you did, using the terms “acid,” “base,” “neutralize,” and “anthocyanins.”

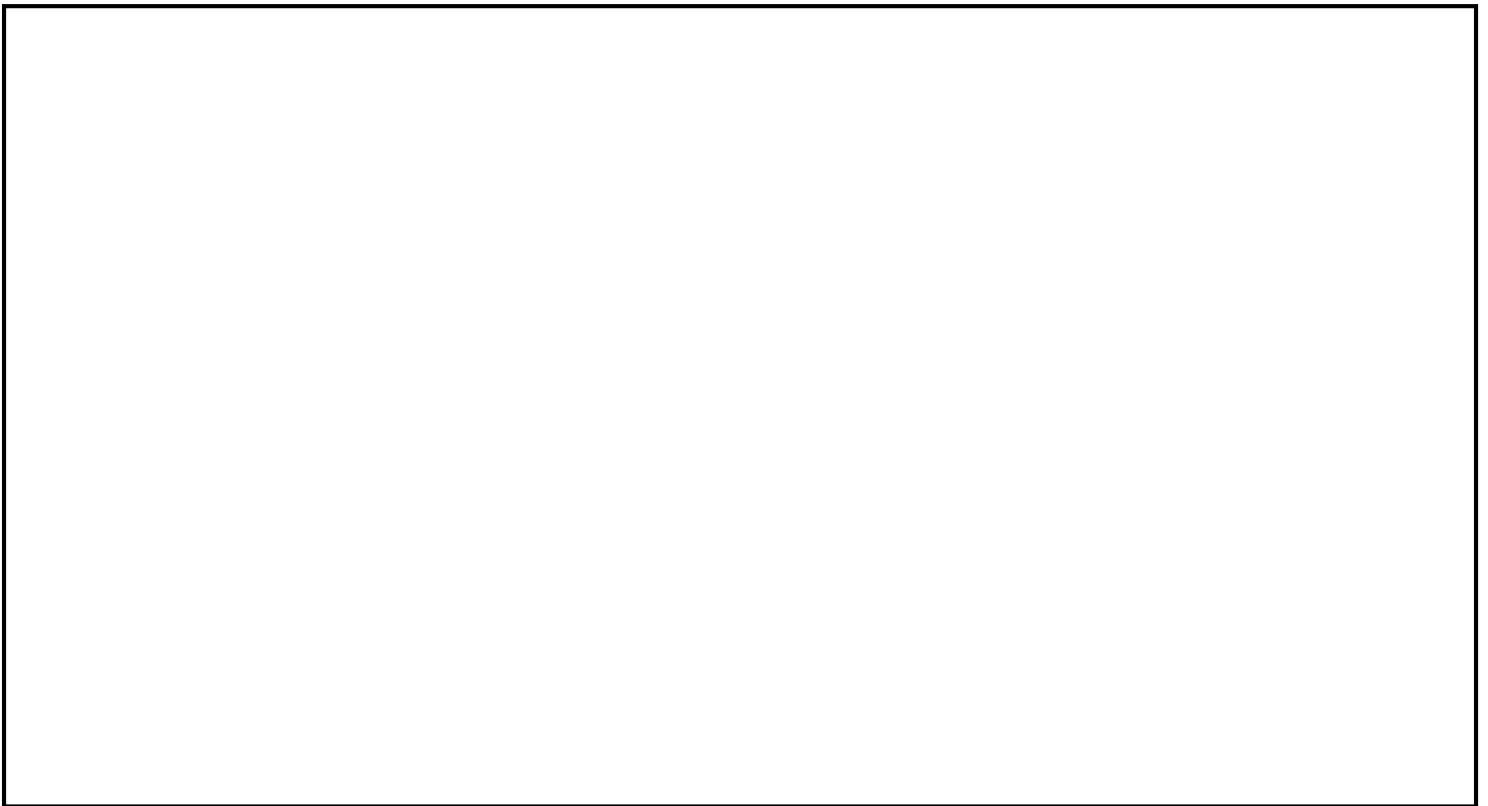
Lesson 61

1. When magma fills a crack in a rock and hardens, we call the result an

_____.

2. Rocks that form from magma are called _____ rocks.

3. Draw a picture that illustrates an intrusion. It can be like the photo on page 188, or something more creative.



1. Hutton figured out that _____ changes not only soil, but also rocks.

2. Where did Hutton think the rocks of mountains that had sea creature fossils actually formed?

3. Explain how Hutton thought heat from underneath the earth and erosion worked together to constantly change the earth.



Believe it or not, erosion caused this rock to be shaped like an elephant!

