Name ____ Hour ________

Unit 2 – The Properties of Matter Packet

OBJECTIVES

_______1. I can recognize that the properties of a compound differ from those of its individual elements.

_______2. I can distinguish between an element, compound, or mixture (heterogeneous or homogenous) based on drawings or words.

_______3. I can identify a pure substance (element or compound) based on unique chemical and physical properties.

_______4. I can separate mixtures based on the differences in physical properties of its individual components.

_______5. I can explain that the number of particles in a system doesn't change as a result of a phase change (i.e. solid to liquid).

_______6. I can compare the motion of particles, arrangement of particles, and relative entropy of solids, liquids, and gases.

_______7. I can explain the need for an input of energy for melting and boiling and the release of energy for condensing and freezing.

_______8. I can describe melting on a molecular level.

_______9. I can explain why freezing is an exothermic change of state.

_______10. I can explain how heat is transferred by conduction and convection methods.

_______11. I can label the phase changes of a heating or cooling curve and explain the temperature and entropy trends.

VOCABULARY (I can define/describe the following terms in my own words)

- boiling
- chemical change
- chemical property
- compound
- condensation
- conduction
- convection
- crystal lattice
- element
- endothermic
- entropy
- exothermic
- freezing
- gas
- heterogeneous
- homogeneous
- liquid
- matter
- melting
- mixture
- phase change
- physical change
- physical property
- precipitate
- pure substance
- solid
- sublimation

The "Water to Wine" Demonstration

DIRECTIONS: Watch the demonstration and record your observations under the following categories. Be specific and critical in your thinking.

I see...

I think...

I wonder...

Extra copy of Notes packet

Matter Graphic Organizer

Matter

~~Has~~ mass & takes up space (volume)

Pure Substances

contain only 1 kind of particle

Elements

Made of only 1 kind of atom

Examples

Anything from the periodic table all by itself

Compounds

made of 2+ kinds of atoms chemically bonded together

Examples

2+ elements from Periodic table: $NaCl$, H_2O, $Ba(OH)_2$

Mixtures

contain 2+ pure substances that are physically combined

Homogenous Mixture

A mixture that appears the SAME throughout

Examples

koolaid, tea, apple juice, milk, flat pop, air

Heterogenous Mixture

A mixture that does NOT appear exactly the same throughout

Examples

italian dressing, oil & water, pop, sand & water,

How do elements become compounds?

Chemically combined

How can compounds be separated into elements?

Separated by a chemical reaction

How do pure substances become mixtures?

physically combined

How can a mixture be separated into pure substances? by utilizing physical properties of the parts

What is the diff. between compounds & mixtures?

Physical vs Chemical Notes

A **physical property** is any property of matter that can be observed w/ the senses & can be determined without destroying the substance.

Examples of physical properties are: color, texture, size, mass, volume, temperature, density, state of matter.

A **physical change** is a change that modifies the form, state, or appearance of the matter, but not the chemical nature of the substance

Some examples of physical changes are: tearing paper, state changes: melting, boiling, freezing, dissolving in water

A **chemical property** is a property of matter that can be observed only when substances interact with each other. When a chemical property is observed, the original substance is changed into a different substance

Examples of chemical properties are: acidity, basicity, flammability, reactivity w/ water

A **chemical change** is a change that produces one or more new substances with properties unique from its starting material. Energy changes & physical changes always accompany chemical changes

Five pieces of evidence to indicate that a chemical change may have occurred:

1. Production of light } energy
2. Change in heat
3. Color change } matter
4. bubbling - evolution of a gas
5. precipitate formation
   ↳ a solid that "falls" out of solution
   ↓
   like snow

Mixture Notes

Kinds of Mixtures:

Solutions

Clear, transparent, homogenous, does not settle, cannot be filtered, can be separated by distillation

Suspensions

Cloudy, heterogeneous, at least 2 substances visible, particles will settle to the bottom over time, can be filtered

Colloids

Cloudy, but uniform, homogenous, does not settle

Intermediate between solution & suspension

Techniques for Separating Mixtures:

Distillation-

using differences in Boiling points to separate 2 liquids. Heat mixture till 1 component boils- then cool, condense & collect that liq.

