Part 3 Properties of Water

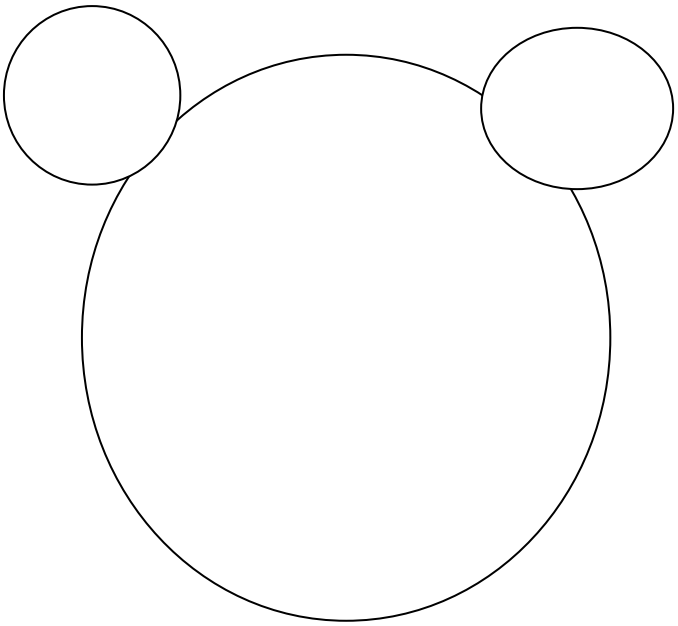
Name:

Part 3 Lesson 1 Structure of Water

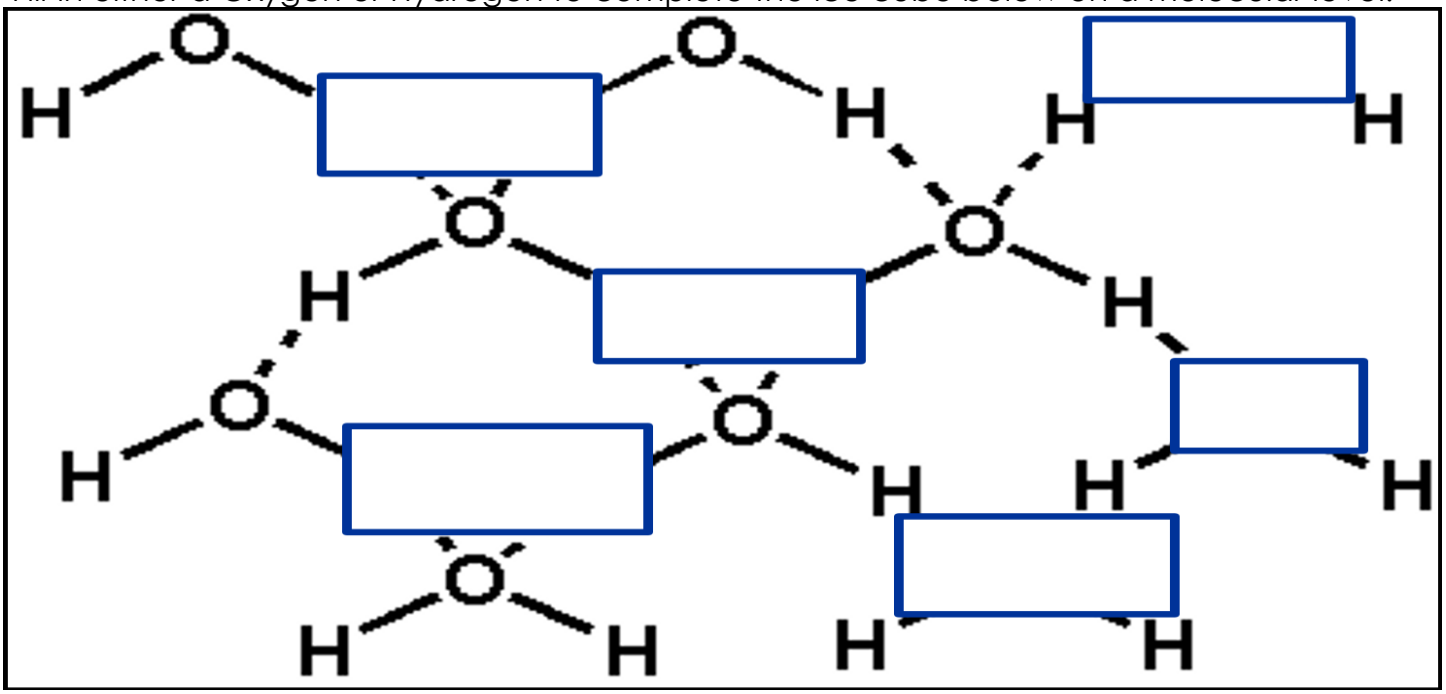
Water is ____. Two _____ atoms, one _____.

- Oxygen shares one _____ with each hydrogen atom.

Please draw and label the most accurate molecule of H2O possible in the box on the right. Please include two atoms of hydrogen, and one of oxygen. A strong answer will also include both + and – charge.



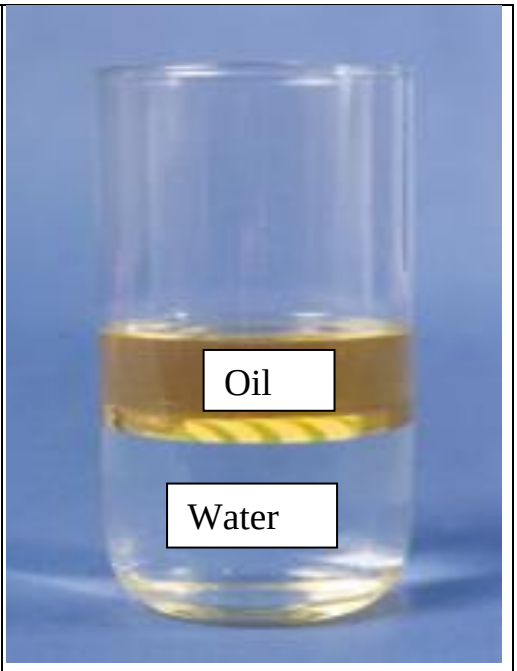
Fill-in either a Oxygen or Hydrogen to complete the ice cube below on a molecular level.



Polar molecule: One end of the water molecule tends to have a _____ charge while the other has a _____ charge.

Polarity comes from an uneven distribution of electrons _____between Oxygen and Hydrogen atoms.

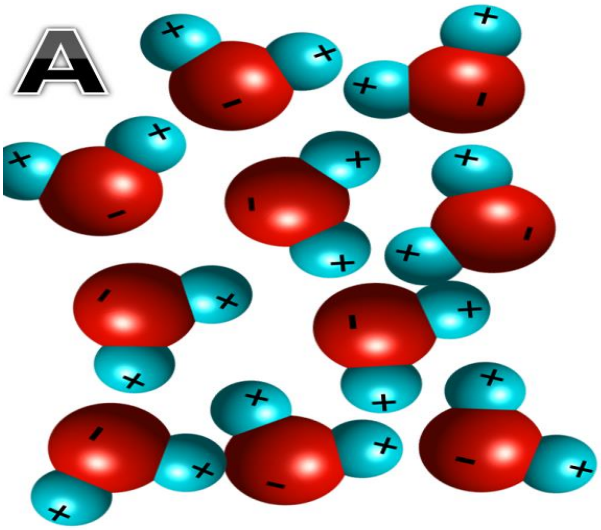
- The positive end of one water molecule is _____ the negative end of another water molecule. Hydrogen to Oxygen
  - The strong attractions between water molecules cause all of waters many properties.

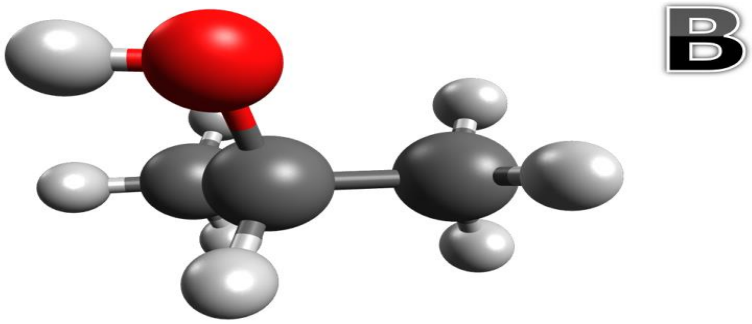
Please describe the property of water on the right? A strong answer will focus on polarity but may include some info about density.	

Activity! What evaporates faster / more volatile? Water or Rubbing Alcohol

- Place a sheet of brown paper towel on your table.
  - Place 20 drops of water on the paper towel next to 20 drops of rubbing alcohol.
    - If you can do it at the same time that would create a more fair test.
  - Record the time it takes for the wet mark made by the drops to disappear on the towel.

Which is water and which is rubbing alcohol? Which one was more volatile?





Part 3 Lesson 2 Polarity Continued / Lava Lamp

Lava Lamp Instructions

- Everyone needs a clear 20 oz bottle + cap.
  - If you want to create a larger lamp (2 liter) please bring in your own vegetable oil.
- Remove wrapper / label.
- Fill the bottle about ¾ with vegetable oil.
- Fill the rest of the bottle with clean water almost to the very top.
- Add many drops of food coloring (15 ish), more if you have a larger bottle.
  - You can experiment with colors if you wish.
- Cap and enjoy. (Anyone have a flashlight)

How does the lava lamp work?

Part 3 Lesson 3 Oil Spill at Sea

Oil is one of the world's main sources of energy, but because it is unevenly distributed it must be transported by ship across oceans and by pipelines across land. This results in accidents when transferring oil to vessels, when transporting oil, and when pipelines break, as well as when drilling for oil. Oil spills from tankers on the ocean contribute about 37 million gallons of oil to the marine environment each year.

While massive and catastrophic oil spills receive most of the attention, smaller and chronic oil spills and seeps occur regularly. Small industrial spills, automobiles, boats, and snowmobiles add about 363 million gallons of oil per year to the environment. All of this oil can contaminate coasts and estuaries, can cost millions and millions of dollars in labor, and they can cause human health problems.

When oil slicks occur in the ocean they can be very dangerous for marine mammals, birds, and inter-tidal organisms. Clean-up efforts are very costly and involve containing and collecting the floating slicks. One technique involves skimming the surface (remove oil on top of water), emulsifying the oil (disperse into droplets), and cleaning the shoreline with detergents. Oil eating bacteria are also used for long term clean-up.

Purpose: You and your table group are going to manage a clean-up team on a recent oil spill. You are required to clean-up all of the oil in the environment and keep track of cost. The agency that hired you wants you to be able to account for every dollar spent, and wants to see every drop of oil that you removed.

Procedure: Teacher adds slick to tray, group observes the oil slick for a few minutes, group then blows on slick and uses eyedroppers to disperse which simulates the ocean. Then create a plan to get all of the oil with your group, implement plan, keep area clean, dispose of materials safely at end of class, calculate costs and answer questions on this sheet.

Materials: Skimmers (eyedroppers), Clean-up boat for spilled oil (cup), String (containment vessels), cotton balls to clean coast, detergent to assist in cleaning plastic bags (for disposal of cotton balls).

Observations and detailed sketch of oil slick

Plan of group + roles of each group member:_____

_____

_____

Cost Analysis Sheet

Equipment and techniques	Cost	Amount Used / minutes used	Total Cost
Skimmer/labor/eye dropper	10,000 dollars a minute		
Cotton Ball	50,000 dollars each		
Waste Disposal			
Used Cotton Ball	100,000 dollars Disposal		
Wastewater (cup)	1,000,000 dollars		
Detergent Labor	1,00,000 dollars a drop		

1) What was the total cost of the clean-up effort?_____

Questions to be answered as table group

2) How did the oil behave on the water?_____

_____

_____

3) How does oil, and around how much, does oil enter the aquatic environment? <u>(Answer on front page)</u>

4) What where some methods used to help clean up the spill in your group? Is cleaning up an oil spill easy?

5) What can be done to minimize oil pollution in our environment (think question)?

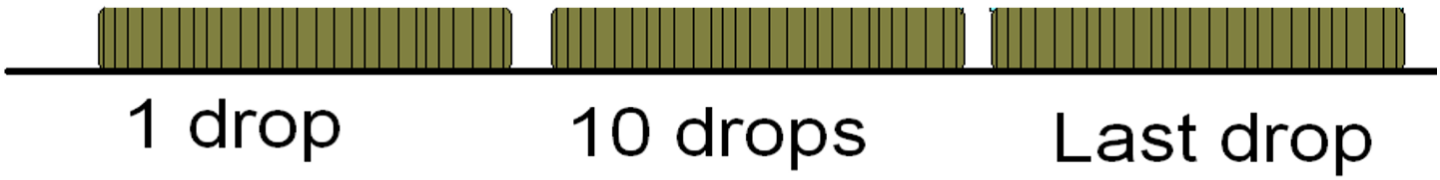
Oil and water don't mix. Describe the difficulties associated with trying to clean up after an oil spill at sea?

Part 3 Lesson 4 Adhesion and Cohesion

Cohesion: When _____ bonds hold water molecules together.

How many drops of water can you get on a penny?

- Make pictures at 1, 10, and your last drop.



Does the side of the penny make a difference? Heads vs. Tails.

Average Heads =

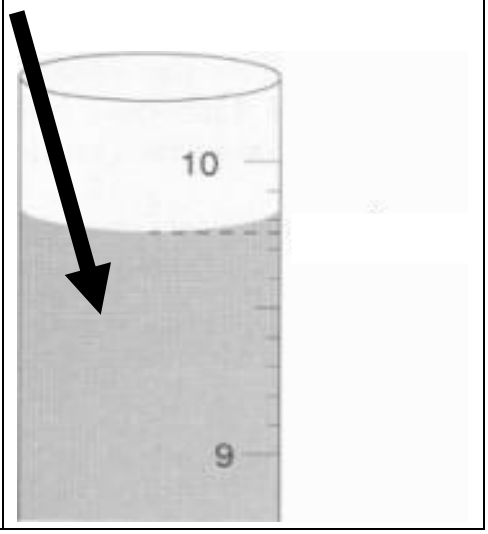
Average Tails =

Trial	1	2	3
Heads			
Tails			

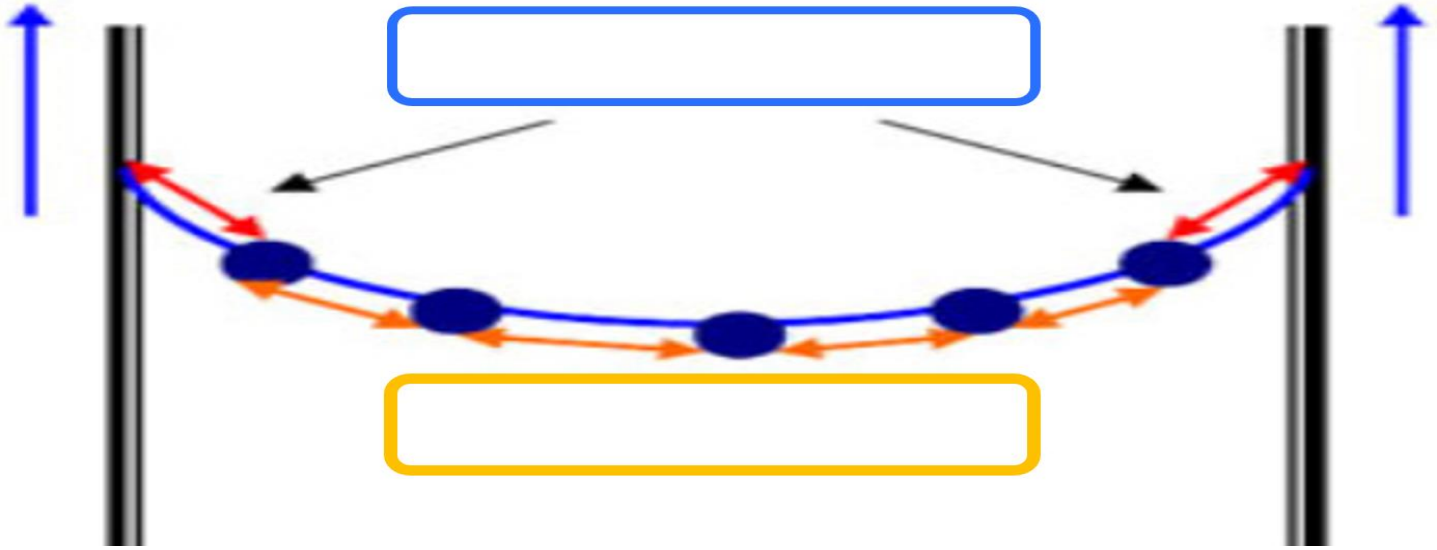
Adhesion: When water molecules _____ to a _____.

A _____ is the curved surface at the top of a column of liquid caused by adhesion to the glass.

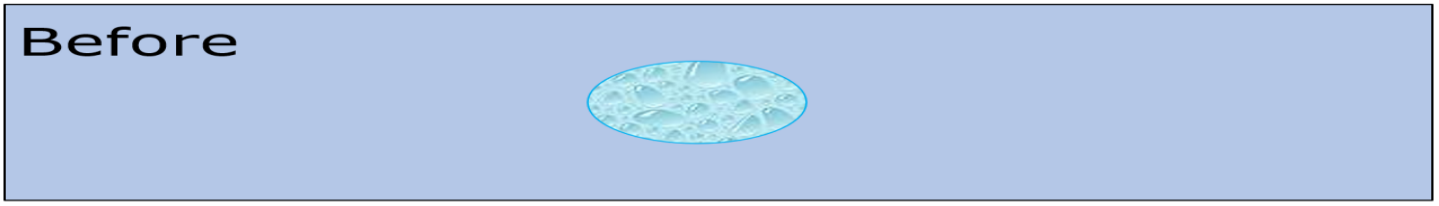
Caution! **This is a three part question**. ◊What is this, ◊what property of water does it demonstrate, ◊and how do you measure the amount of water in this cylinder?



Which is adhesion and which is cohesion in this graduated cylinder full of water?



Follow the instructions in the slideshow below.



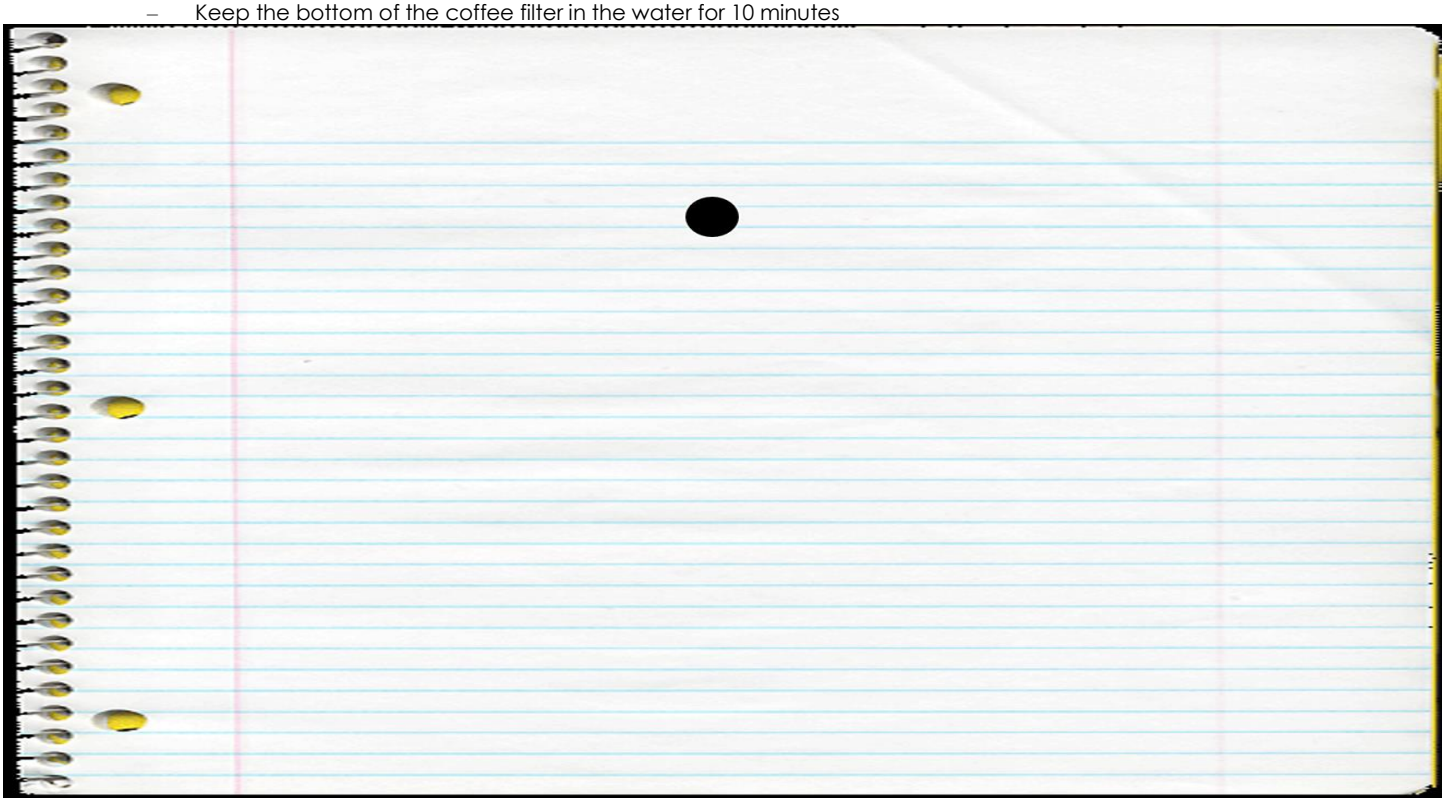
What happened to the water drop?
Why is it hard to lift the slide after the drop smeared?