(Artist: Francesco Canu License: CC 3.0)

1. What kind of rock is like the dough you made in your experiment?

2. What do we call the layers that sedimentary rocks form?

3. List some differences between sedimentary and igneous rock.

4. Explain how and where Hutton thought sedimentary rock formed, using the word "strata."

Lesson 64

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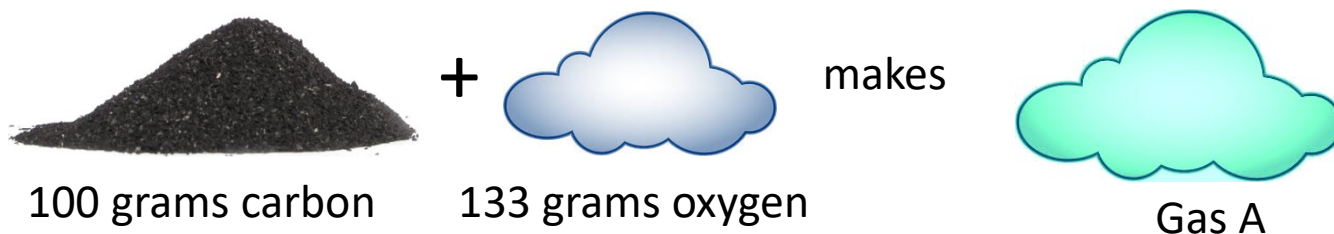
Lesson 66

1. When two elements react, they can form only one chemical.

True **OR** False

2. What is the name of the law that Joseph Proust discovered?

3. A chemist makes two gases according to the following recipes:



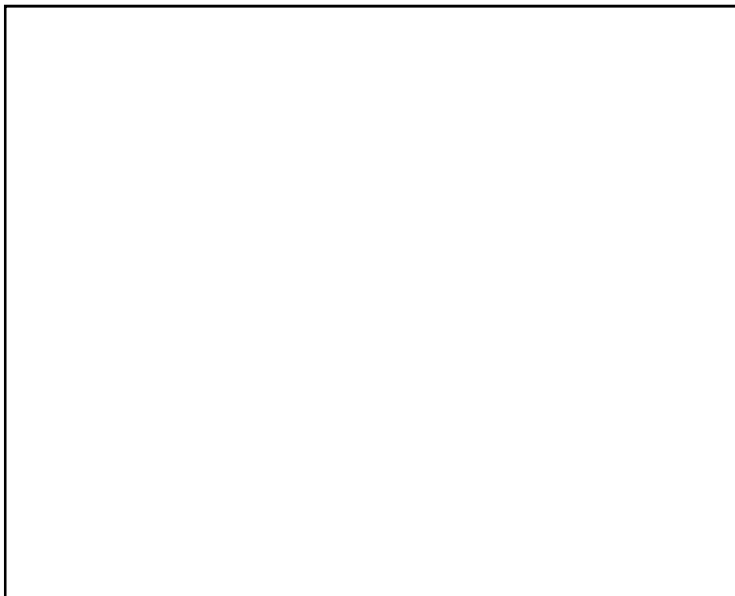
Are Gas A and Gas B the same gas or different gases? Why? Check your answer and correct it if it is wrong.

Lesson 67

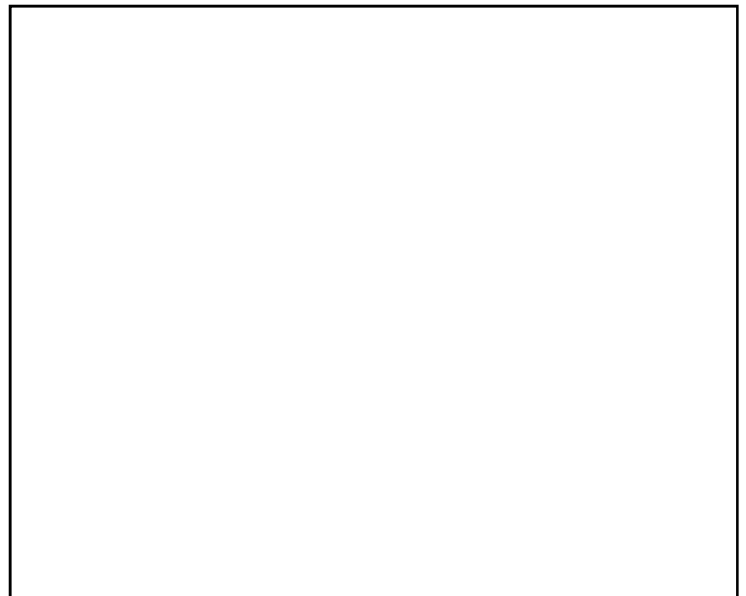
1. Lavoisier thought that heat was an _____.
2. Davy thought that heat had something to do with _____.
3. When an object is heated, the motion of its atoms and molecules?