Decantation-

pour off a liquid w/o disturbing solids below. or use special glassware to take out liquid on bottom of another liquid

Filtration-

passing a mixture through a filter to separate specific particles

Solubility-

dissolving a solid in a liquid to separate it from other insoluble solids

(insoluble → will NOT dissolve)

Magnetic Properties-

using a magnet to remove magnetic particles from a mixture

Chromatography-

Separation of particles within a liquid or a gas as a result of distribution through a solid

Mixtures Video

Mixtures: Together but Separate

1. Molecules within mixtures are NOT chemically combined.
2. Examples of Mixtures from Video
   a. Granite
   b. Blood
   c. Atmosphere
3. When Iron is **physically** combined with sulfur can you still separate it out using a magnet? yes
4. When Iron is **chemically** combined with sulfur can you still separate it out using a magnet? NO
5. Mixtures can have variable ratios. Compounds have fixed ratios.

Heterogeneous Mixtures

6. Properties of a heterogeneous mixture are NOT the same throughout.
7. Examples: Trash, Iron filings and Sand

Homogeneous Mixtures: Solutions

8. Homogeneous mixtures are called solutions.
9. Solutions have the same properties throughout.
10. Solutions are formed when substances dissolve the other substances.
11. Example: Tap water

Separating Mixtures

12. Mixtures can be separated physically. Compounds can only be separated by chemical reactions.
13. The video features 3 methods of mixture separation. Describe the examples for what mixtures can be separated with each method.
    a. Filtration: Water @ water treatment plants, automobile filters of ~~of~~ oil, water or air
    b. Magnetism: solid waste recycling of iron cans
    c. Distillation: suspended & dissolved impurities in water, crude oil

Separation of Mixtures Lab

Mixtures are a common occurrence in our lives and are not unique to chemistry. The beverages we drink each morning, the fuel we use in our automobiles and the ground we walk on are mixtures. Very few materials we encounter are pure, homogeneous substances. Any material made up of two or more substances that are not chemically combined is a mixture. The separation of pure substances of a mixture requires the separation of one substance from another. Chemists have developed techniques for the separation or isolation of pure substances from a mixture. These methods take advantage of the differences in physical properties of the components.

Part I – Separating a Mixture Using Chromatography

1. Cut strips of filter paper so that the filter paper fits inside the test tube and cut a point in the end of the strip.
2. In the center of each strip about 3 cm from the pointed end, place a dot of the marker to be tested. Record the original color of the marker in the data table.
3. Place a small amount of water in the bottom of the test tube.
4. Carefully insert the filter paper with the dot into the test tube, dotted end down. The dot must be above the water and the side of the paper should not touch the sides of the test tube.
5. Allow the test tube to remain undisturbed until a good separation is obtained or until the water reaches the top of the filter paper.
6. Record the colors separated on the line below.

Original Marker Color ______________________

Colors Separated: ____

Part II – Separating a Mixture of Solids Using their Physical Properties

You will be given a mixture composed of salt, sand, poppy seeds and iron.

What are physical properties of each substance that might help you separate the mixture?

Salt - ____

Sand - ____

Poppy Seeds - ____

Iron - ____

Using the materials that are provided on the lab tables, separate the mixture into pure substances. You must show your teacher the final separated pure substances.

When you are finished, use the space below to summarize your procedure.