Capillary action: When water _____ plants by _____.

Chromatography: A method used to _____ complex mixtures using adhesion.

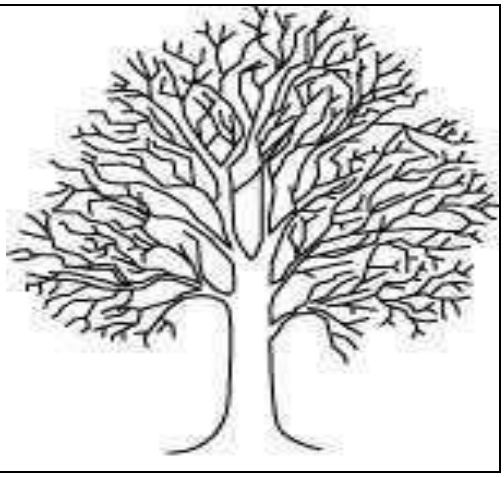
Dissecting a black dot.

- Challenge, Separate all of the colors of a black dot.
- Procedure: Make a black dot on the bottom of the coffee filter paper with black vis-à-vis marker (cut into long rectangles).
- Place bottom of coffee filter in water.
  - (Dot needs to stay above water level.)
- Keep the bottom of the coffee filter in the water for 10 minutes



Please draw arrows showing where the water in this picture will go? That is, how does a plant get water to the leaves?

#1) What is the name of this type of phenomenon?
#2) What property of water causes it?
#3) What do know about plant biology? Ph_t_ _y_ _ h_s_s



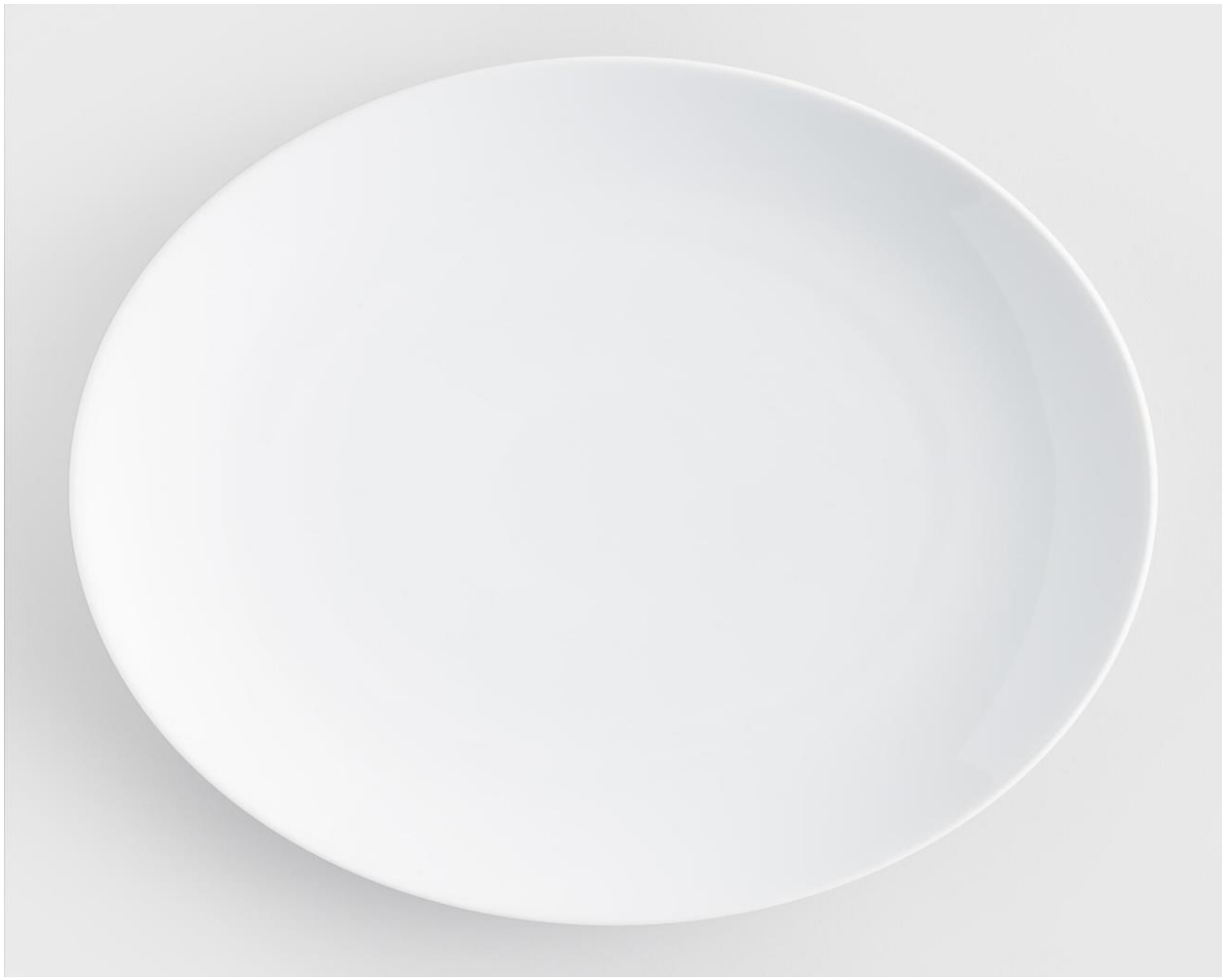
The leaf below used to be green but is now changing colors. How could you separate a leaf into all of its different colors?
Think chromatography.

Part 3 Lesson 5 Surface Tension

Surface tension: Water molecules tend to _____ to themselves instead of the air.

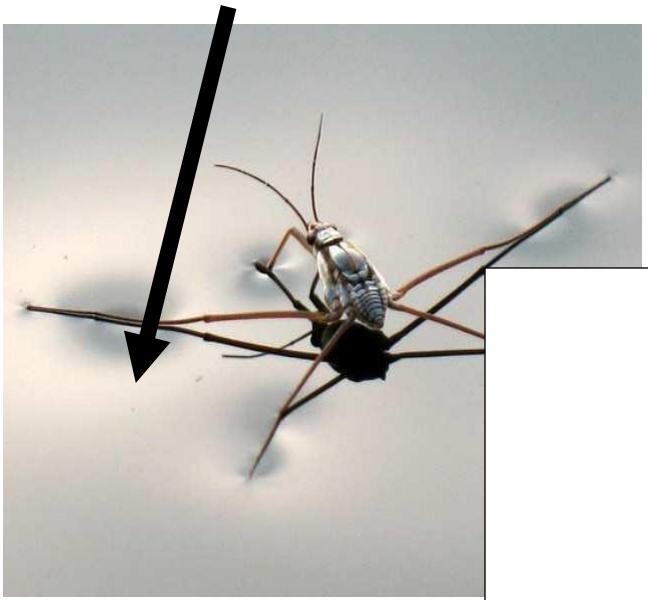
- This creates a small film over the water.

What did your swirly milk look like? Draw it!



What property of water can be seen in the photograph below?
Please draw another example of this property in the space below.

Why does this property occur?



Part 3 Lesson 6 High Specific Heat of Water

High Specific Heat: Hydrogen bonds _____ heat when they break, and _____ heat when they form.

The high specific heat of water means that a lake won't freeze or heat up suddenly.

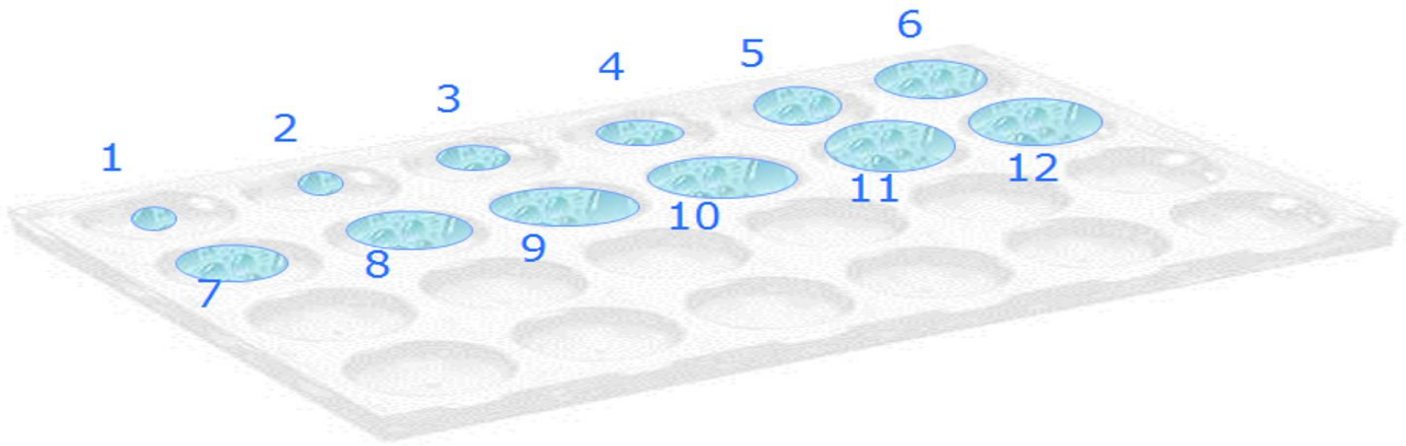
- This gives aquatic organisms a chance to adjust to temperature changes slowly.

It takes significant _____ to change the state of water.

_____ → _____→_____.

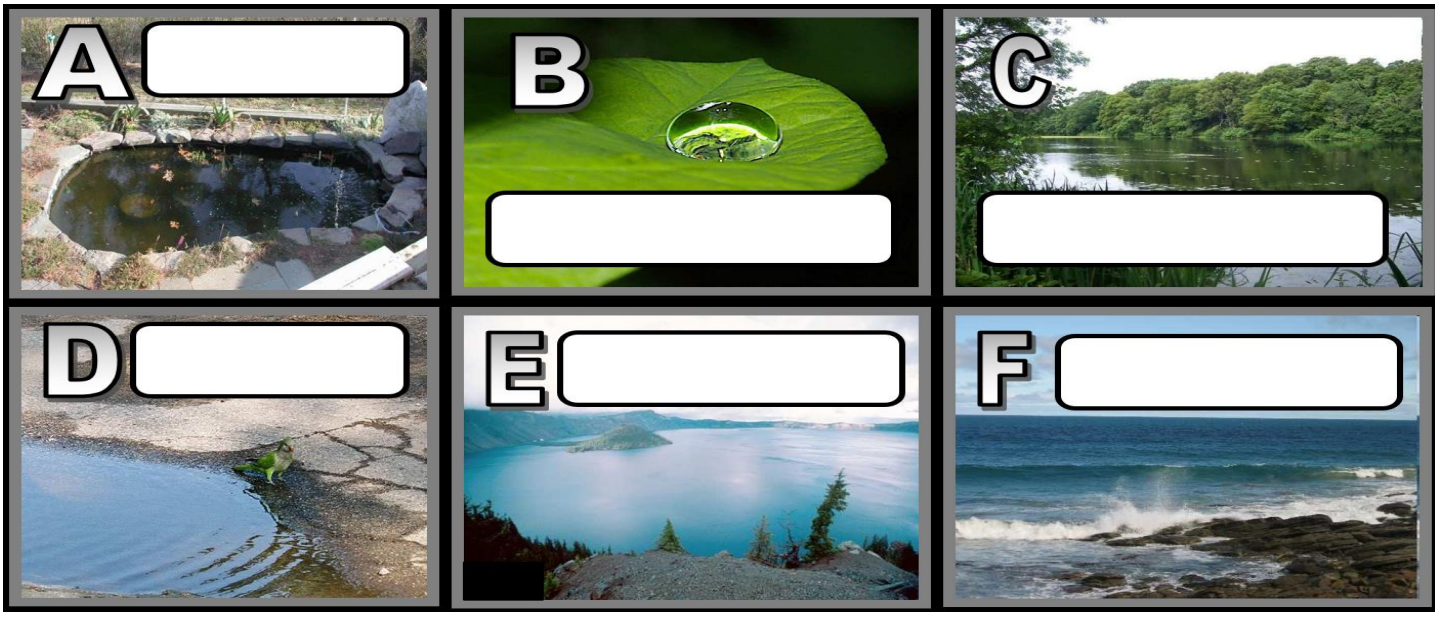
_____ → _____→_____.

Which ones were frozen, and which were unfrozen after 15 minutes?



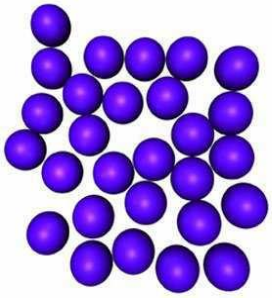
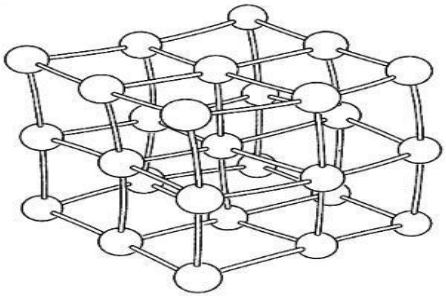
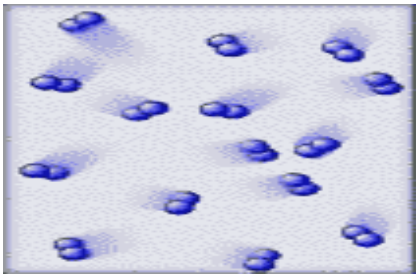
Why? How does this show waters high specific heat?

Which of the following pictures will freeze first, second, third, fourth, fifth, and last?



Part 3 Lesson 7 The Water Cycle

Name each state of matter on a molecular level. (Solid, Liquid, Gas)

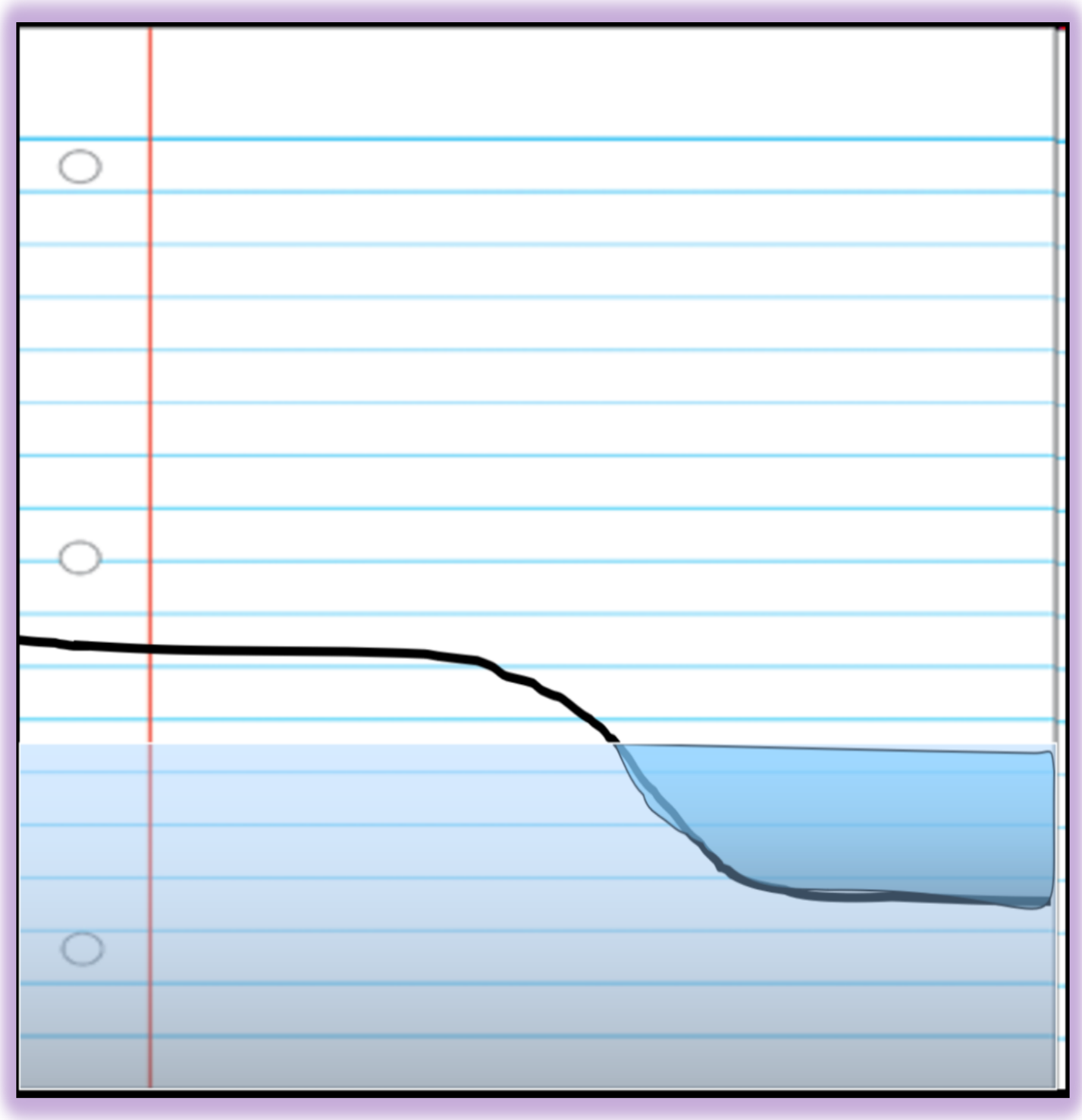
 Semi Ordered	 Called a crystal _____	 Moving fast!
True or False? On earth water exists in all three states of matter?	True or False? The lower density of ice causes it to float?	True or False? The oceans and atmosphere move heat around the planet?

The Water Cycle also known as the hydrologic cycle

Driven by the _____ and _____.

The hydrologic cycle (Water Cycle): The continuous movement of water _____, _____, and _____ the surface of the earth.

Please complete the diagram below on the water cycle as described in the slideshow



Evaporation – Substance changes from a _____ state to _____ state (requires energy).

Condensation – Water vapor (gas) turns back to a _____. (energy required/cold) -cloud formation.

Precipitation – Water that is so heavy it _____ as liquid / solid.

Sublimation – Solid state turns directly to a _____ state skipping liquid phase.