4. Draw what the two bowls looked like in step 11 of the experiment, and explain why the bowl that had hot water in it had a more even distribution of color.

Bowl with hot water



Bowl with cold water



Lesson 68

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Lesson 69

1. The distinct types of material that you find in a living creature are called _____.

2. Draw lines from the tissue on the left to its description on the right:

Epithelial Tissue

Helps connect one thing to another in the body

Muscle Tissue

Makes up the skin of the body and lines organs

Connective Tissue

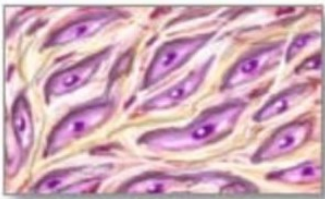
Makes up your nerves, spinal cord & brain

Nervous Tissue

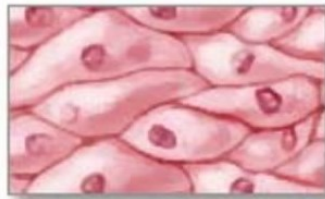
Made of long, “stringy” fibers; aids movement

3. The tissue that makes up the thin, transparent structure in your experiment is called _____.

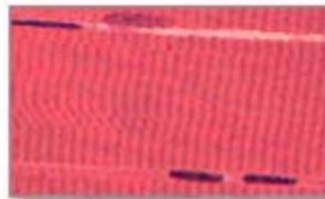
Here is what the four types of tissue look like under a microscope:



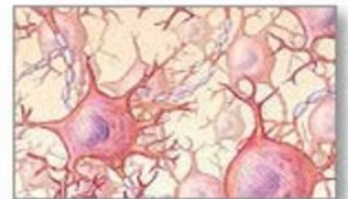
Connective
Tissue



Epithelial
Tissue



Muscle
Tissue



Nervous
Tissue

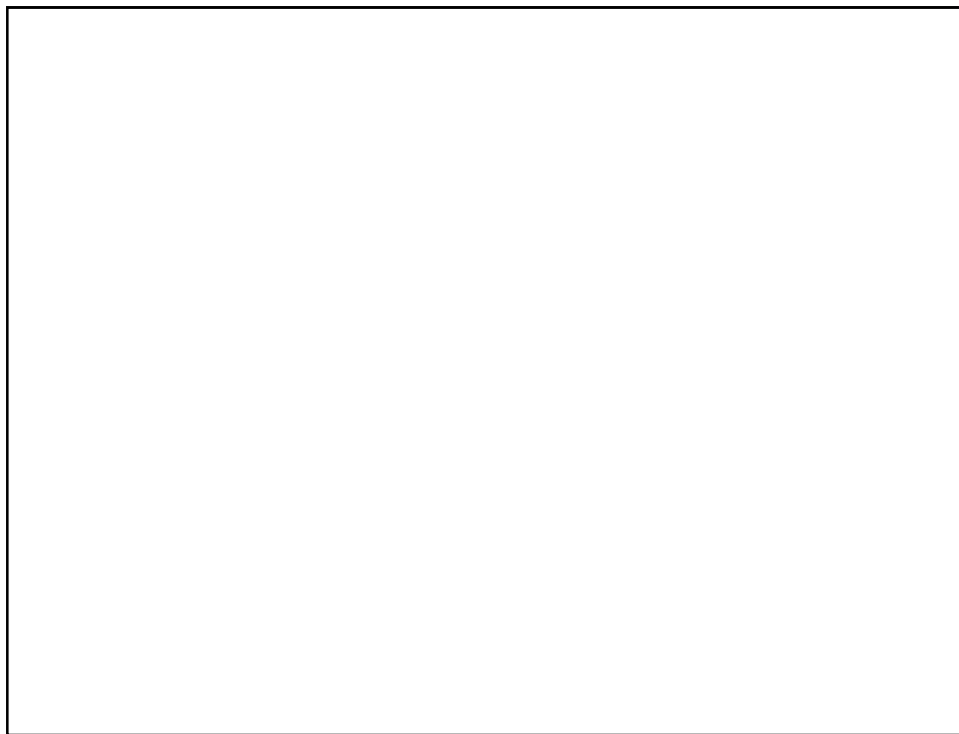
Lesson 70

1. Electrolysis is when we use _____ to break down chemicals.

2. What two elements are made in the electrolysis of water?

_____ and _____

3. Make a drawing that represents the first part of your experiment. It should have the two foil wires going from the battery into the bowl of water.