Physical and Chemical Changes Videos

Record the ALL evidence of a chemical reaction you observed in the following experiments:
(I've included the web address so you can go back to view these videos later if you feel so inclined)

Sodium + water
URL: http://www.youtube.com/watch?v=YvSkXd_VVYk

production of light
change in heat
generation of a gas

Aluminum + Iron Oxide
URL: http://www.youtube.com/watch?v=euQUgp5AY-Y

production of light
change in heat

Calcium Chloride + Sodium Bicarbonate
URL: http://www.youtube.com/watch?v=tULcZsDfoRA

change in heat
color change
generation of a gas

Side Note: Phenol Red is an acid/base indicator that is red in neutral or base and yellow in acid. Beyond the five evidences we learned for this unit, what could be another example of evidence of a chemical change? pH change

A physical change
URL: http://www.youtube.com/watch?v=7h767n_gaCc

What do you notice that is different between this change and those we observed previously?

heat must come from outside source
substance retains its original properties

Observations of Chemical Reactions Lab

Purpose: To observe evidence of a chemical change.

Procedure:

1. Wear goggles at all times. Record all results and observations in the data table below.
2. FIRST make observations about each substance individually. Observations should include: color, state of matter and any other notable characteristics of each substance.

Chemical	A	B	C	D
Observations of Chemical before reaction				

3. Using a well plate, combine 5 to 10 drops of each chemical in the combinations listed below.
   a. chemical A and B in a well and record your observations.
   b. chemical C and D in a well and record your observations.
   c. chemical A and C in a well and record your observations.
   d. chemical B and D in a well and record your observations.

Combination	A + B	C + D	A + C	B + D
Reaction Observation				

4. When finished, rinse and dry your well plate and return to your seat

Conclusions:

1. List the five pieces of evidence for recognizing that a chemical reaction has taken place.
   a. ______________________________
   b. ______________________________
   c. ______________________________
   d. ______________________________
   e. ______________________________
2. For each reaction above, did a chemical reaction take place? If so, cite the evidence you used to make that determination.
   a. Reaction A & B______________________________
   b. Reaction C & D______________________________
   c. Reaction A & C______________________________
   d. Reaction B & D______________________________

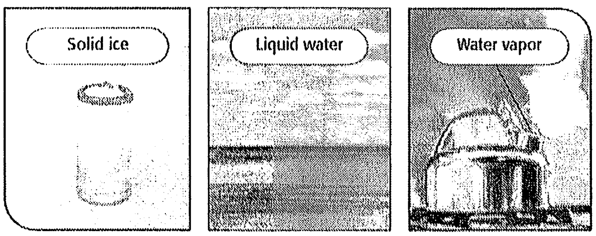
Changes of State Reading

Pre-Reading: Visualizing to activate prior knowledge

1st Scenario: Record all the changes of states of matter you "observed" and describe the temperature and heat energy involved in each change.

2nd Scenario: Record all the changes of states of matter you "observed" and describe the temperature and heat energy involved in each change. Be aware that there are some chemical changes occurring in this scene. Be sure to only describe the changes of states and no chemical changes.

Reading: What Causes Matter to Change State?

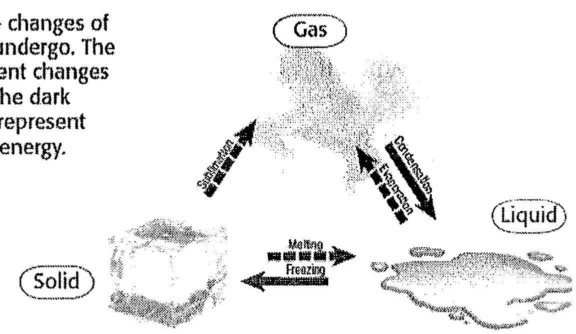


Imagine that you have a glass of ice water. You leave it on a table to answer the phone. When you come back, what do you find? The ice has melted and the outside of the glass is wet. You are observing two changes of state. During a *change of state*, matter changes from one physical form to another. In your glass, solid ice became a liquid. Water vapor from the air around the glass cooled and became liquid water. Changes of state area caused by a transfer of energy. Thus, during a change of state, the energy of a substance changes. However, the identity of a substance does not change during a change of state. For example, ice and liquid water are the same substance.