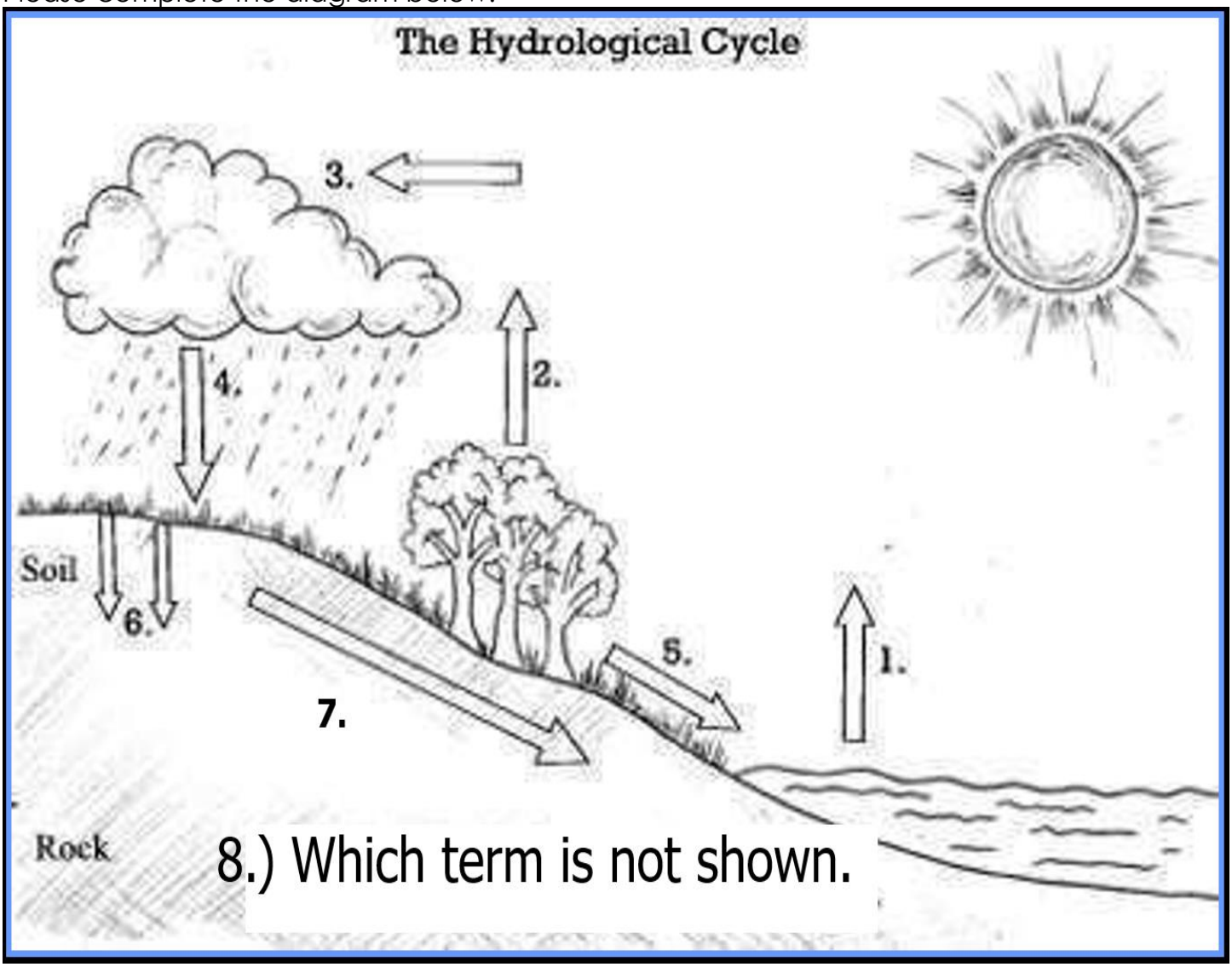
Evapotranspiration – Water released by _____ into air.
Non-living to the living, and back again.

Surface run-off: The water flow which occurs when soil is full to capacity and excess water travels over the _____.

Percolation: The slow movement of water through the _____.

Groundwater discharge: Water that has been _____ seeps back into the oceans, or into rivers or lakes.

Please complete the diagram below.

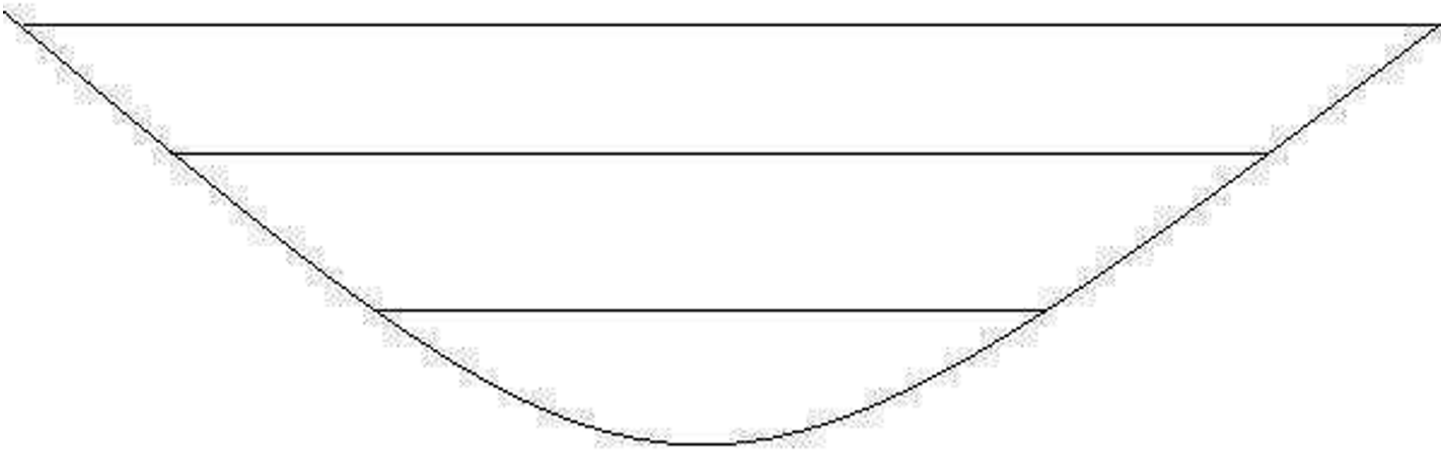


Part 4 Lesson 8 Lake Turnover

Lower Density of _____" Water forms a _____ _____when it freezes which is less dense than
water…Ice Floats!

Lake Turnover…

- Fall - Air temperatures drop, and the upper layers of water get cold.
- Wind and chop mix the upper layers as well.
    - Upper water layer gets colder, denser, heavier, and sink.
- Colder water displaces the water the lake bottom forcing the lower layers to the surface.
- Winter - Ice forms layer over water. Lake becomes layered.
- Spring – Melting ice causes water to sink and mixes layers
- Summer – Warm temperatures cause layering.



Please demonstrate your knowledge of lake-turnover in the space below.

Summer Stagnation	Early Fall
Late Fall	Winter (please include an example of the lower density of ice)

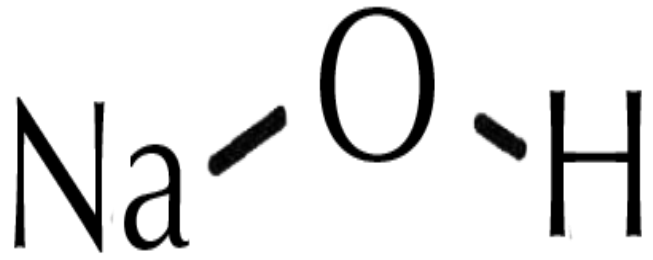
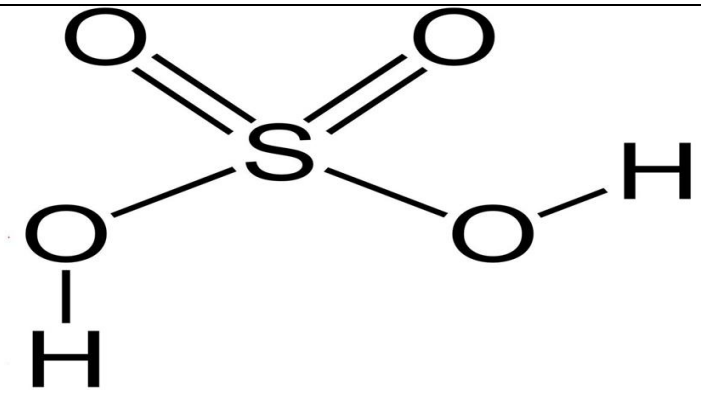
Part 3 Lesson 9 Acids and Bases

An acid is any hydrogen-containing substance that is capable of _____ a proton (hydrogen ion) to another substance.

Acidic substances are usually identified by their _____ taste. ... Acids are known to turn litmus _____.

A base is a molecule or ion able to _____ a hydrogen ion from an acid.

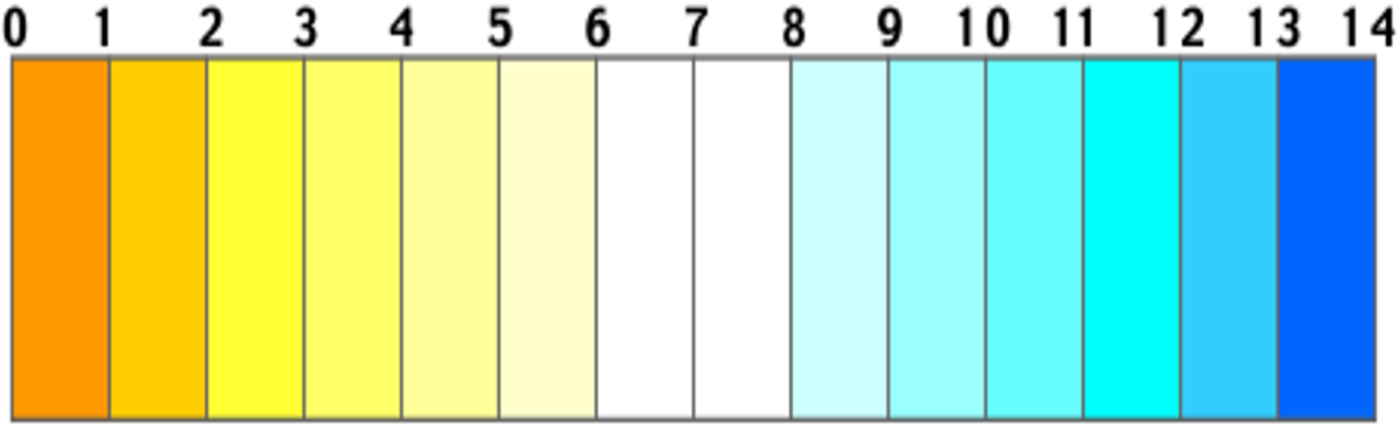
Which is the acid and which is the base?

 Answer=	 Answer=

Water in a pure state has a _____ pH.

- Pure water is neither acidic or basic.

Provide some info on the pH scale below as described in the slideshow.

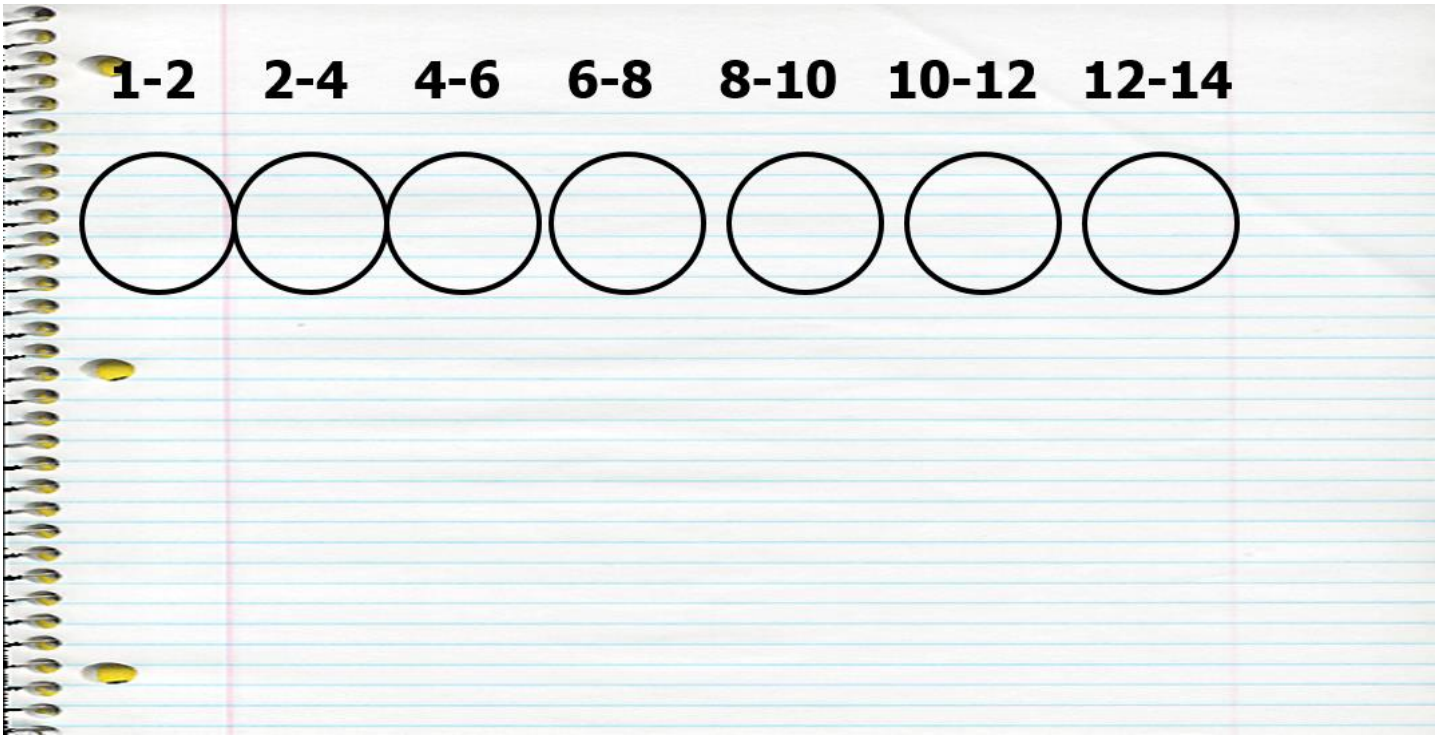


Use the diagram below to assist you in writing a short paragraph that describes the differences between acids and bases?

Which is an acid? And which is a base?

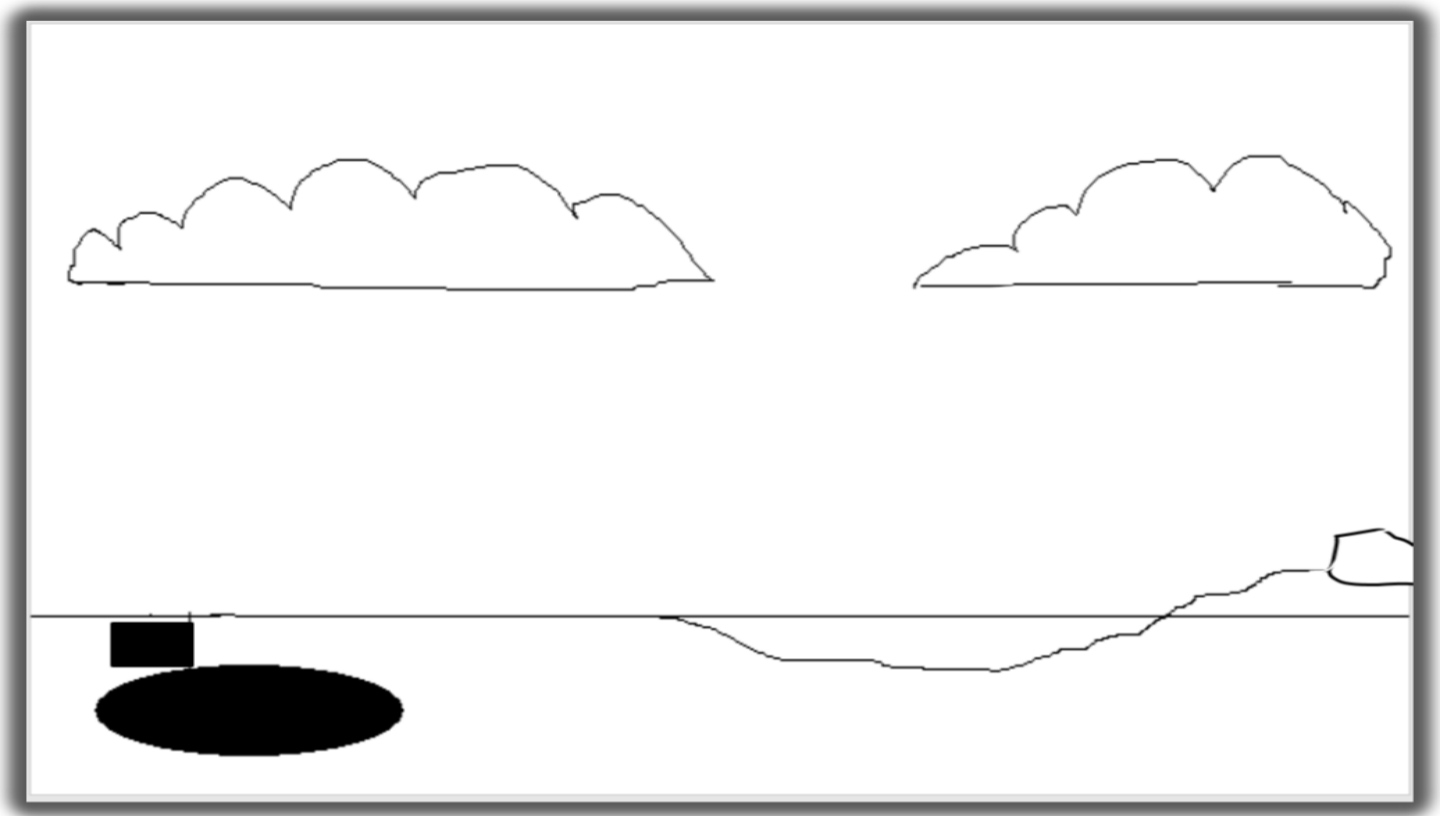
A substance which when added to water produces hydroxide ions [OH^-]. Turns litmus blue. They react with most cations to precipitate hydroxides. Taste bitter Do not taste in the lab.	A substance which when added to water produces hydrogen ions [H^+]. React with zinc, magnesium, or aluminum and form hydrogen ($H_{2(g)}$). React with compounds containing CO_3^{2-} and form carbon dioxide and water. Turns litmus red. Taste sour (lemons contain citric acid, for example). Tasting Acids in the lab would be unsafe.

Please complete as described in the slideshow? What are some of the mystery solutions.



Part 3 Lesson 10 Acid Rain

Acid Rain is caused by _____ and _____ dioxides. aka – Air pollution (smog) causing the rain to become slightly more acidic. This has a negative impact on _____ and _____ organisms. Sketch out the diagram of acid rain below as described in the slideshow.