4. What was necessary in order to see lots of bubbles? Why?

Lesson 71

1. Besides the gases in the air, what gases were in the bottle that held the carbonated drink?

2. Dalton's Law of Partial Pressure tells us that when gases are mixed together, they each exert their own pressure, and the total pressure is the

_____ of the individual pressures.

3. Explain your experiment and why the balloon covering the bottle with the carbonated drink was inflated more than the balloon covering the bottle with the water.

Dalton's Atomic Theory

1. _____

What is wrong with this principle: _____

2. _____

Is this principle completely correct? _____

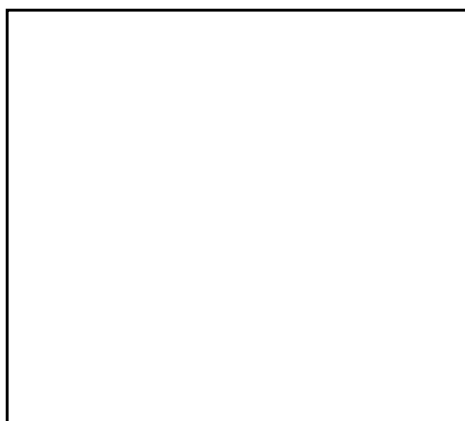
3. _____

4. _____

Lesson 73

Remember to update the previous page with the third principle of Dalton's atomic theory!

1. Draw pictures of the five molecules you made in the experiment and give their chemical formulas under the drawings:



Lesson 75

This is a challenge lesson, so I want to challenge you to make your own notebook page for it!

Lesson 76

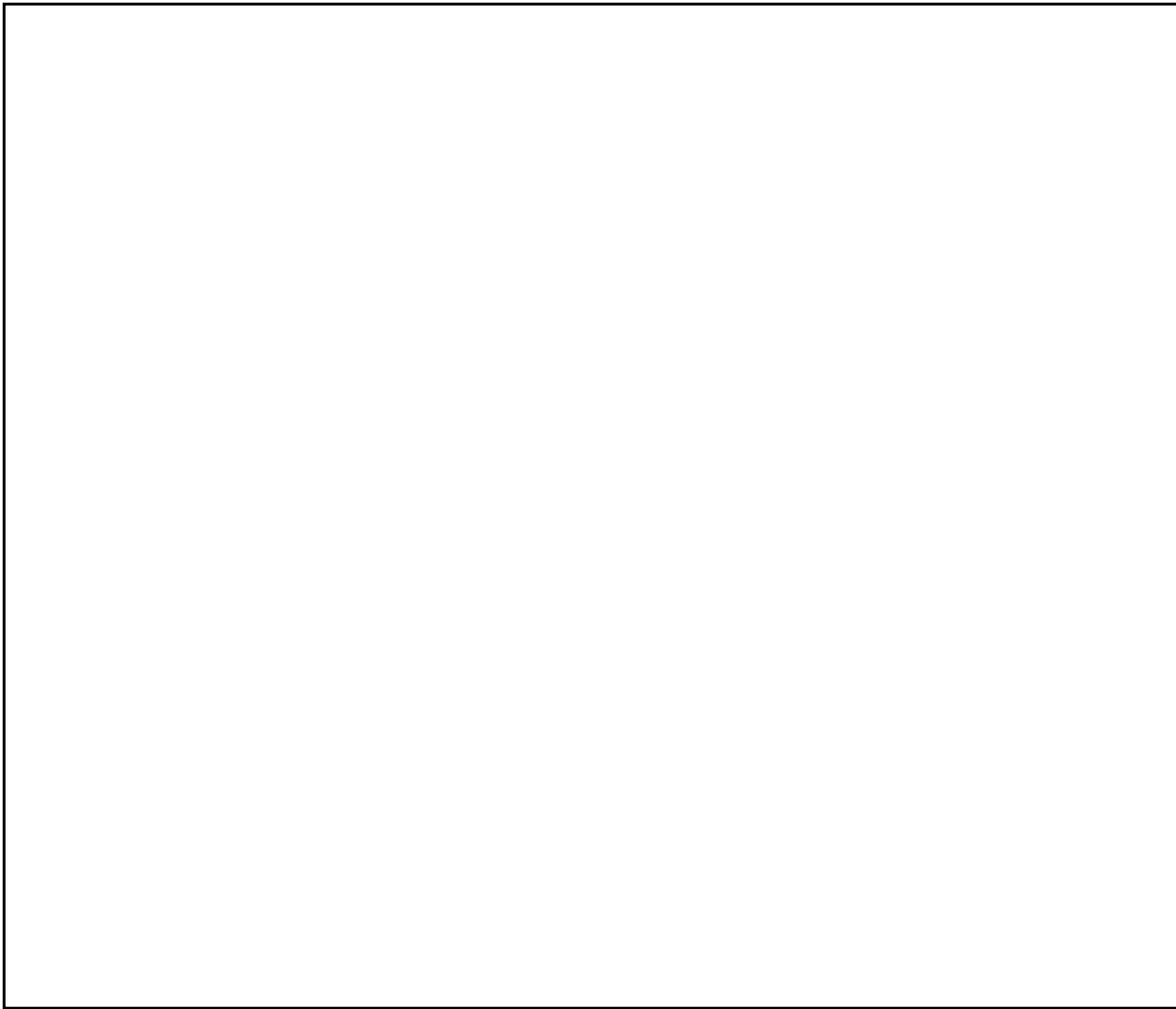
1. Why does a can of carbonated drink hiss when you open it?