ADDING AND REMOVING ENERGY

You can change the state of a substance by adding or removing energy. For example, you can add energy to a substance by heating it. Adding energy causes the particles of a substance to move more quickly. Removing energy causes the particles of a substance to move more slowly. If enough energy is added to or removed from a substance, the substance will change state.

This figure shows five changes of state that water can undergo. The dotted arrows represent changes that require energy. The dark colored solid arrows represent changes that release energy.

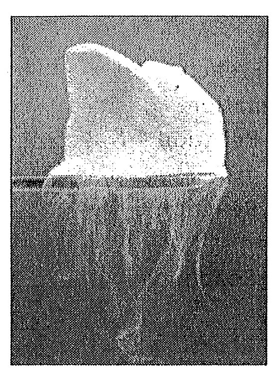


TEMPERATURE AND ENERGY

In most cases, when you add energy to a substance, the particles in the substance will move more quickly. In other words, adding energy can increase the kinetic energy of the particles. Recall that temperature is a measure of the average kinetic energy of particles in a substance. When you remove energy from a substance, the particles in the substance usually move more slowly. Removing energy can decrease the kinetic energy of the particles. Thus, as you remove energy from a substance, its temperature usually decreases.

CHANGES OF STATE THAT REQUIRE ENERGY

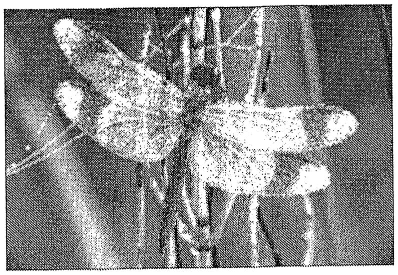
Some changes of state can happen only if energy is added. *Melting* is the changes in state from a solid to a liquid. When you heat a solid, you transfer energy to the substances particles. As the particles gain energy, they vibrate faster. When the particles have enough energy to break from their rigid positions, the substance melts. The melting point is the temperature at which a substance changes from a solid to a liquid. the *melting point* of a substance can change if the pressure changes. *Evaporation* is the change of state from a liquid to a gas. *Boiling* is evaporation that happens throughout a liquid at a specific temperature and pressure. The temperature at which a liquid boils is its *boiling point*. *Sublimation* is the change in state from a solid to a gas. For examples, solid carbon dioxide, or dry ice, changes directly to a gas at room temperature.



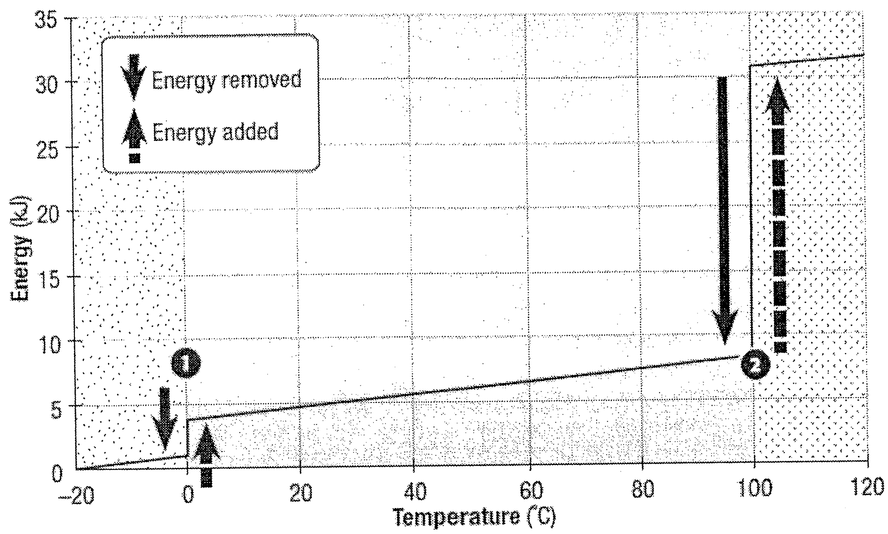
Some solids can change to a gas without first changing to a liquid. This is called sublimation.