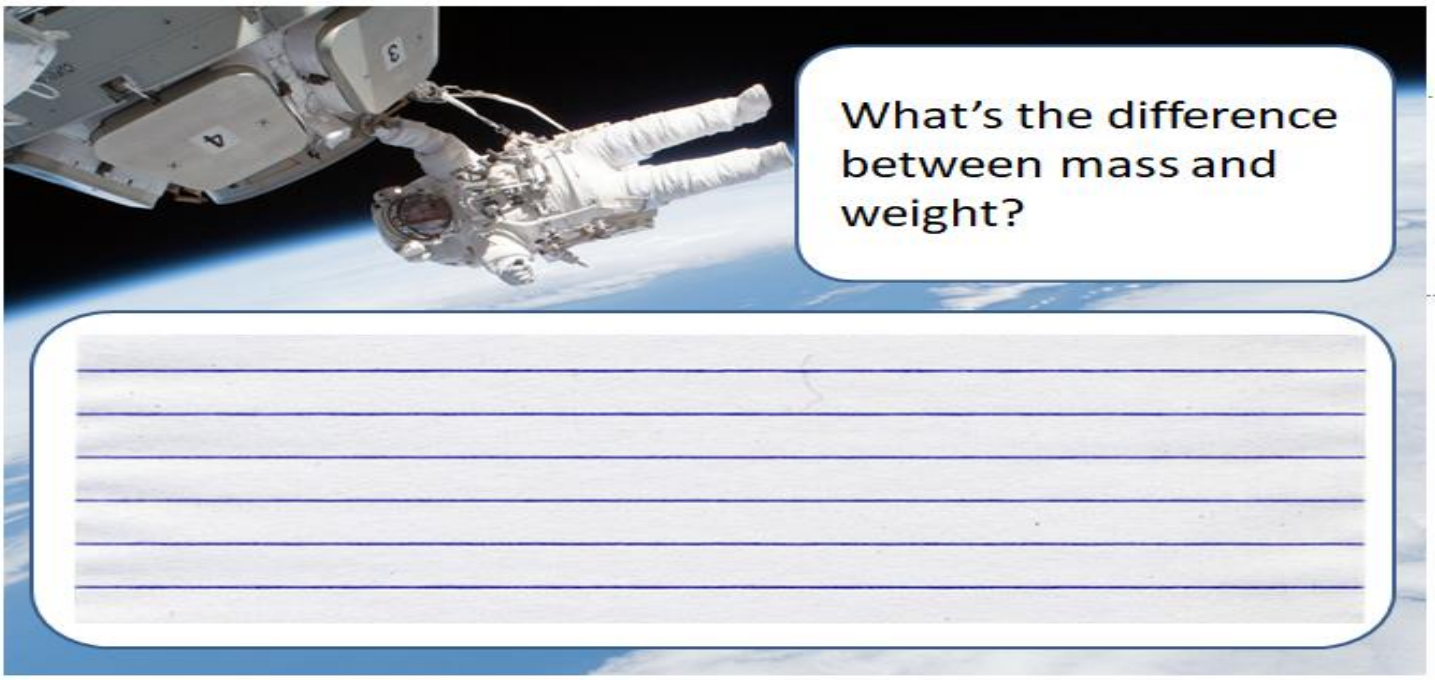


Part 3 Lesson 11 Mixtures, Solubility, Soda Store Project

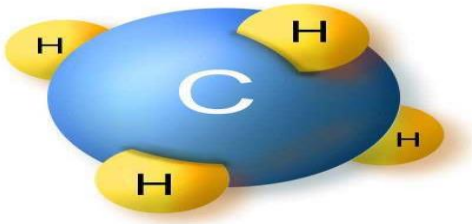
Matter : Anything that has _____ and takes up _____.

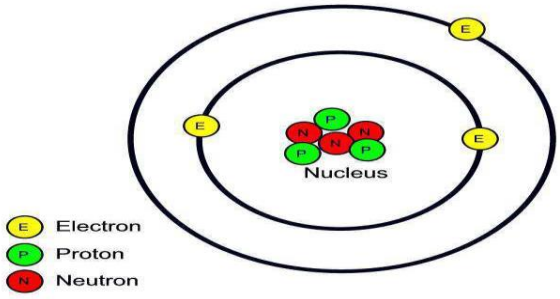
Element: A substance that is made entirely from one type of _____.

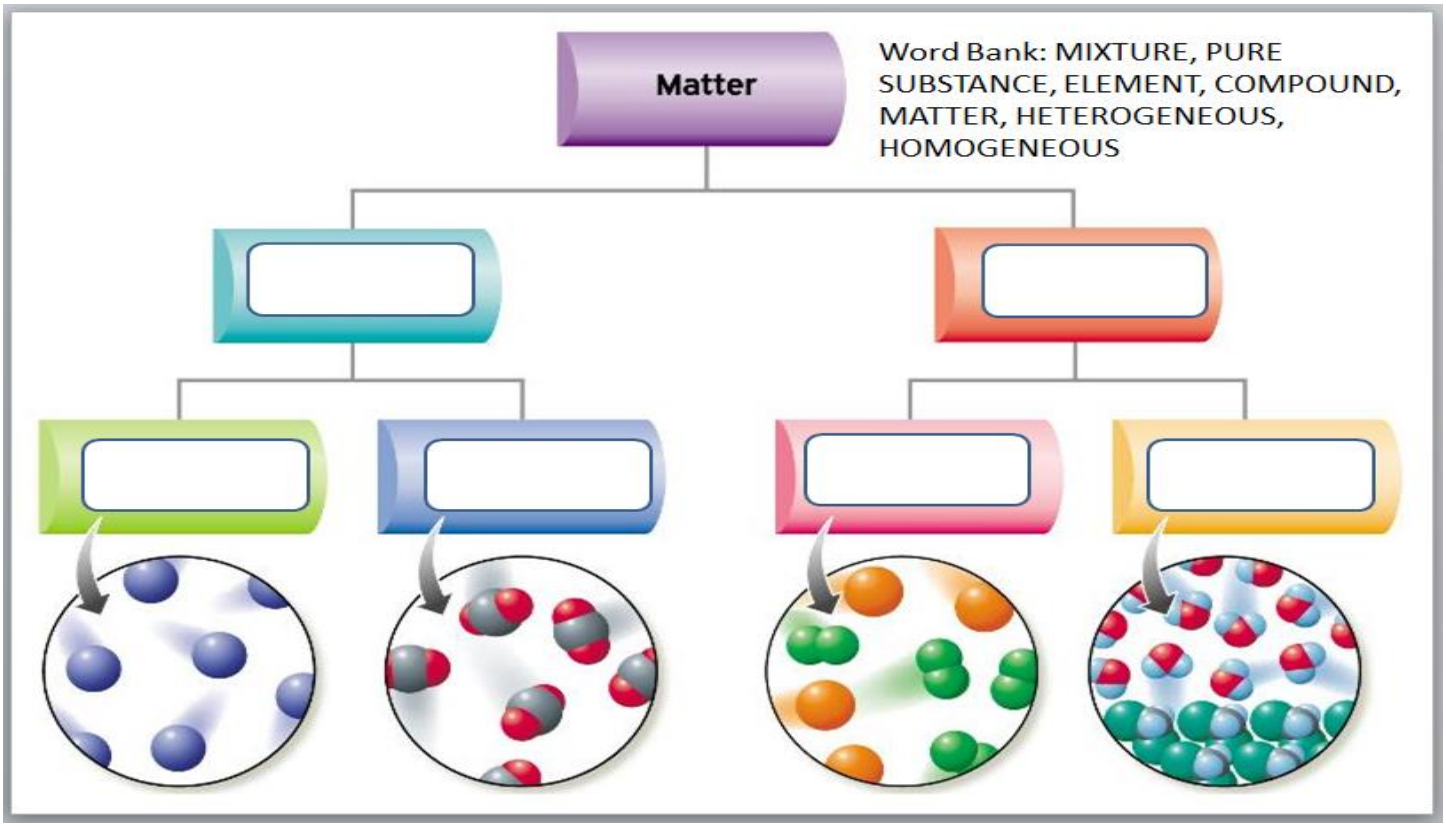
Compound: Made up of _____ or more elements bonded together.



Which of the following drawings are of an element, and which is of a compound? Describe your reasoning in the spaces around each picture.







Homogeneous mixture: _____ molecules throughout.

Heterogeneous: A mixture of _____ or more compounds.

Quiz Wiz! 1-10 Homogeneous or Heterogeneous.

1)	2)	3)	4)
5)	6)	7)	8)
9)	10)	*11)	

Part 3 Lesson 12 Soda Store Project

Solvent: A substance that does the _____ (usually larger amount / Water).

Solute: The substance that gets dissolved (usually _____ amount).

Solubility: How much _____can dissolve in a substance before it becomes saturated.

Supersaturated: When no more solute will _____. (crystals become visible)

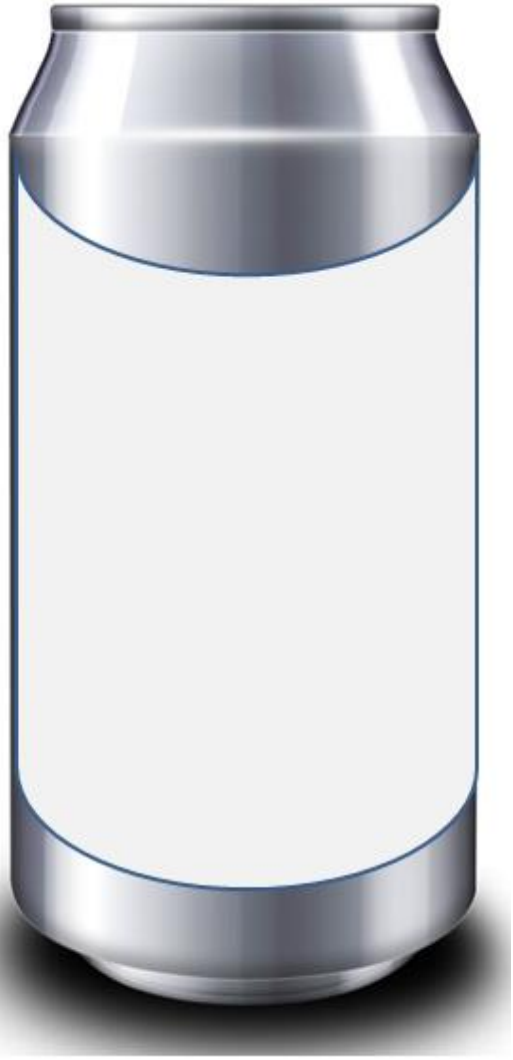
SODA STORE! Make a brand of soda for scientists. Please describe your solution using some science terminology below. Be prepared to present your soda.

Group members and Role: President, Graphic Designer, Taste Chemist, Marketer

Name of your Soda?_____ Name #2_____
Color of your Soda?_____ How are you going to get that color?
Taste of your Soda?_____
Taste of your Soda #2?_____

Ingredients (dry solute only) No pharmaceuticals etc. : Amount of Sugar in grams _____

Your Motto / Jingle / Presentation / Your Label, Use the space below to prepare.
You must include the word solution, solvent, solute, solubility.



How did it taste? What would you do differently next time?

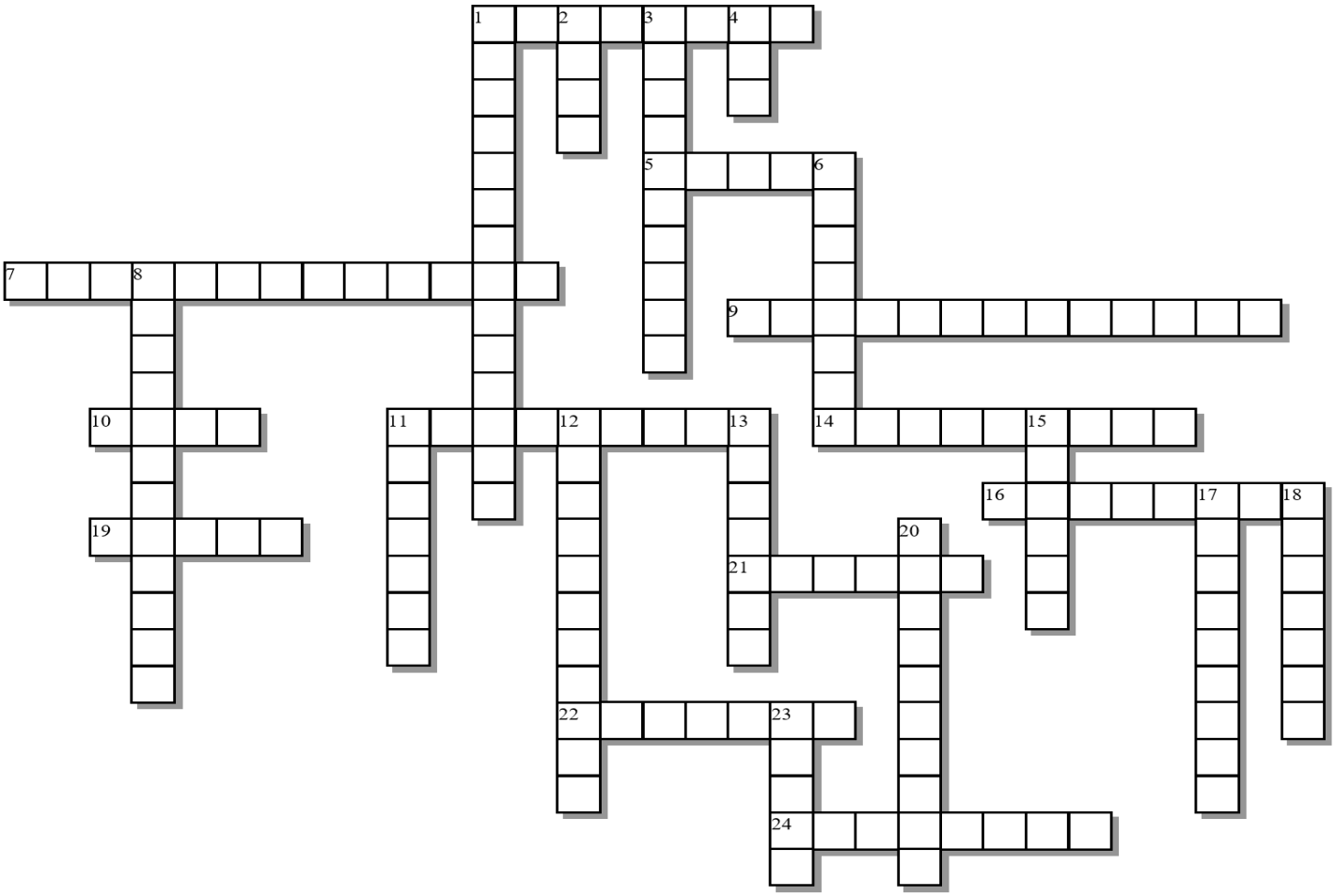
Does mixing sugar and water result in a new substance? _____

_____

The sugar changed from a solid to a _____. This is a _____ change and not a chemical change.

When we burn the sugar in our cells, we do change its form / create a ch_____ _____. We eat / drink sugar and breath in oxygen gas. The products of the chemical reaction are carbon dioxide gas and water vapor that we exhale.

$$C_{12}H_{22}O_{11} + 12O_2 \rightarrow 12CO_2 + 11H_2O$$



Answers:

Adhesion, Boils, Capillary, Chromatography, Cohesion, Condensation, Density, Depletion, Evaporation, Heat, Heterogeneous, Icecaps, Meniscus, Neutral, Non-polar, Oceans, One, Polar, Precipitation, Properties, Rivers, Solubility, Solution, Solvent, Water, Zero

Across:

1 - Hydrogen bonds hold water molecules together to each other.
5 - Water _____ at 100 degrees Celsius
7 - Water that is so heavy it falls as liquid / solid.
9 - A mixture of two or more compounds.
10 - Water freezes at _____ degrees Celsius
11 - The drying up of wells is one effect of groundwater _____?
14 - These molecules tend to have like charges (+ +) (- -)
16 - The curved surface at the top of a column of liquid
19 - The _____ Cycle: The continuous movement of water on, above, and below the surface of the earth.
21 - Inland Lakes, Groundwater, and _____ are available freshwater sources?
22 - Most of the freshwater is locked away in the _____?
24 - property that holds water to a surface

Down:

1 - A method used to separate complex mixtures
2 - High Specific _____ : Hydrogen bonds absorb heat when they break, and release heat when they form.
3 - How much solute can dissolve in a substance before it becomes saturated.
4 - Water weighs ____ gram per cubic centimeter
6 - A liquid mixture in which the minor component (the solute) is uniformly distributed within the major component (the solvent)
8 - Water vapor (gas) turns back to a liquid. (energy required / cold) -cloud formation.
11 - Lower _____ of Ice: Molecules are spaced far apart. Ice floats
12 - Substance changes from a liquid state to gas state (requires energy).
13 - Water in a pure state has a _____ pH. As a result, pure water is neither acidic nor basic.
15 - Most of earths water can found in the _____?
17 - _____ Action. Name for when water moves up plants by adhesion.
18 - Water is the Universal _____.
20 - Water has unique _____ because of its lopsided + and – ends.
23 - These molecules tend to have a positive charge and negative charge.

Part 3 Review Game

Name:

Due: Today

1-20 = 5 pts Part 3 Lesson 14

*20-*25 * = Bonus + 1 pt,

(Secretly write owl in correct space +1 pt)

Final Question = 5 pt wager

Score ____ / 100

PROPPED UP	THIRSTY CHARLIE	HOT WATER	MIXED UP	FAMOUS FISH Bonus round 1pt each
1)	6)	11)	16)	*21)
2)	7)	12)	17)	*22)
3)	8)	13)	18)	*23)
4)	9)	14)	19)	*24)
5)	10)	15)	20)	*25)

Final Question Wager ___ /5 Answer: _____

Part 3 Properties of Water

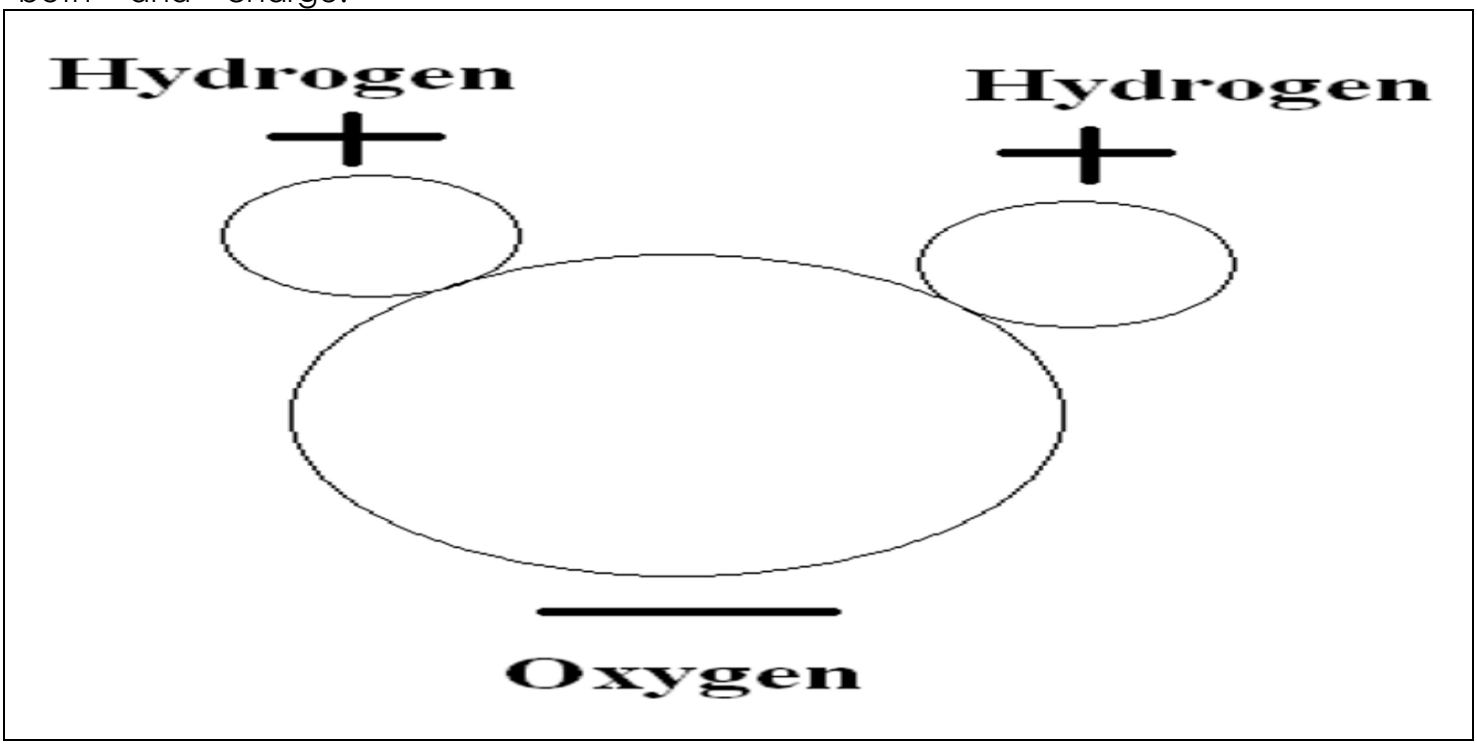
Name:

Part 3 Lesson 1 Structure of Water

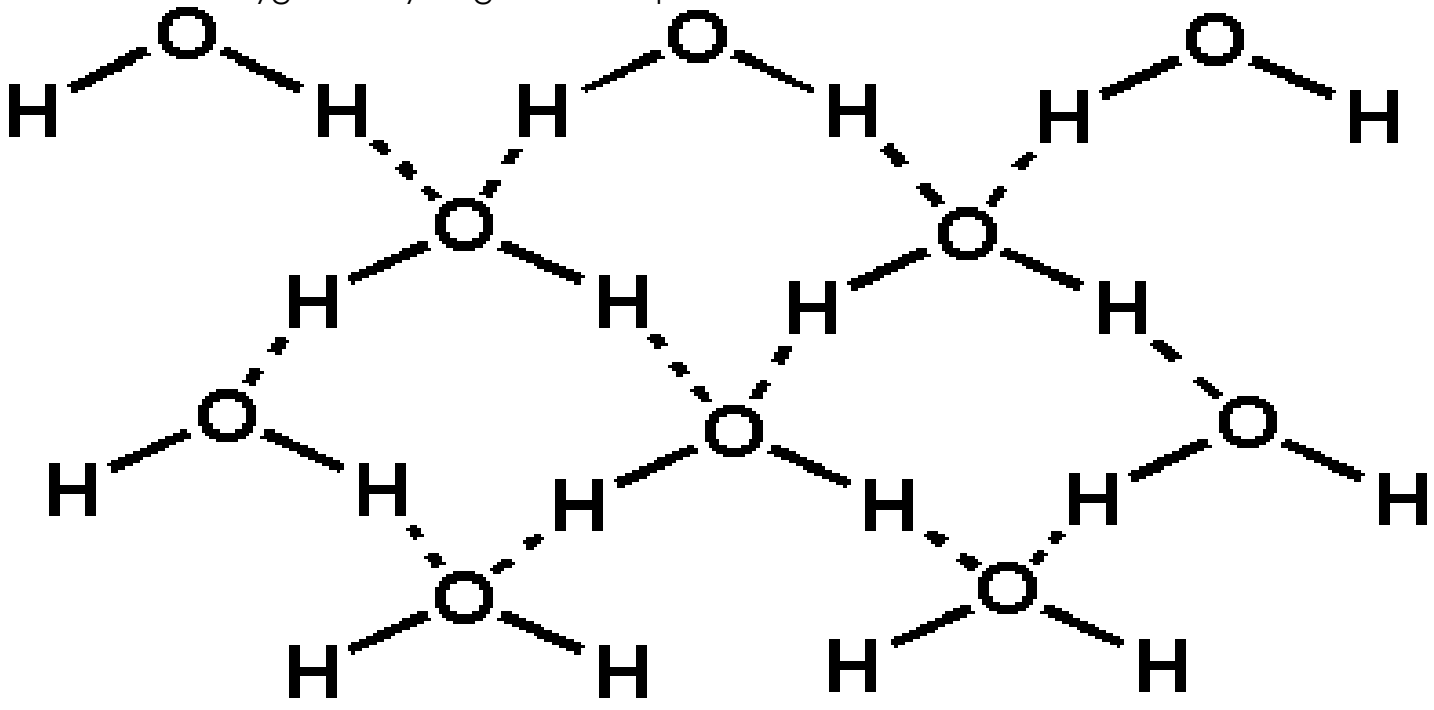
Water is H_2O. Two Hydrogen atoms, one Oxygen.

- Oxygen shares one electron with each hydrogen atom.

Please draw and label the most accurate molecule of H2O possible in the box on the right. Please include two atoms of hydrogen, and one of oxygen. A strong answer will also include both + and – charge.



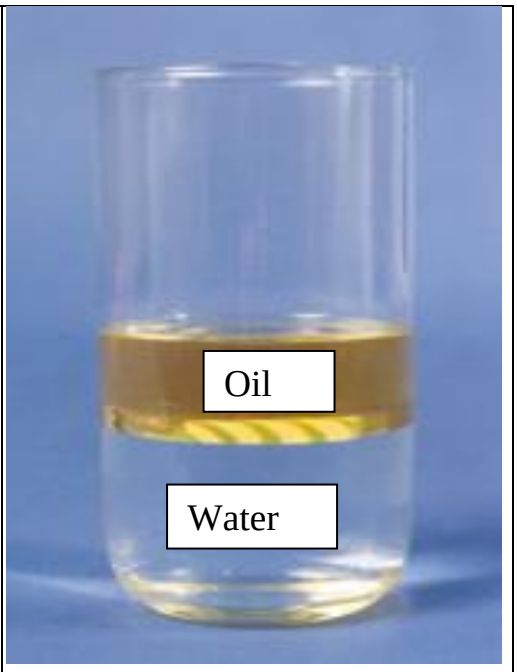
Fill-in either a Oxygen or Hydrogen to complete the ice cube below on a molecular level.



Polar molecule: One end of the water molecule tends to have a positive charge while the other has a negative charge.

Polarity comes from an uneven distribution of electrons shared between Oxygen and Hydrogen atoms.

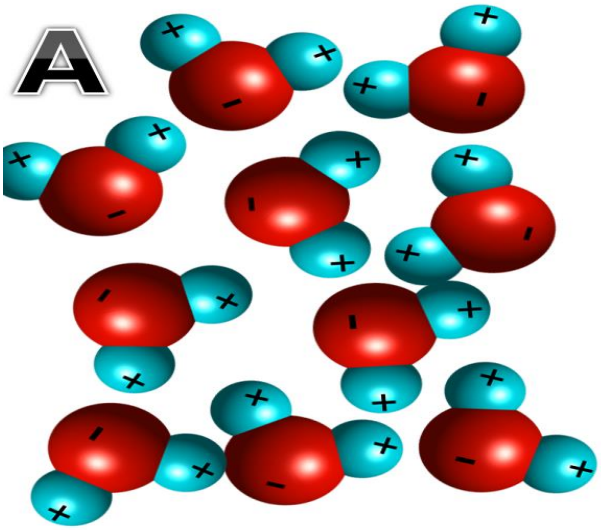
- The positive end of one water molecule is attracted the negative end of another water molecule. Hydrogen to Oxygen
  - The strong attractions between water molecules cause all of waters many properties.

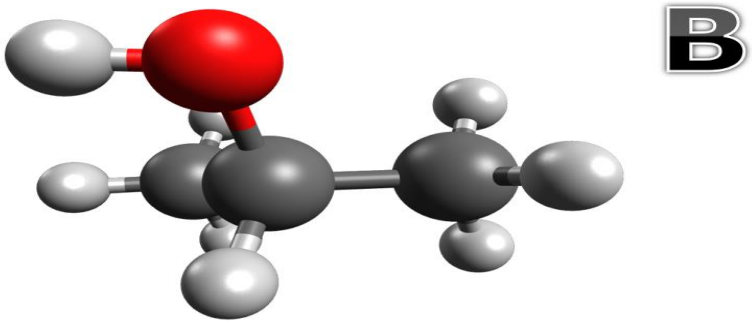
Please describe the property of water on the right? A strong answer will focus on polarity but may include some info about density. Oil and water don't mix because water is polar and the oil is non-polar. Water H_2O is a Polar molecule which means that one end of the water molecule tends to have a positive charge while the other has a negative charge. Oil is non-polar so each end has a similar charge. Oil is less dense than water and tends to rest on the surface.	

Activity! What evaporates faster / more volatile? Water or Rubbing Alcohol

- Place a sheet of brown paper towel on your table.
  - Place 20 drops of water on the paper towel next to 20 drops of rubbing alcohol.
    - If you can do it at the same time that would create a more fair test.
  - Record the time it takes for the wet mark made by the drops to disappear on the towel.

Which is water and which is rubbing alcohol? Which one was more volatile?





This is water. This was less volatile because water tends to bond easily with other water molecules.	This is rubbing alcohol. The alcohol evaporated more easily / was more volatile because the alcohol is non-polar and doesn't bond easily with itself.

Part 3 Lesson 2 Polarity Continued / Lava Lamp

Lava Lamp Instructions

- Everyone needs a clear 20 oz bottle + cap.
  - If you want to create a larger lamp (2 liter) please bring in your own vegetable oil.
- Remove wrapper / label.
- Fill the bottle about ¾ with vegetable oil.
- Fill the rest of the bottle with clean water almost to the very top.
- Add many drops of food coloring (15 ish), more if you have a larger bottle.
  - You can experiment with colors if you wish.
- Cap and enjoy. (Anyone have a flashlight)

How does the lava lamp work?

- Water and oil do not mix. One is non-polar (oil) while the other is polar (water).
- Food coloring is also polar and only mixes with the water.

Oil is less dense than water so it floats on top

Part 3 Lesson 3 Oil Spill at Sea

Oil is one of the world's main sources of energy, but because it is unevenly distributed it must be transported by ship across oceans and by pipelines across land. This results in accidents when transferring oil to vessels, when transporting oil, and when pipelines break, as well as when drilling for oil. Oil spills from tankers on the ocean contribute about 37 million gallons of oil to the marine environment each year.

While massive and catastrophic oil spills receive most of the attention, smaller and chronic oil spills and seeps occur regularly. Small industrial spills, automobiles, boats, and snowmobiles add about 363 million gallons of oil per year to the environment. All of this oil

can contaminate coasts and estuaries, can cost millions and millions of dollars in labor, and they can cause human health problems.

When oil slicks occur in the ocean they can be very dangerous for marine mammals, birds, and inter-tidal organisms. Clean-up efforts are very costly and involve containing and collecting the floating slicks. One technique involves skimming the surface (remove oil on top of water), emulsifying the oil (disperse into droplets), and cleaning the shoreline with detergents. Oil eating bacteria are also used for long term clean-up.

Purpose: You and your table group are going to manage a clean-up team on a recent oil spill. You are required to clean-up all of the oil in the environment and keep track of cost. The agency that hired you wants you to be able to account for every dollar spent, and wants to see every drop of oil that you removed.

Procedure: Teacher adds slick to tray, group observes the oil slick for a few minutes, group then blows on slick and uses eyedroppers to disperse which simulates the ocean. Then create a plan to get all of the oil with your group, implement plan, keep area clean, dispose of materials safely at end of class, calculate costs and answer questions on this sheet.

Materials: Skimmers (eyedroppers), Clean-up boat for spilled oil (cup), String (containment vessels), cotton balls to clean coast, detergent to assist in cleaning plastic bags (for disposal of cotton balls).

Observations and detailed sketch of oil slick

Plan of group + roles of each group member:_____

_____

_____

Cost Analysis Sheet

Equipment and techniques	Cost	Amount Used / minutes used	Total Cost

Skimmer/labor/eye dropper	10,000 dollars a minute		
Cotton Ball	50,000 dollars each		
Waste Disposal			
Used Cotton Ball	100,000 dollars Disposal		
Wastewater (cup)	1,000,000 dollars		
Detergent Labor	1,00,000 dollars a drop		

1) What was the total cost of the clean-up effort

Students should add up the amount of equipment and time used to create a total cost. It should be high.

2) How did the oil behave on the water? Oil and do not mix. Water is polar and oil is non-polar. The oil floated on top because it's less dense creating a slide. It got everywhere and was difficult to control.

2) How does oil, and around how much, does oil enter the aquatic environment? (Answer on front page)

While massive and catastrophic oil spills receive most of the attention, smaller and chronic oil spills and seeps occur regularly. Small industrial spills, automobiles, boats, and snowmobiles add about 363 million gallons of oil per year to the environment. All of this oil can contaminate coasts and estuaries, can cost millions and millions of dollars in labor, and they can cause human health problems.

4) What where some methods used to help clean up the spill in your group? Is cleaning up an oil spill easy? Answers will vary but using the eye drops "Skimmer" seemed to be the best strategy for success

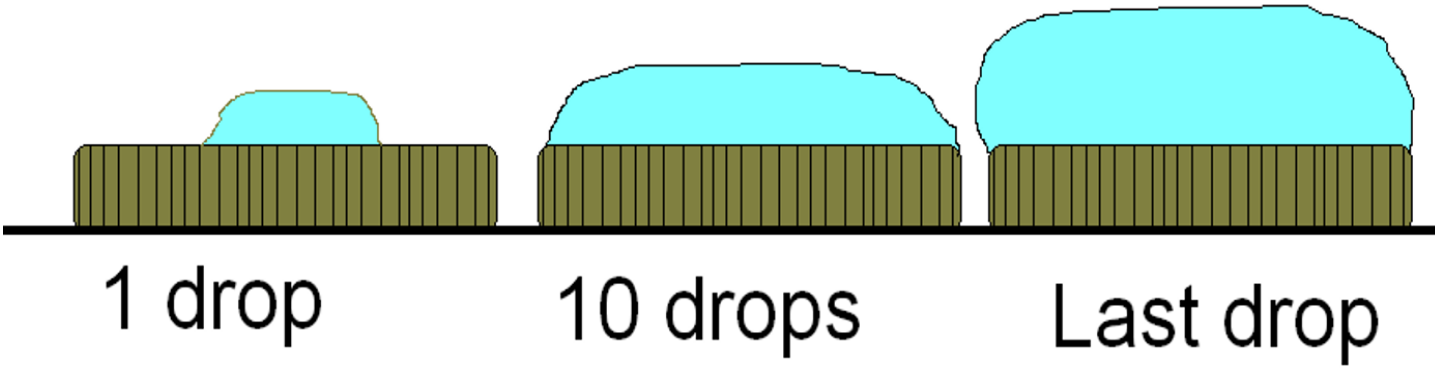
5) What can be done to minimize oil pollution in our environment (think question)?
Answers will vary. Moving away from oil as a global energy resource. If using oil, extra care should be put into preventing it from ever entering an aquatic environment.

Part 3 Lesson 4 Adhesion and Cohesion

Cohesion: When hydrogen bonds hold water molecules together.

How many drops of water can you get on a penny?

- Make pictures at 1, 10, and your last drop.



Does the side of the penny make a difference? Heads vs. Tails.
Average Heads =
Average Tails =

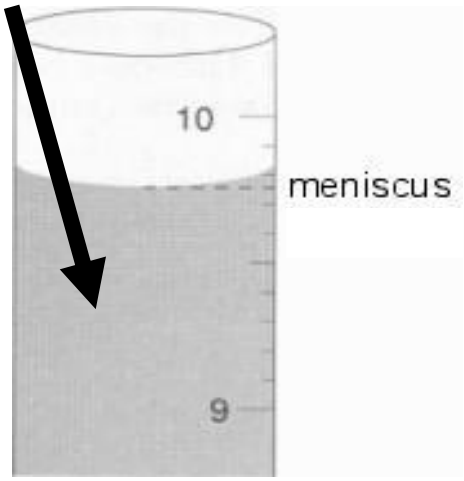
Trial	1	2	3
Heads			
Tails			

Adhesion: When water molecules hold to a surface.

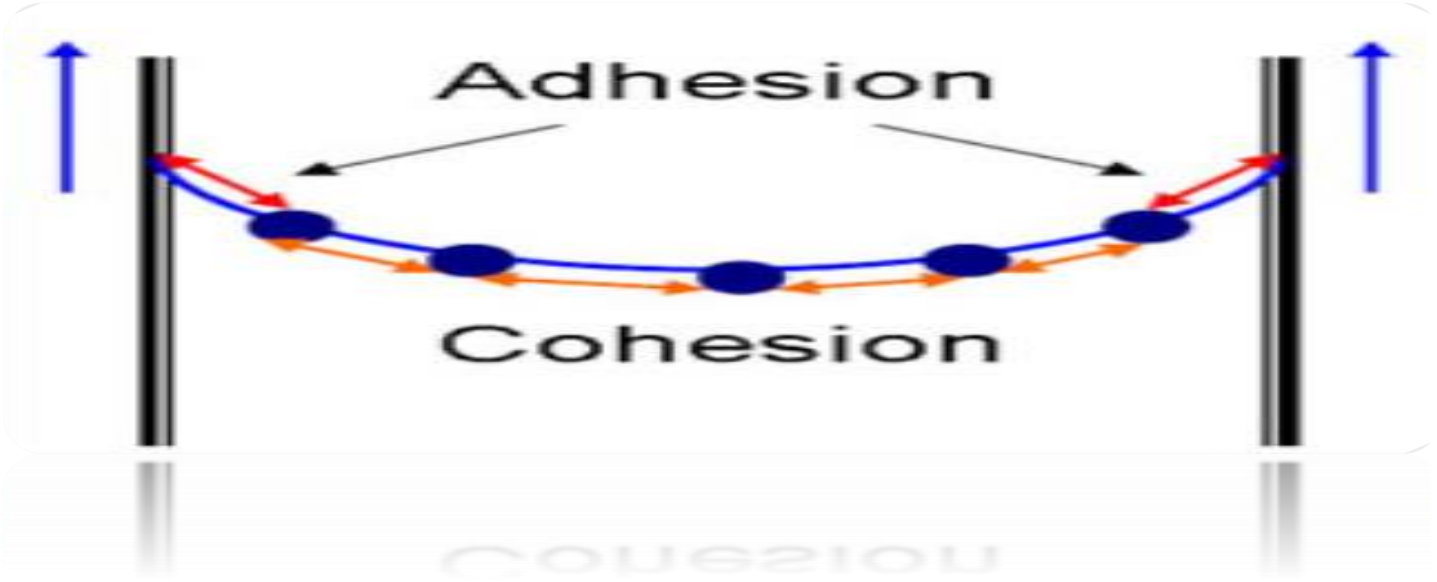
A meniscus is the curved surface at the top of a column of liquid caused by adhesion to the glass.

Caution! **This is a three part question**. ◊What is this, ◊what property of water does it demonstrate, ◊and how do you measure the amount of water in this cylinder?

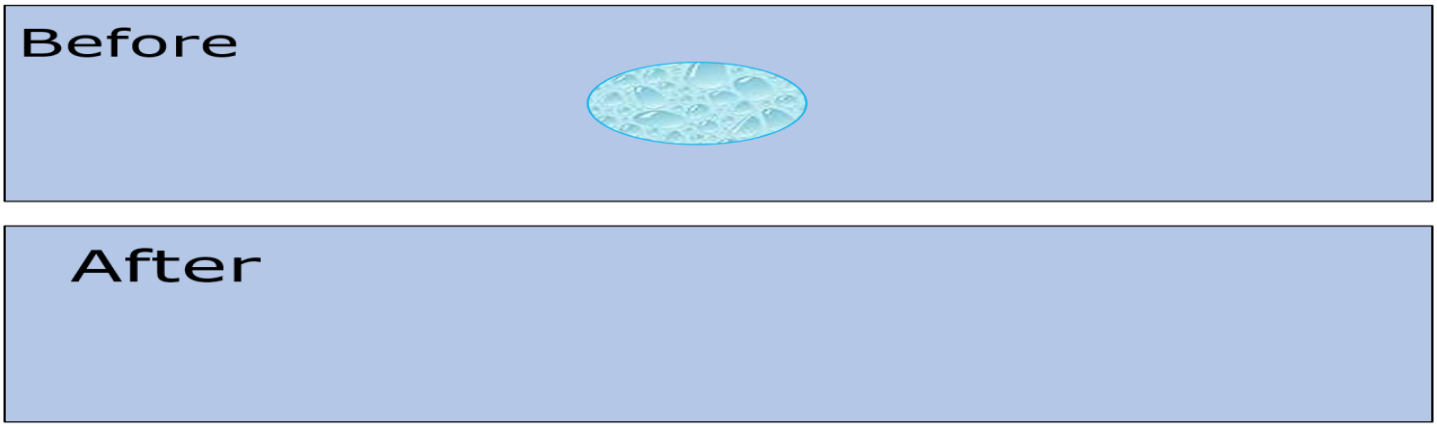
This is a meniscus, and it is the curved surface at the top of a column of liquid caused by adhesion to the glass. Always measure the liquid at the bottom curve of the meniscus. There is 9.75 ml of liquid in this cylinder.