2. Why are carbonated drinks packaged that way? (Use Henry's Law in your explanation.)



Lesson 77

1. Draw a picture like the one on page 238, labeling the cornea, retina, lens, and ciliary muscle.



2. Where is the light focused in the eye? _____

3. What does the lens do to change the distance at which it is focusing?

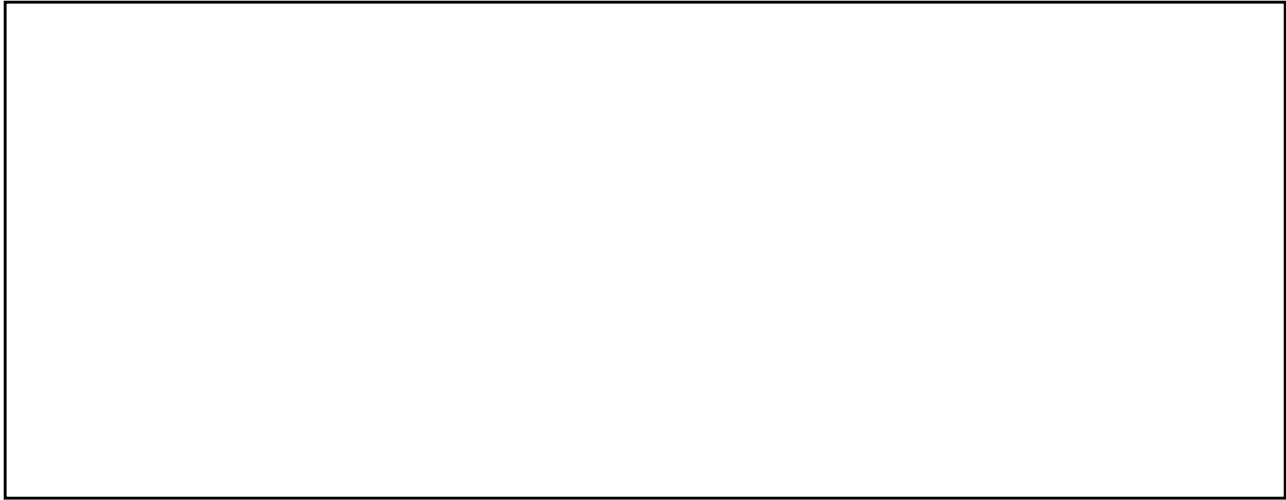
Lesson 78

1. Draw a picture like the one on the bottom of page 240. For one of the waves, label a crest and a trough.



2. When two waves overlap like that to make a new wave, what do we call it?

1. Draw a wave below, indicating what the wavelength is.



2. What does wavelength determine for light?

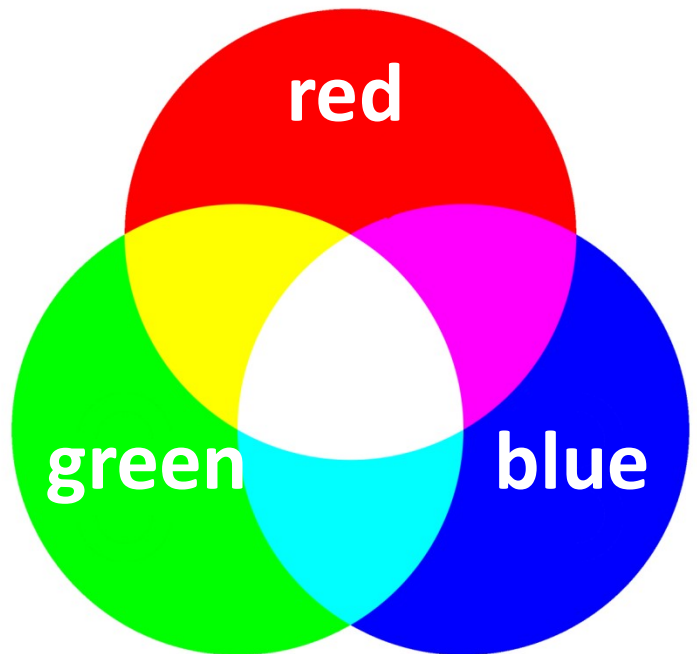
3. What is Mr. White Light's Name?

4. What does that name tell you about the wavelengths of the different colors of light?

1. The retina has two special kinds of cells called _____ and _____ . The ones that detect light are the _____. The ones responsible for how we see color are _____ .

2. What three colors can the color-sensitive cells see?

3. How do those cells allow us to see any color of light?



Lesson 81

This is a challenge lesson, so I want to challenge you to make your own notebook page for it!

Lesson 82

1. What kind of electricity did you make in the experiment?

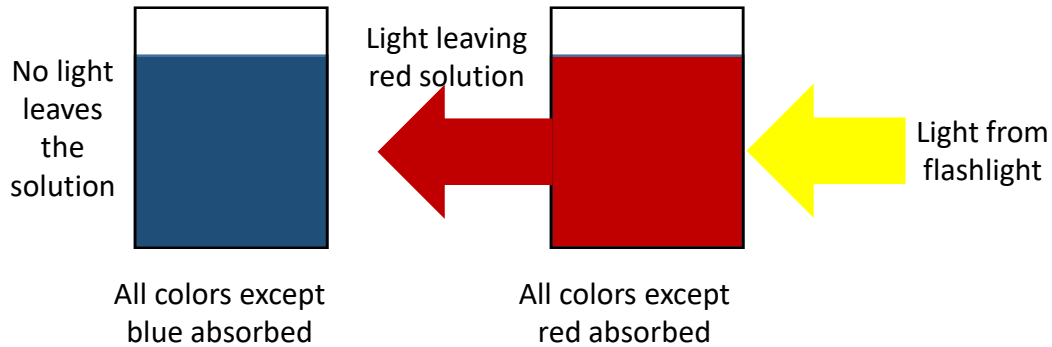
2. What kind of electricity comes out of a battery?

3. What is the difference between these two kinds of electricity?

4. How did Wollaston show that they are both the same thing?

Lesson 84

Here is a diagram that might help you understand the experiment:



1. Draw a strip of rainbow colors like you see on page 257 to represent sunlight. Put a few of the black lines in the drawing.

2. Why are those black lines found in sunlight?

Lesson 85

This is a challenge lesson, so I want to challenge you to make your own notebook page for it!

1. What aspect of the earth's magnetic field did Gauss measure?

2. How has that been changing over time?

3. What does the earth's magnetic field do besides tell which way is north?

4. Explain what you did in your experiment and how it was a measure of the strength of the magnets you used.

Lesson 88

1. What acid is found in Sprite (and all other carbonated drinks)?

2. Plants don't take in anything by their roots except water.

True **OR** False

3. Use the table below to list the things a plant needs to get from its environment and what part of the plant takes it in.

What the plant must take in to grow	What part of the plant takes it in



1. In your experiment, what happened to the air pressure inside the bottle when you cooled it?

2. What happens if you heat a gas in a container that can change volume?

3. What happens if you heat a gas in a container that can't change volume?

4. What completely original observation did Gay-Lussac make?

Lesson 90

This is a challenge lesson, so I want to challenge you to make your own notebook page for it!