CHANGES OF STATE THAT RELEASE ENERGY

Some changes of state release energy. For example, when water vapor in the air becomes a liquid, energy is released. This process is an example of condensation. *Condensation* is the change in state from a gas to a liquid. The *condensation point* is the temperature at which a gas becomes a liquid. Condensation often happens when a gas touches a cool surface. For instance, drops of water may form on a glass of ice water as air touches the cool glass. *Freezing* is the change in state from a liquid to a solid. The temperature at which a substance freezes is its *freezing point*. The freezing point of a substance is the same as its melting point. Recall that energy must be added for substances to melt. When a substance freezes, energy is released.


Water vapor can change to drops of water when it touches a cool surface, such as grass or dragonfly wings.

Changes of State for Water



1 When water freezes, energy is released, or removed. When ice melts, energy is absorbed, or added.

2 When water vapor condenses, energy is released. When liquid water becomes a gas, or *vaporizes*, energy is absorbed.

What Happens to Temperature During Changes of State?

When a substance loses or gains energy, either its temperature changes or its state changes. In other words, these two changes do not happen at the same time. The temperature of a substance does not change during a change of state. For example, if you heat a pot of water on a stove, the temperature of the water increases. When the water's temperature reaches the boiling point, adding more energy will not increase the temperature further. Instead, adding energy causes the water to change state. The temperature of the water will stay the same until all of the water has changed to water vapor.

Entropy

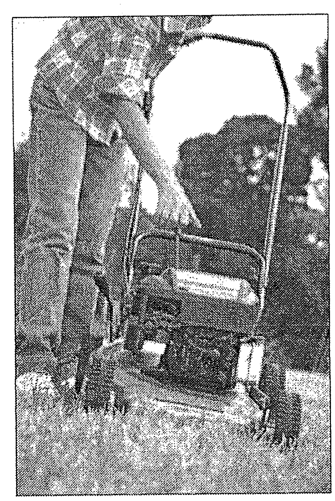
Entropy is the measure of the randomness of particles in a substance. As a substance increases in energy, the particles move more quickly. Faster moving particles are not able to maintain as ordered an arrangement as slower moving particles. Therefore, the more energy a substance has, the more entropy it has as well; randomness increases as energy does. The less energy a substance has, the less entropy it has. For example, solids have less entropy than gases since their particles have less energy, move slower, and have a more ordered structure. Entropy increases any time that energy of particles increases. Therefore, when energy is used to increase the temperature of a substance, entropy of the substance increases. And when energy is increased to change the state of a substance, entropy of the substance also increases. Even when the temperature of a substance does not change during a state change, entropy is still changing. Conversely, when energy of the particles decreases, entropy decreases as well.

What Happens to Mass During Physical and Chemical Changes?

Imagine weighing an ice cube. After the ice cube melts, you weigh the liquid that formed. Which state weighed more – the solid or the liquid? Neither – they have the same mass. During a chemical or physical change, mass cannot be created or destroyed. This is the *law of conservation of mass*. *Conserve* means "to keep the same. When ice melts and becomes liquid water, no mass is lost.

What Happens to Energy During Chemical and Physical Changes?

Just like mass, energy cannot be created or destroyed during a physical or chemical change. This is known as the *law of conservation of energy*. Energy can be changed to another form of energy. However, the total amount of energy before the change must equal the total amount of energy after the change. For example, when a lawn mower burns gasoline for energy, a chemical change takes place. The lawn mower uses some of the energy stored in the gasoline. Some of the energy is transferred to the environment as heat. Thus, the total amount of energy released equals the energy used by the lawn mower, plus heat energy. No energy is created or destroyed.


When a lawn mower burns gasoline, the forms of energy change. However, the total amount of energy stays the same.

During-Reading: Predicting and Summarizing

Name ______________________________ Hour ______ Date ______________________

SECTION 1

Predict: What causes matter to change state?