Which is adhesion and which is cohesion in this graduated cylinder full of water?



Follow the instructions in the slideshow below.



What happened to the water drop?
Why is it hard to lift the slide after the drop smeared?

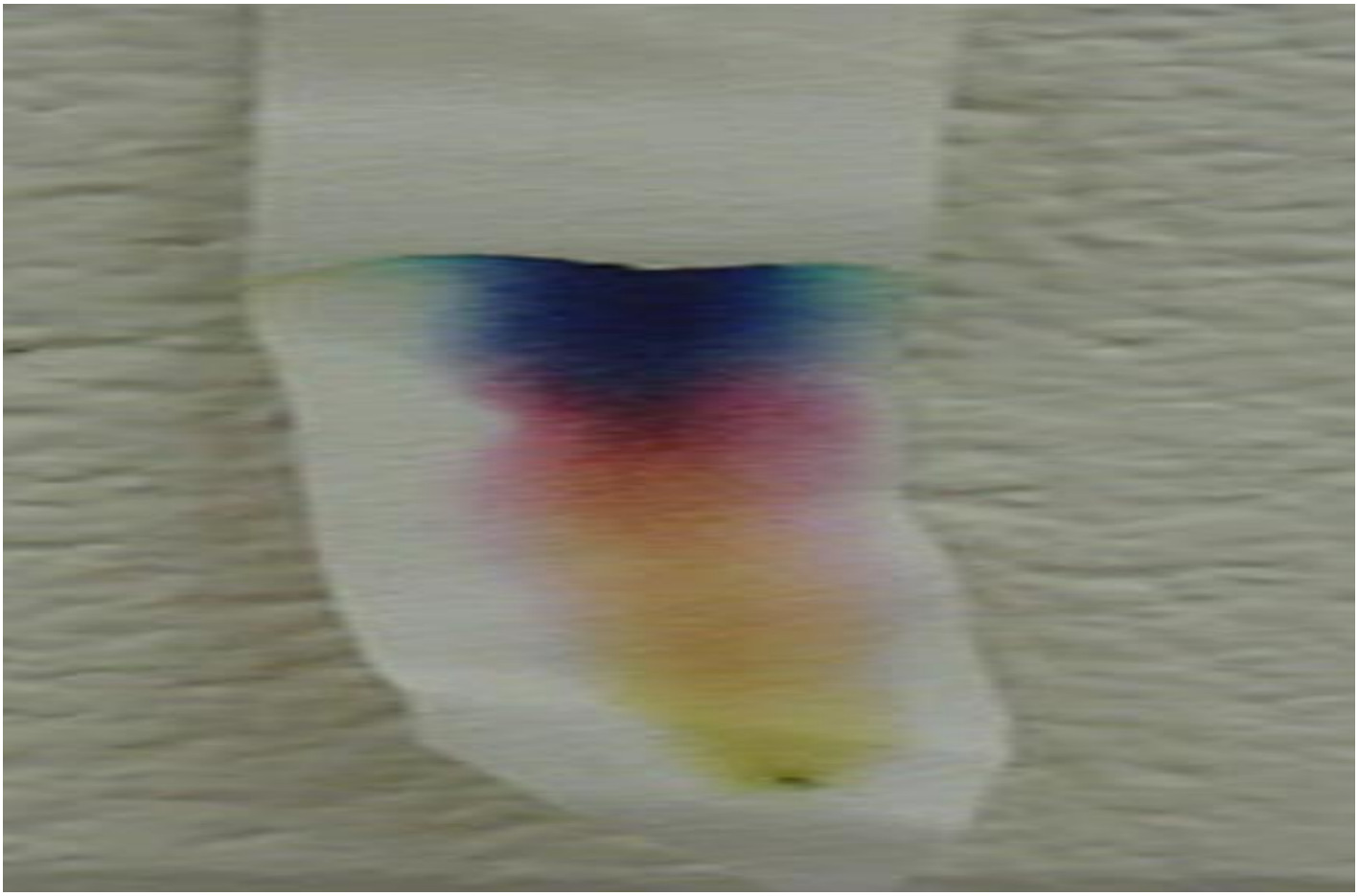
- The water molecules adhered to the table, glass, and other water molecules.

Capillary action: When water climbs plants by adhesion.

Chromatography: A method used to separate complex mixtures using adhesion.

Dissecting a black dot.

- Challenge, Separate all of the colors of a black dot.
- Procedure: Make a black dot on the bottom of the coffee filter paper with black vis-à-vis marker (cut into long rectangles).
- Place bottom of coffee filter in water.
  - (Dot needs to stay above water level.)
- Keep the bottom of the coffee filter in the water for 10 minutes



Please draw arrows showing where the water in this picture will go? That is, how does a plant get water to the leaves?

#1) What is the name of this type of phenomenon?

#2) What property of water causes it?

#3) What do know about plant biology? Photosynthesis

Please draw arrows showing where the water in this picture will go?

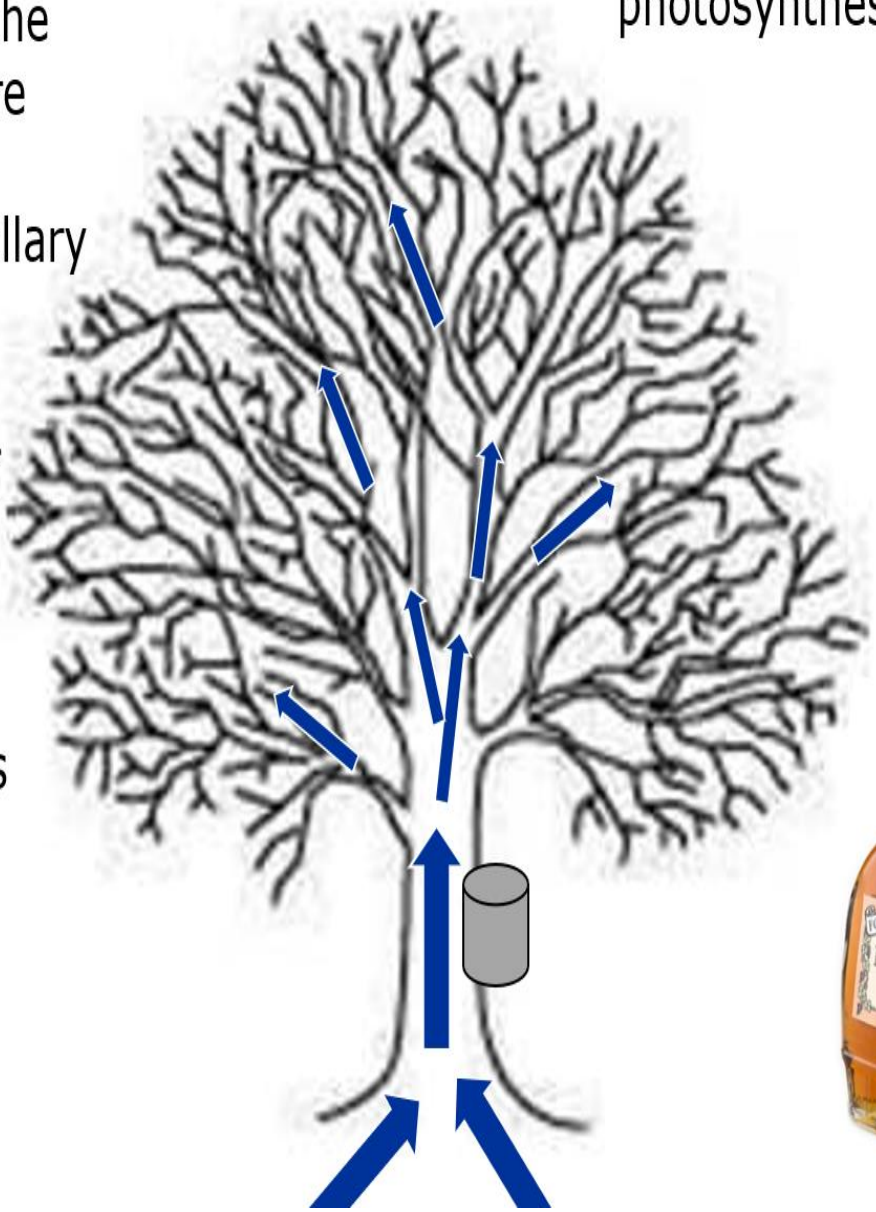
#1) What is the name of this type of phenomenon?

#2) What property of water causes it?

#3) What do you know about plant biology?

3.) Plants need water to do photosynthesis

1.) The name for the phenomenon where water travels up a plant is called capillary action



2.) The property of water that causes capillary action is adhesion. This is where water climbs / attaches to something other than water.

The leaf below used to be green but is now changing colors. How could you separate a leaf into all of its different colors?
Think chromatography.
You could separate the colors of a leaf by using chromatography paper. You first need to mash up a leaf into a solution and allow them time to be absorbed by the chromatography

paper. The lighter less dense colors will travel further up the paper, and the heavier / more dense materials will be near the bottom of the paper.

Part 3 Lesson 5 Surface Tension

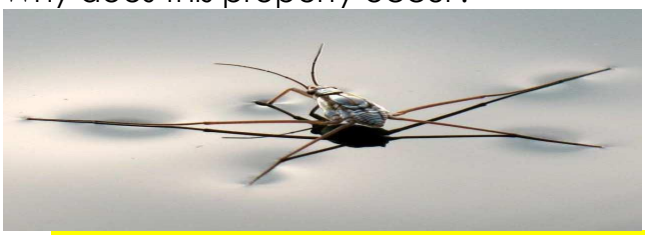
Surface tension: Water molecules tend to stick to themselves instead of the air.

- This creates a small film over the water.

What did your swirly milk look like? Draw it!

What property of water can be seen in the photograph below?
Please draw another example of this property in the space below.

Why does this property occur?



- This is an example of surface tension. Surface tension is when water molecules tend to stick to themselves instead of the air. This creates a film on the water that an organism such as a water strider can walk one. The water strider is specially adapted to not break through this film, and feeds on insects that aren't as fortunate.

Part 3 Lesson 6 High Specific Heat of Water

High Specific Heat: Hydrogen bonds absorb heat when they break, and release heat when they form.

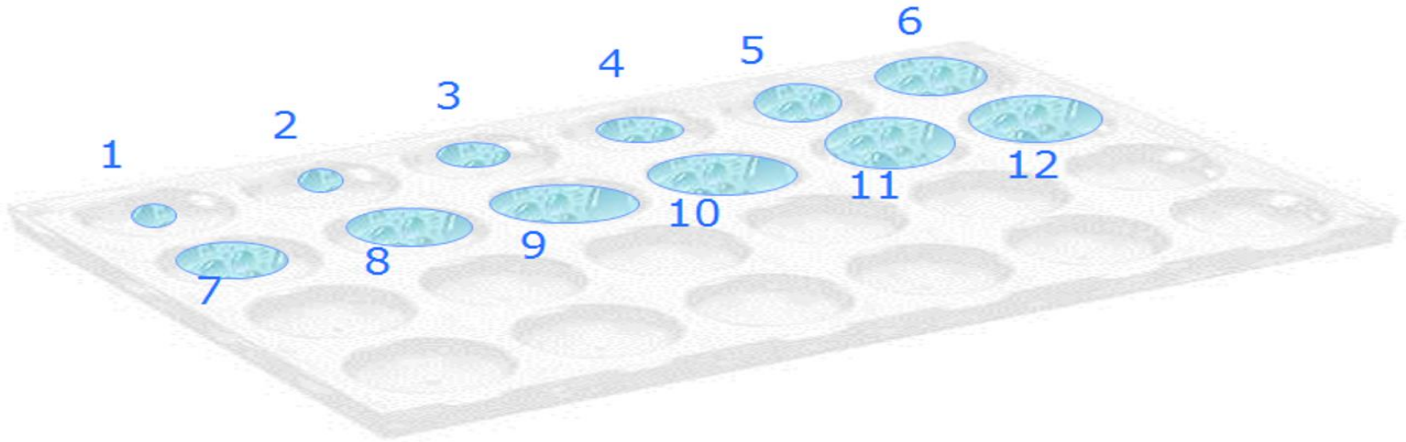
The high specific heat of water means that a lake won't freeze or heat up suddenly.

- This gives aquatic organisms a chance to adjust to temperature changes slowly.

It takes significant energy to change the state of water.

Solid → Liquid → Gas (Energy Added)
Gas → Liquid → Solid (Energy Removed)

Which ones were frozen, and which were unfrozen after 15 minutes?



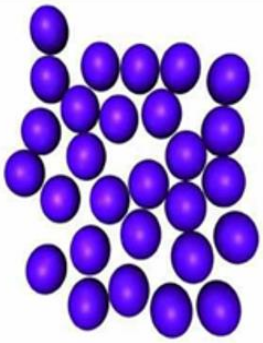
The smaller amounts of water will freeze. The first to freeze will be the single drop, and the largest may not freeze.

Why? How does this show waters high specific heat?
This shows high specific heat because it took more energy to freeze the larger amounts of water.

Which of the following pictures will freeze first, second, third, fourth, fifth, and last?

Part 3 Lesson 7 The Water Cycle

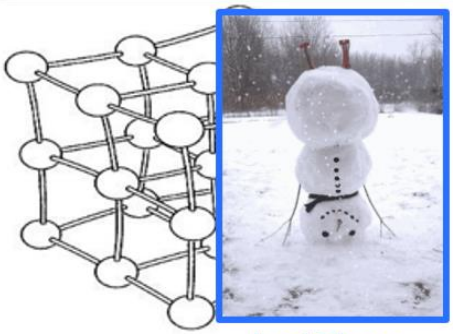
Name each state of matter on a molecular level. ~~(Solid, Liquid, Gas)~~



Semi Ordered

Liquid

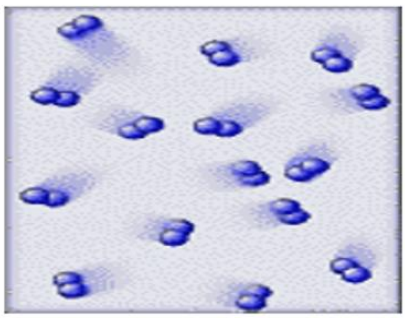
True or False? On earth water exists in all three states of matter?



Called a crystal Lattice

Solid

True or False? The lower density of ice causes it to float?



Moving fast!

Gas

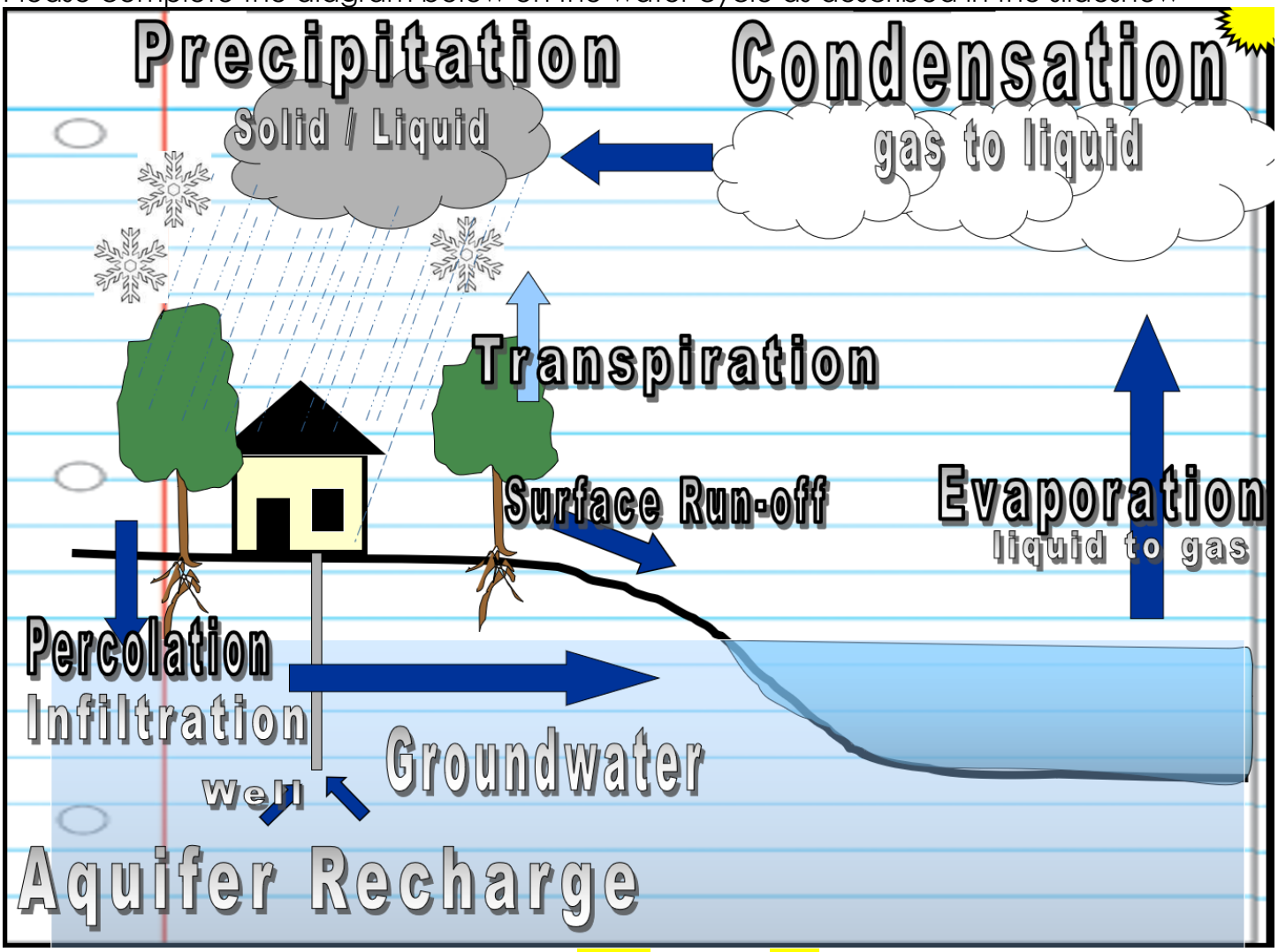
True or False? The oceans and atmosphere move heat around the planet?

The Water Cycle also known as the hydrologic cycle

Driven by the Sun and Gravity.

The hydrologic cycle (Water Cycle): The continuous movement of water on, above, and below the surface of the earth.

Please complete the diagram below on the water cycle as described in the slideshow



Evaporation – Substance changes from a liquid state to gas state (requires energy).

Condensation – Water vapor (gas) turns back to a liquid. (energy required/cold) -cloud formation.

Precipitation – Water that is so heavy it falls as liquid / solid.

Sublimation – Solid state turns directly to a gas state skipping liquid phase.

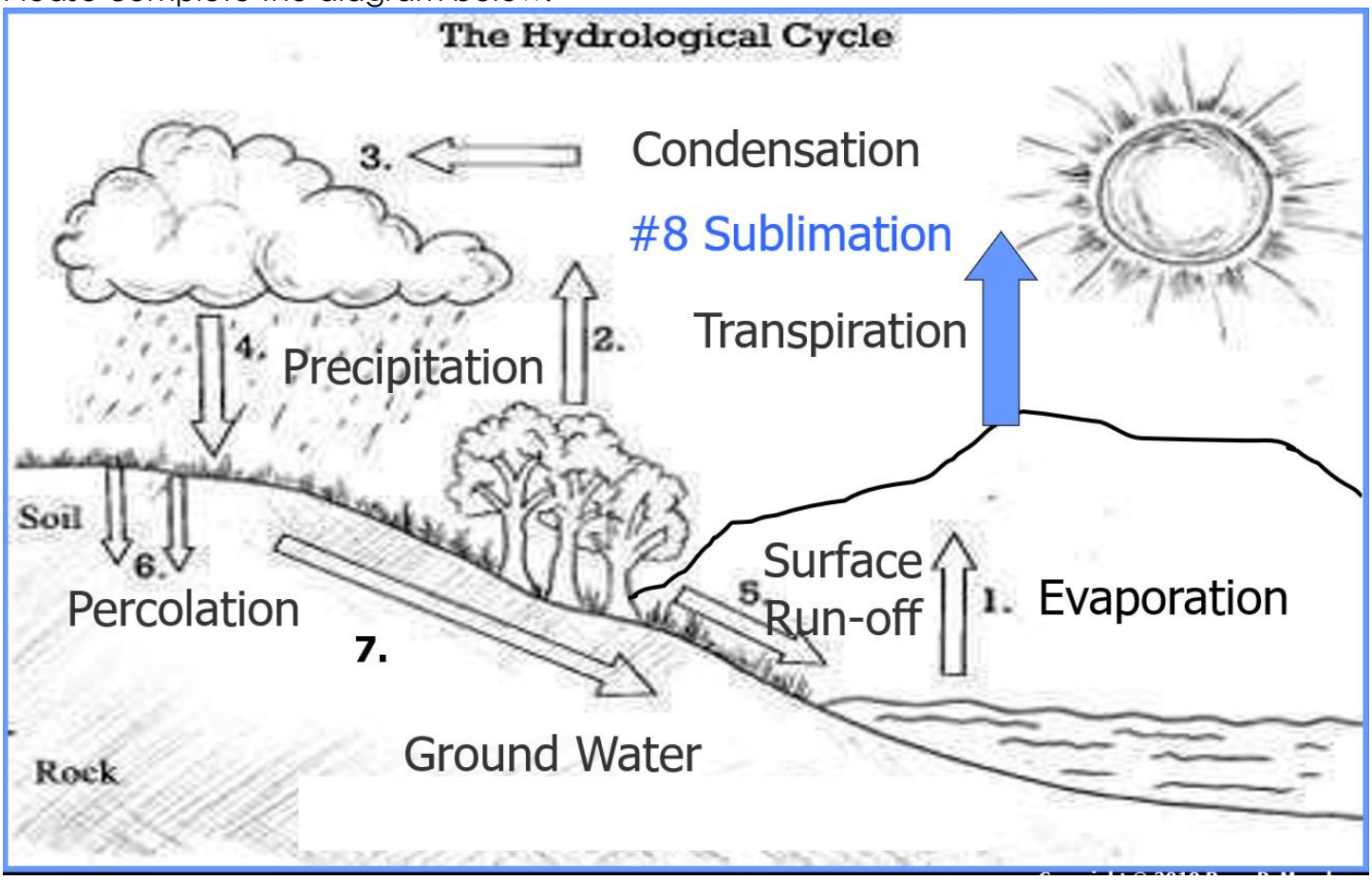
Evapotranspiration – Water released by plants into air.
Non-living to the living, and back again.

Surface run-off: The water flow which occurs when soil is full to capacity and excess water travels over the surface.

Percolation: The slow movement of water through the soil.

Groundwater discharge: Water that has been underground seeps back into the oceans, or into rivers or lakes.

Please complete the diagram below.

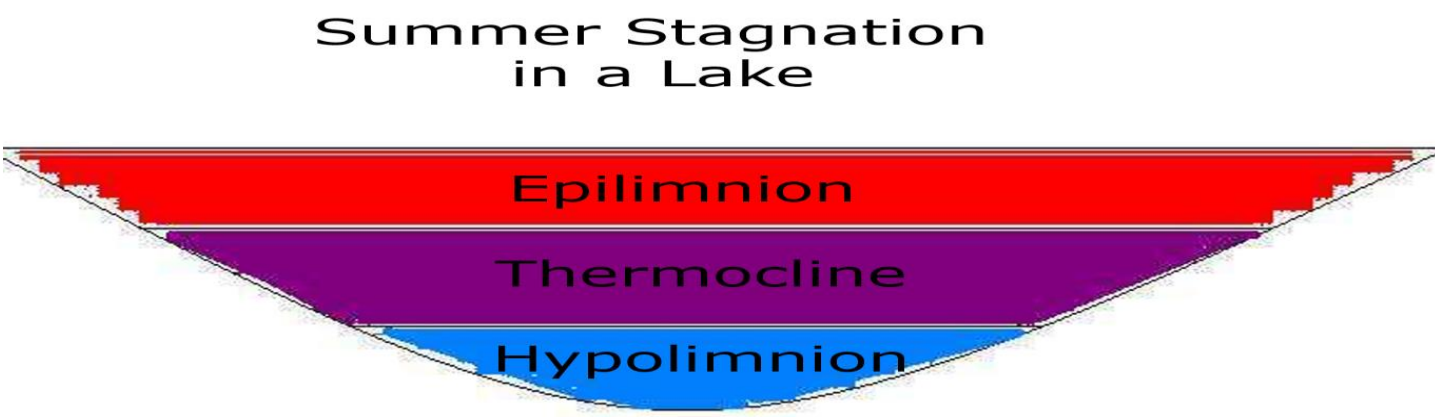


Part 4 Lesson 8 Lake Turnover

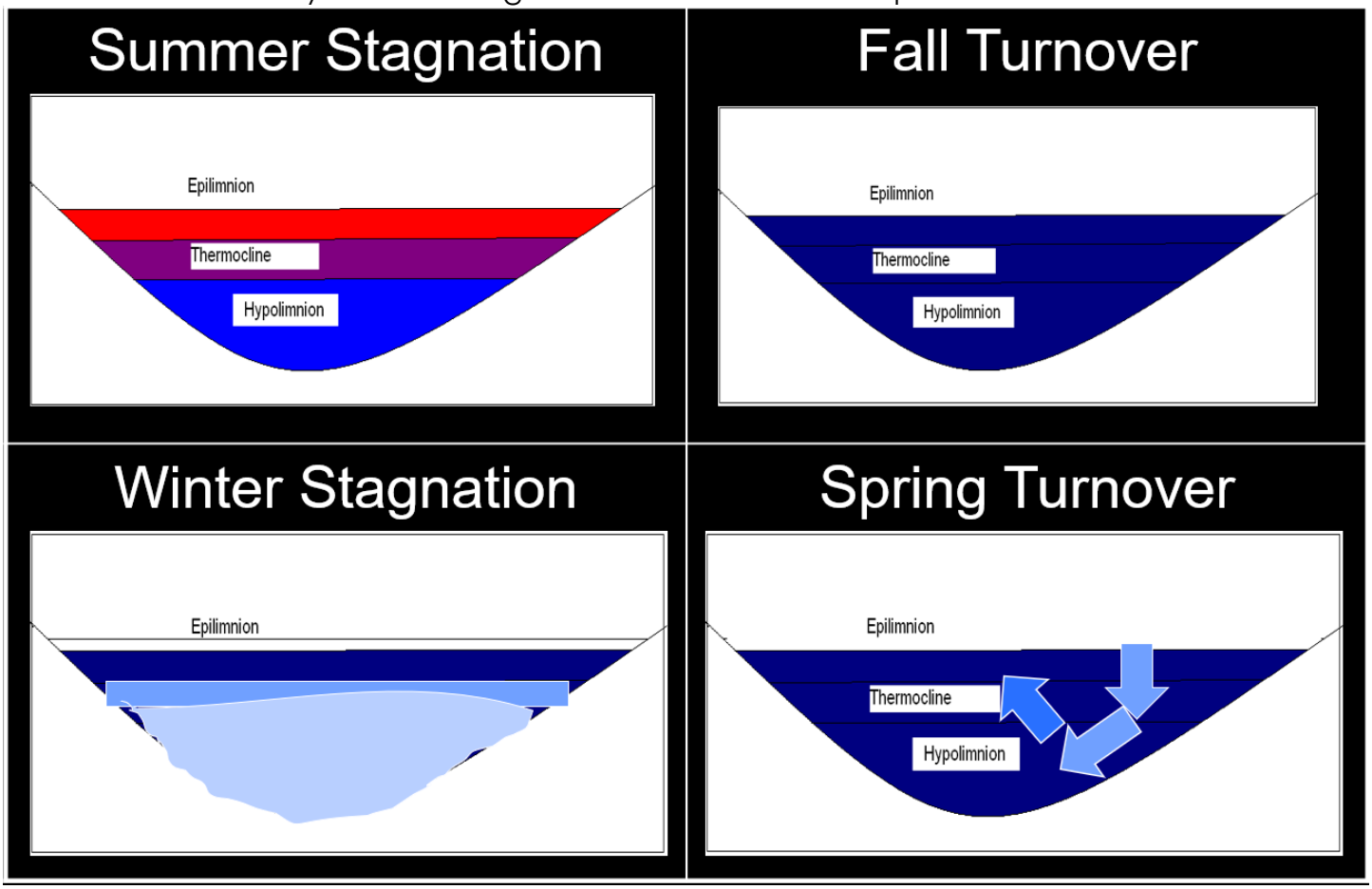
Lower Density of Ice Water forms a crystal lattice when it freezes which is less dense than water…Ice Floats!

Lake Turnover…

- Fall - Air temperatures drop, and the upper layers of water get cold.
- Wind and chop mix the upper layers as well.
  - Upper water layer gets colder, denser, heavier, and sink.
- Colder water displaces the water the lake bottom forcing the lower layers to the surface.
- Winter - Ice forms layer over water. Lake becomes layered.
- Spring – Melting ice causes water to sink and mixes layers
- Summer – Warm temperatures cause layering.



Please demonstrate your knowledge of lake-turnover in the space below.



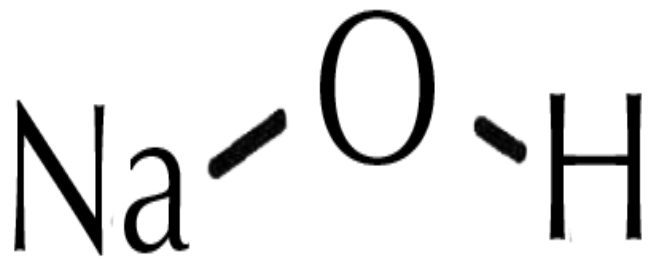
Part 3 Lesson 9 Acids and Bases

An acid is any hydrogen-containing substance that is capable of donating a proton (hydrogen ion) to another substance.

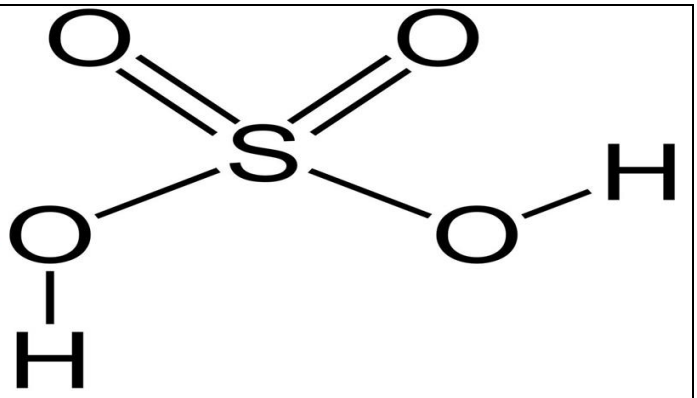
Acidic substances are usually identified by their sour taste. ... Acids are known to turn litmus red.

A base is a molecule or ion able to accept a hydrogen ion from an acid.

Which is the acid and which is the base?



Answer= Base

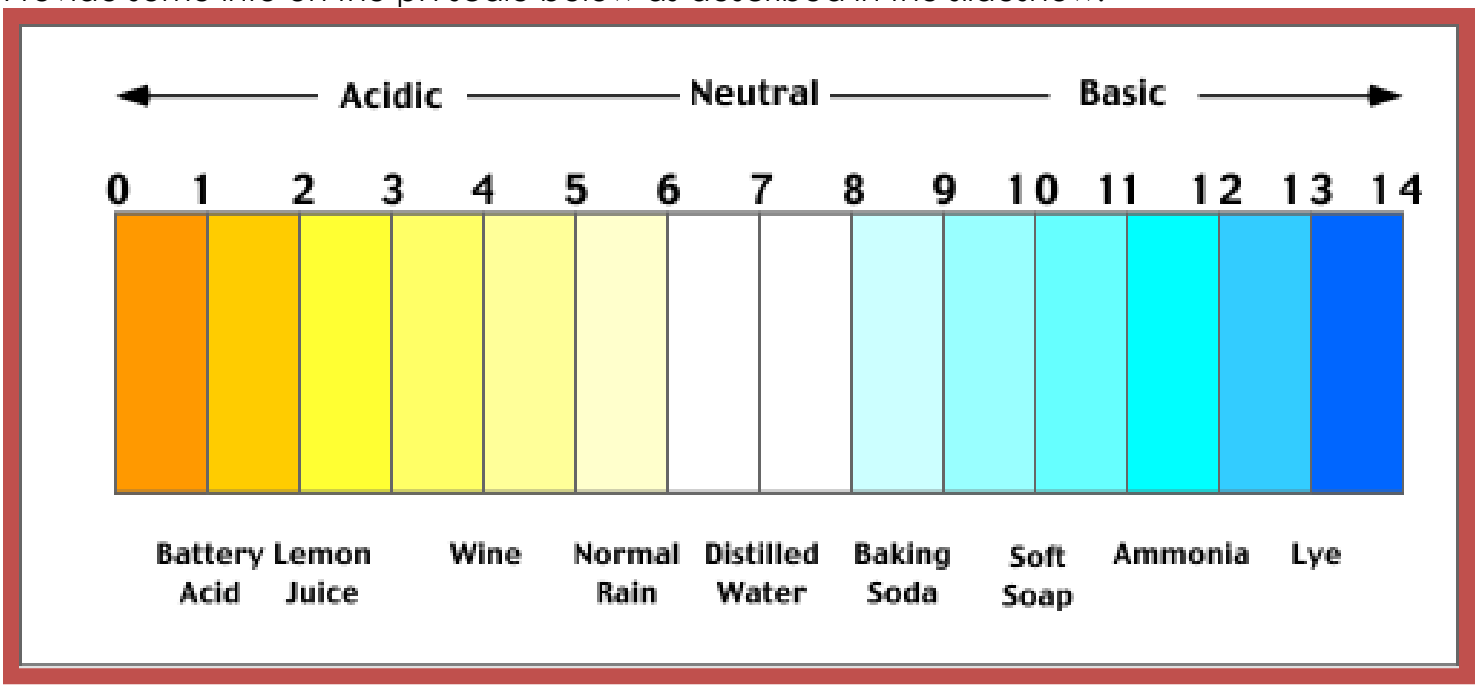


Answer= Acid

Water in a pure state has a neutral pH.

- Pure water is neither acidic or basic.

Provide some info on the pH scale below as described in the slideshow.



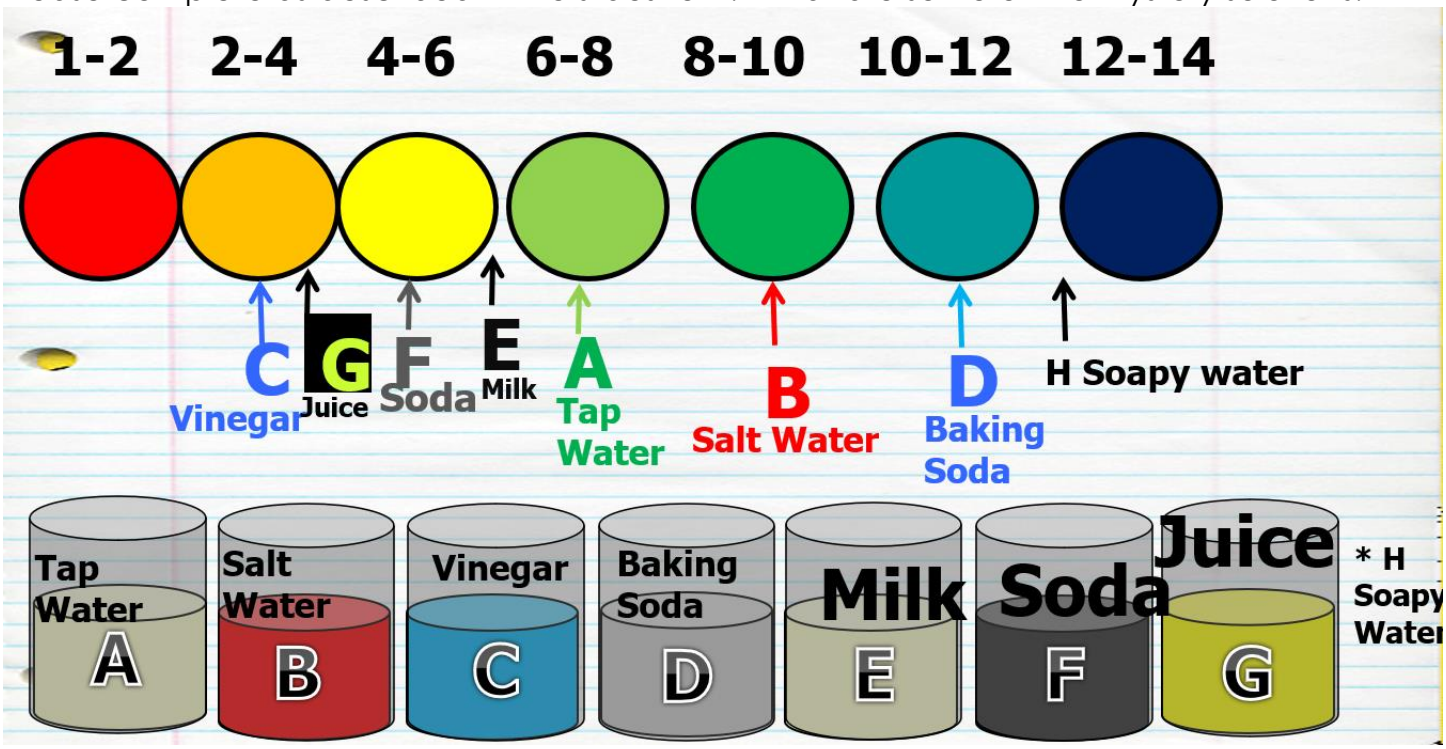
Use the diagram below to assist you in writing a short paragraph that describes the differences between acids and bases?

Acids usually have a pH between 0 and 7, they donate protons and a solution that has H+ is usually acidic. Acids have sour taste such as lemons, vinegar, and the dangerous HCL. Bases, on the other hand are proton receivers. They have a pH of 8 to 14 and turn litmus paper blue. They are slippery and a solution that has an excel of OH- ions is basic. Acids and bases are different, there ability to donate or accept a proton creates these differences.

Which is an acid? And which is a base?