Summarize: Write one sentence summarizing the introductory paragraph.

Summarize: Write one sentence summarizing the section – ADDING AND REMOVING ENERGY

Summarize: Write one sentence summarizing the section – TEMPERATURE AND ENERGY

Summarize: Write one sentence summarizing the section – CHANGES OF STATE THAT *REQUIRE* ENERGY

Summarize: Write one sentence summarizing the section – CHANGES OF STATE THAT *RELEASE* ENERGY

Evaluating Predictions: Reread your original answer to the question. Was the answer you predicted addressed in the paragraph? Were you correct?

SECTION 2

Predict: What happens to temperature during changes of state?

Summarize: Write one sentence summarizing the introductory paragraph.

Summarize: Write one sentence summarizing the information found in the graphs and figures.

Summarize: What is entropy? How is it related to energy?

Evaluating Predictions: Reread your original answer to the question. Was the answer you predicted addressed in the paragraph? Were you correct?

SECTION 3

Predict: What happens to MASS during physical and chemical changes?

Summarize: Write one sentence summarizing the paragraph.

Evaluating Predictions: Reread your original answer to the question. Was the answer you predicted addressed in the paragraph? Were you correct?

SECTION 4

Predict: What happens to ENERGY during chemical and physical changes?

Summarize: Write one sentence summarizing the paragraph.

Evaluating Predictions: Reread your original answer to the question. Was the answer you predicted addressed in the paragraph? Were you correct?

Post-Reading Vocabulary Practice: Three Truths and a Lie

DIRECTIONS: Identify the "lie" for each substance and put an X on the box. Then write a corrected statement for the lie.

SOLID

Low entropy	Particles with high kinetic energy
Can melt and sublimate	Highly ordered structure

Correction:

LIQUID

Can freeze	Can vaporize
Lower kinetic energy than gas particles	Lower entropy than a solid

Correction:

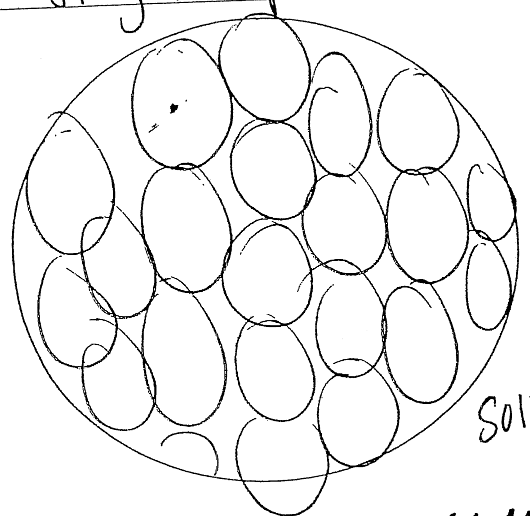
GAS

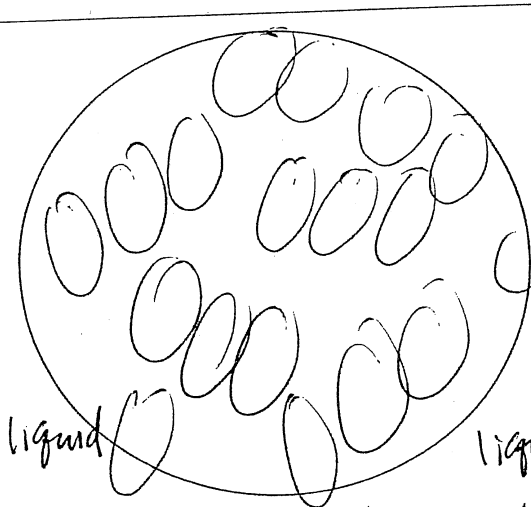
Highest entropy	Can condense
Can sublimate	High kinetic energy of particles