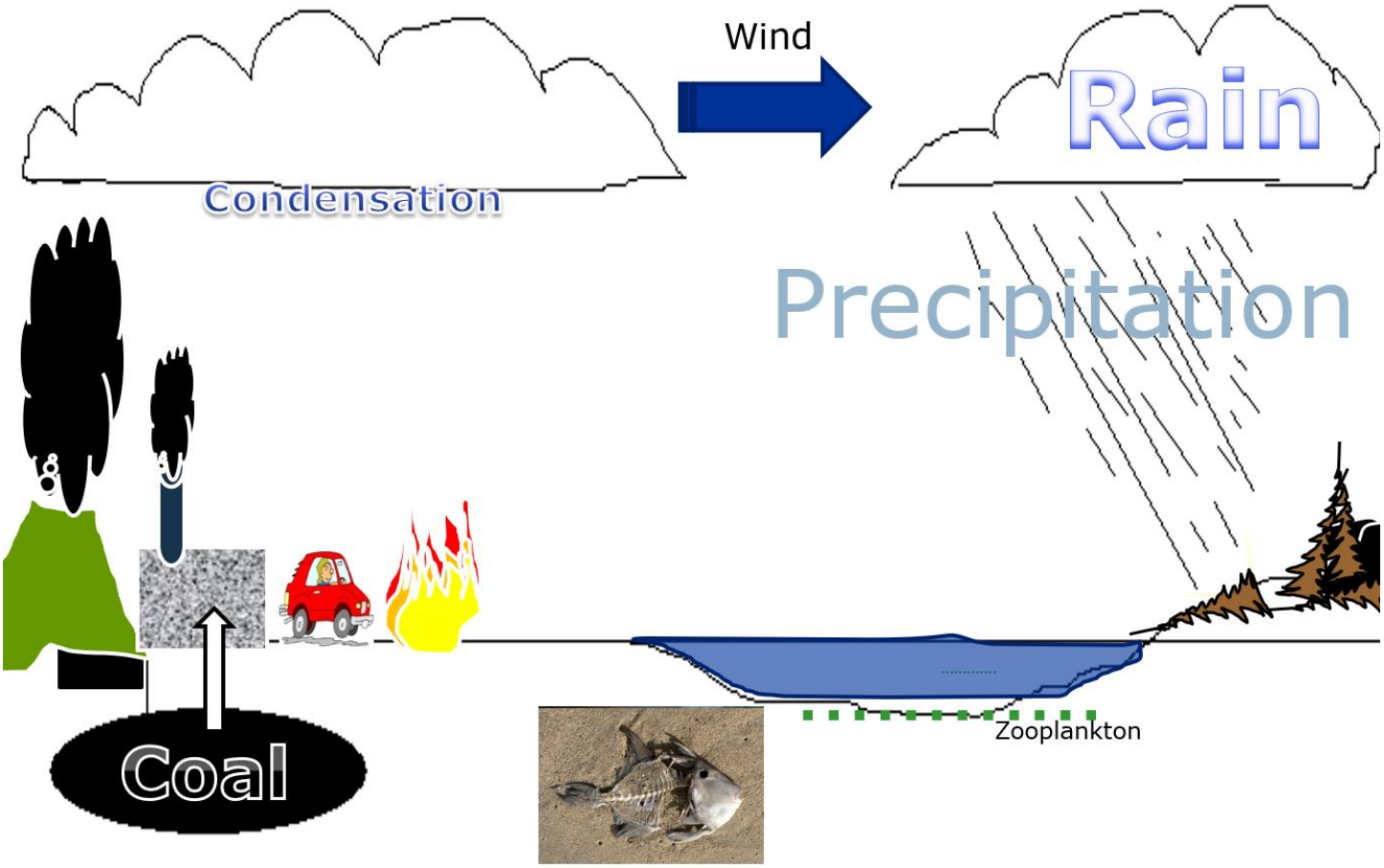
Base	Acid
A substance which when added to water produces hydroxide ions [OH^-]. Turns litmus blue. They react with most cations to precipitate hydroxides. Taste bitter Do not taste in the lab.	A substance which when added to water produces hydrogen ions [H^+]. React with zinc, magnesium, or aluminum and form hydrogen ($H_{2(g)}$). React with compounds containing CO_3^{2-} and form carbon dioxide and water. Turns litmus red. Taste sour (lemons contain citric acid, for example). Tasting Acids in the lab would be unsafe.

Please complete as described in the slideshow? What are some of the mystery solutions.



Part 3 Lesson 10 Acid Rain

Acid Rain is caused by Nitrogen and Sulfur dioxides. aka – Air pollution (smog) causing the rain to become slightly more acidic. This has a negative impact on plants and micro-organisms. Sketch out the diagram of acid rain below as described in the slideshow.



Part 3 Lesson 11 Mixtures, Solubility, Soda Store Project

Matter : Anything that has mass and takes up space.

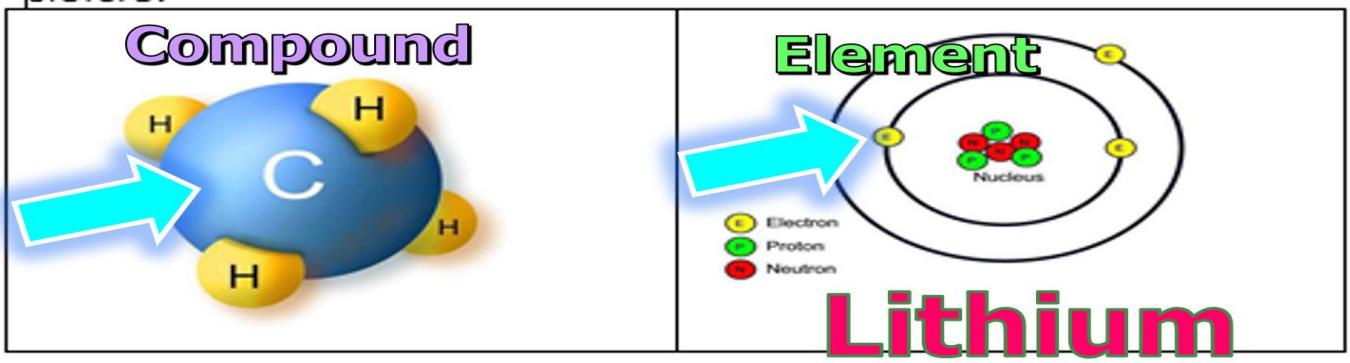
Element: A substance that is made entirely from one type of atom.

Compound: Made up of two or more elements bonded together.

- Mass is a measurement of the amount of matter something contains.
- Weight deals with the pull of gravity.
- Even if you are weightless in space you still have mass.

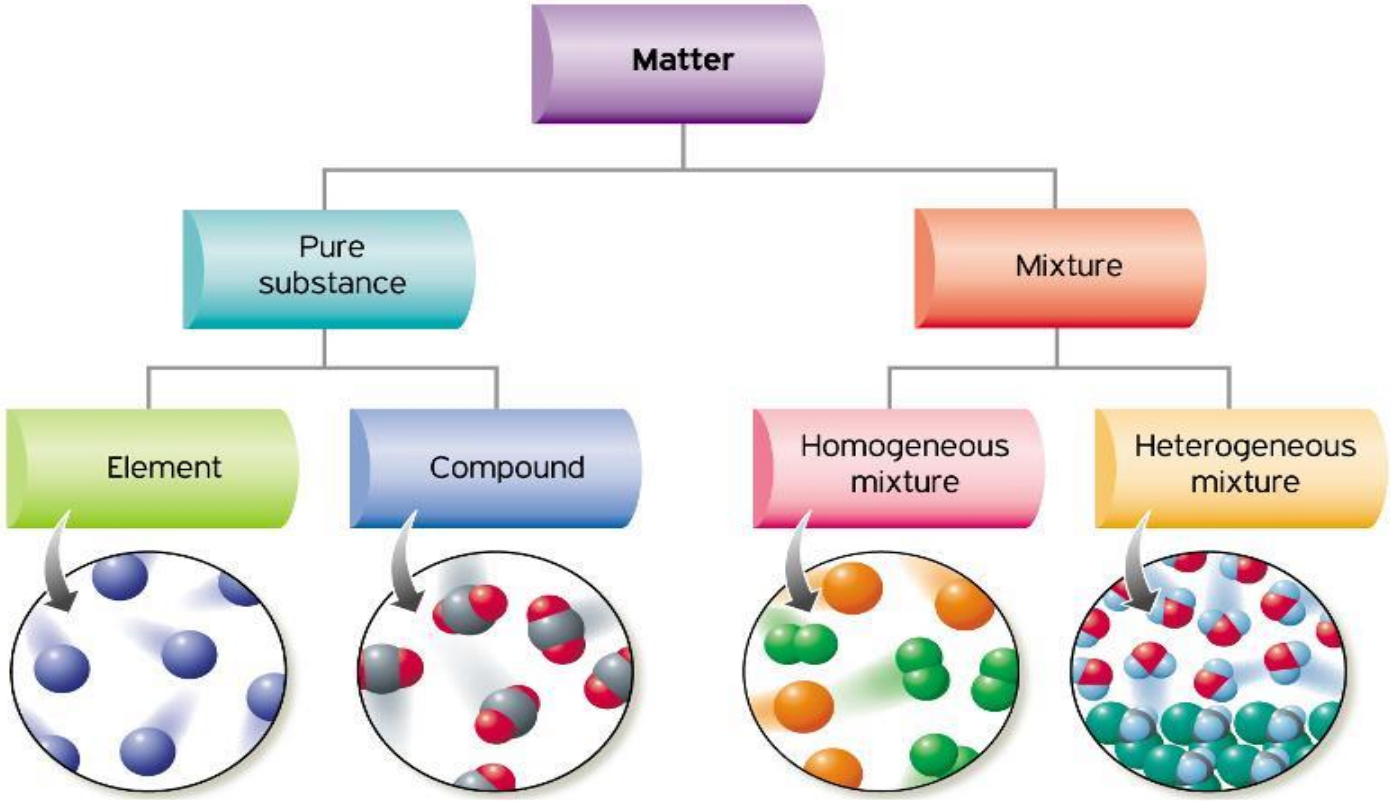
Which of the following drawings are of an element, and which is of a compound? Describe your reasoning in the spaces around each picture.

Which of the following drawings are of an element, and which is of a compound? Describe your reasoning in the spaces around each picture.



Compound, Made of more than one element
CH_4 (Methane)
Carbon and Hydrogen

Made of only one type of atom



Homogeneous mixture: Same molecules throughout.

Heterogeneous: A mixture of two or more compounds.

Quiz Wiz! 1-10 Homogeneous or Heterogeneous.

1)Homogeneous	2) Homogeneous	3) Homogeneous	4)Heterogeneous
5)Heterogeneous	6) Homogeneous	7) Homogeneous	8) Heterogeneous
9) Heterogeneous	10) Homogeneous	*11) Lord Farquaad (Shrek, 2001)	

Part 3 Lesson 12 Soda Store Project

Solvent: A substance that does the dissolving (usually larger amount / Water).

Solute: The substance that gets dissolved (usually lesser amount).

Solubility: How much solute can dissolve in a substance before it becomes saturated.

Supersaturated: When no more solute will dissolve. (crystals become visible)

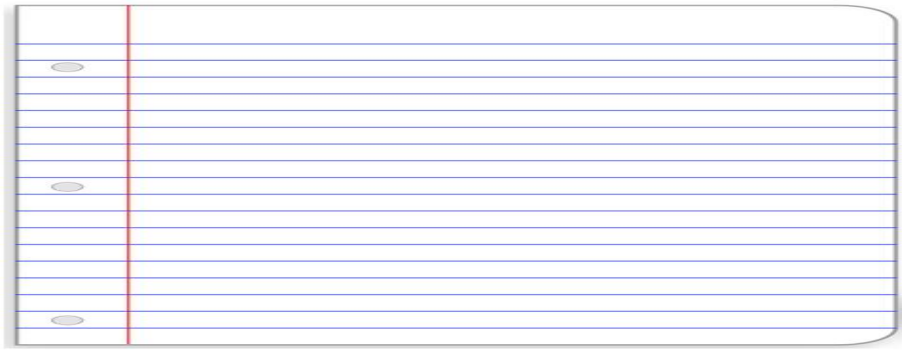
SODA STORE! Make a brand of soda for scientists. Please describe your solution using some science terminology below. Be prepared to present your soda.

Group members and Role: President, Graphic Designer, Taste Chemist, Marketer

Name of your Soda?_____ Name #2_____
Color of your Soda?_____ How are you going to get that color?
Taste of your Soda?_____
Taste of your Soda #2?_____

Ingredients (dry solute only) No pharmaceuticals etc. : Amount of Sugar in grams _____

Your Motto / Jingle / Presentation / Your Label, Use the space below to prepare.
You must include the word solution, solvent, solute, solubility.



How did it taste? What would you do differently next time?

Does mixing sugar and water result in a new substance?

- Answer: No, In order to create a new substance you would need a chemical change.
  - The sugar changed from a solid to a liquid. This is a physical change and not a chemical change.

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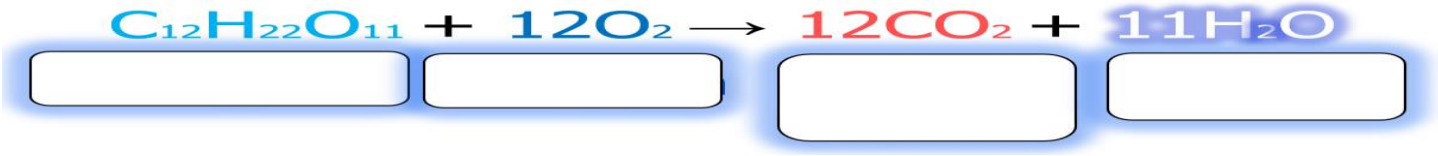
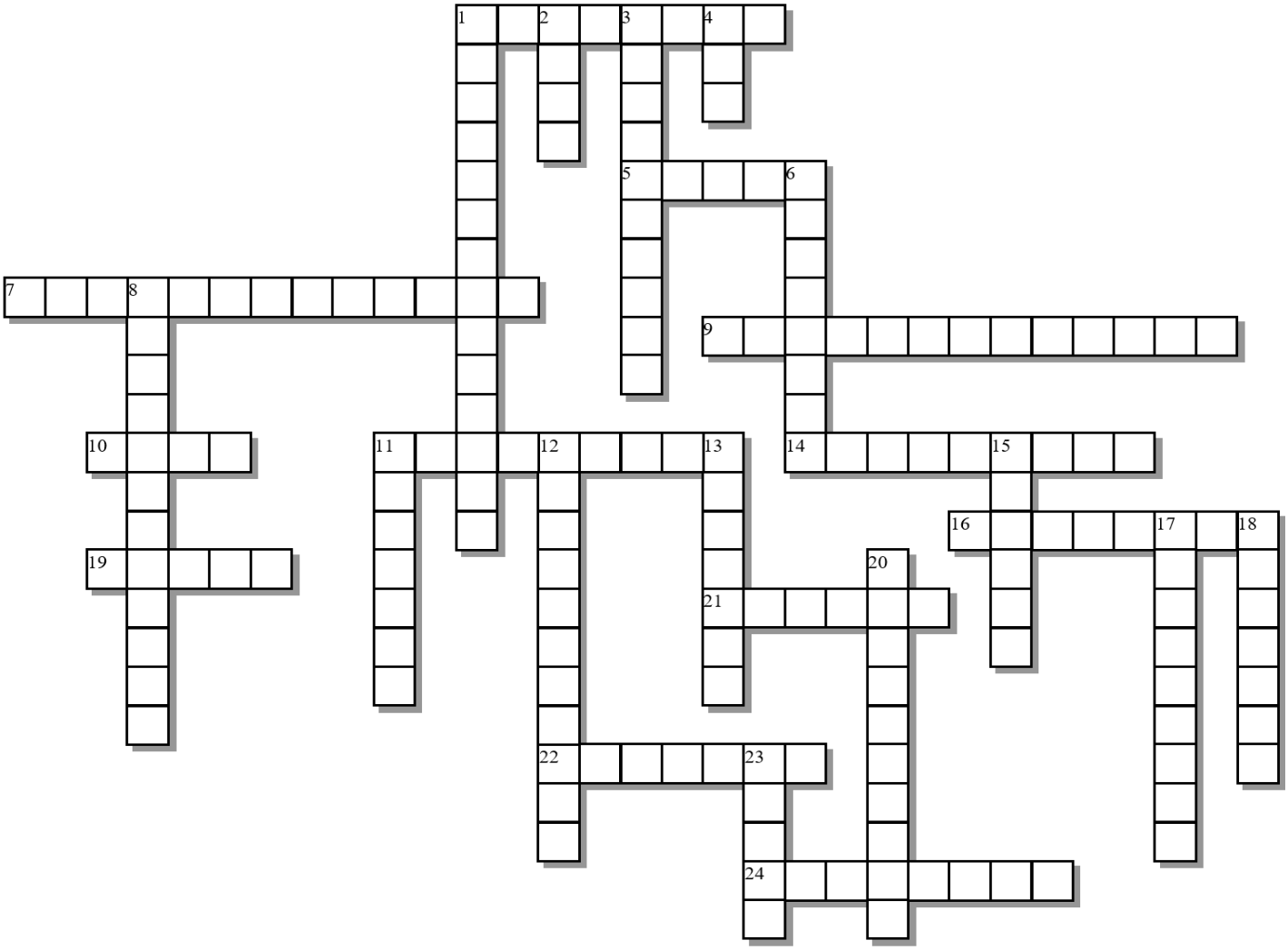
When we burn the sugar in our cells, we do change its form / create a chemical change. We eat / drink sugar and breath in oxygen gas. The products of the chemical reaction are carbon dioxide gas and water vapor that we exhale.



Cellular Respiration

Sugar	Oxygen	Carbon Dioxide	Water

Note- The solution for the crossword has disappeared. Sorry for that… Life happens



Answers:
Adhesion, Boils, Capillary, Chromatography, Cohesion, Condensation, Density, Depletion, Evaporation, Heat, Heterogeneous, Icecaps, Meniscus, Neutral, Non-polar, Oceans, One, Polar, Precipitation, Properties, Rivers, Solubility, Solution, Solvent, Water, Zero

Across:
1 - Hydrogen bonds hold water molecules together to each other.
5 - Water _____ at 100 degrees Celsius
7 - Water that is so heavy it falls as liquid / solid.
9 - A mixture of two or more compounds.
10 - Water freezes at _____ degrees Celsius
11 - The drying up of wells is one effect of groundwater _____?
14 - These molecules tend to have like charges (+ +) (- -)
16 - The curved surface at the top of a column of liquid
19 - The _____ Cycle: The continuous movement of water on, above, and below the

Down:
1 - A method used to separate complex mixtures
2 - High Specific _____ : Hydrogen bonds absorb heat when they break, and release heat when they form.
3 - How much solute can dissolve in a substance before it becomes saturated.
4 - Water weighs ____ gram per cubic centimeter
6 - A liquid mixture in which the minor component (the solute) is uniformly distributed within the major component (the solvent)
8 - Water vapor (gas) turns back to a liquid. (energy required / cold) -cloud formation.
11 - Lower _____ of Ice: Molecules are

surface of the earth.
21 - Inland Lakes, Groundwater, and _____ are available freshwater sources?
22 - Most of the freshwater is locked away in the _____?
24 - property that holds water to a surface

spaced far apart. Ice floats
12 - Substance changes from a liquid state to gas state (requires energy).
13 - Water in a pure state has a _____ pH. As a result, pure water is neither acidic nor basic.
15 - Most of earths water can found in the _____?
17 - _____ Action. Name for when water moves up plants by adhesion.
18 - Water is the Universal _____.
20 - Water has unique _____ because of its lopsided + and – ends.
23 - These molecules tend to have a positive charge and negative charge.

Part 3 Review Game

Name:

1-20 = 5 pts Part 3 Lesson 14

Due: Today

*20-*25 * = Bonus + 1 pt,

(Secretly write owl in correct space +1 pt)

Score ____ / 100

Final Question = 5 pt wager

PROPPED UP	THIRSTY CHARLIE	HOT WATER	MIXED UP	FAMOUS FISH Bonus round 1pt each
1) C.) Two hydrogen atoms bound to one Oxygen atoms	6) Cohesion	11) Surface Tension	16) A=Condensation B=Precipitation C=Surface Run-off D=Evaporation	*21) Marlin And Nemo
2) A=Hydrogen B=Oxygen	7) Adhesion	12) Hydroplaning	17) LOWER DENSITY OF ICE IT FLOATS!	*22) Big Mouth Billy Bass
3) Water is Polar Hydrogen + Oxygen -	8) Meniscus A=Adhesion B= Cohesion	13) HEAT HEAT	18) Acid N Basic	*23) Flounder
4) A=Hydrogen Bonds	9) E=Capillary Action	14) GULF STREAM	19) SOLUTE SOLVENT	*24) STARKIST
5) Water= Polar Oil = Non-polar	10) Chromatography Bottom colors are the most dense	15) SOLID LIQUID GAS	20) WATER is the Universal Solvent	*25) "P. Sherman, 42 Wallaby Way, Sydney"

Final Question Wager ___ /5 Answer: Heterogeneous, Oil=Non-polar, Water=Polar, Oil is less dense, Water is more dense