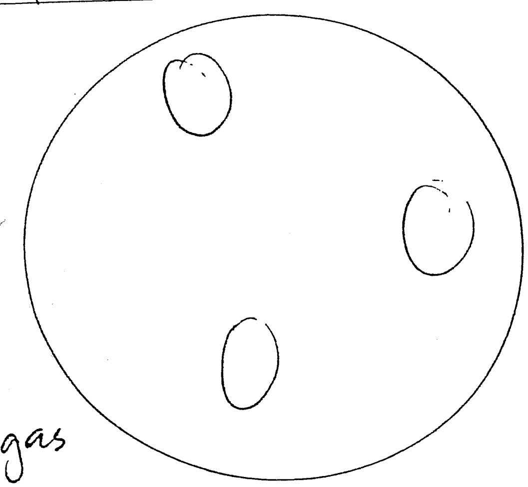
Correction:

Solid, Liquid, and Gas Graphic Organizer

Solid	Liquid	Gas
1. fixed volume & fixed shape	1. fixed volume, no fixed shape	1. NO fixed volume, NO fixed shape
2. Crystal Lattice – held tightly in a rigid structure w/ a pattern	2. particles not held as tightly, slip past each other	2. particles can spread out
3. particles vibrate, but stay in place	3. Takes shape of its container	3. move the most, most free to move about







Solid → liquid

liquid → gas

energy has to be absorbed – endothermic →

← energy has to be released – exo thermic

ENTROPY HAPPENS!!

Entropy is a measure of the disorder or randomness of a system. (A system is anything we are studying at the time!)

Heat ↑, Speed of particles ↑ Entropy ↑ / Heat ↓ Speed of particles ↓ ENTROPY ↓

Solid, Liquid, and Gas Graphic Organizer

Note: within each arrow are vocabulary words and definitions to know!

Gas
No fixed volume & No fixed shape
High entropy

Liquid
fixed volume, no fixed shape
Medium entropy

Solid
fixed volume & fixed shape
Low entropy

Condensation - energy is released to pack particles together
* EXOTHERMIC *

Evaporation - energy must be absorbed to separate particles.
* ENDOTHERMIC *

Freezing - energy is released so particles can pack together.
* EXOTHERMIC *

melting - energy must be absorbed to separate particles
* ENDOTHERMIC *

Sublimation - energy must be absorbed to separate particles.
* ENDOTHERMIC *

deposition → Not need to know

Arrows represent phase changes → a physical change between 2 states of matter

* Temperature STAYS THE SAME during a phase change

* ENTROPY will increase or decrease during a phase change

Methods of Transfer of Heat Energy Video Notes

Conduction – The transfer of heat between particles in a solid caused by a temperature difference between the particles

During Video Questions:

1. The increased speed of vibration and therefore the heat is passed on molecule to molecule.
2. Like a row of dominoes
3. Nonmetals such as wood and plastic conduct heat quite slowly.
4. All metals conduct heat very rapidly.

Post-Video Question:

5. Explain how heat is transferred between molecules in a solid.

Convection – movement within a fluid caused by the tendancy of hotter, therefore less dense material to rise & colder, more dense material to sink

During Video Questions:

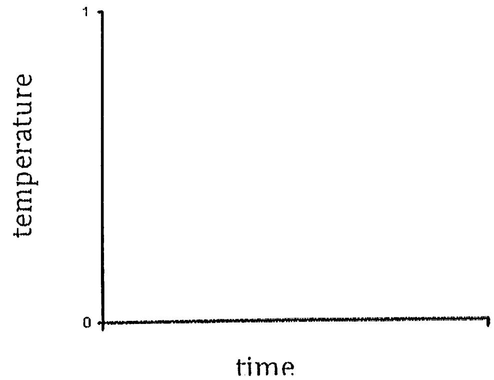
6. When water is heated, molecules speed up and expand and become less dense.
7. This less dense water will therefore go up and then cool and become dense again, and therefore go down.
8. Hot air rises just as hot water rises.

Post-Video Question

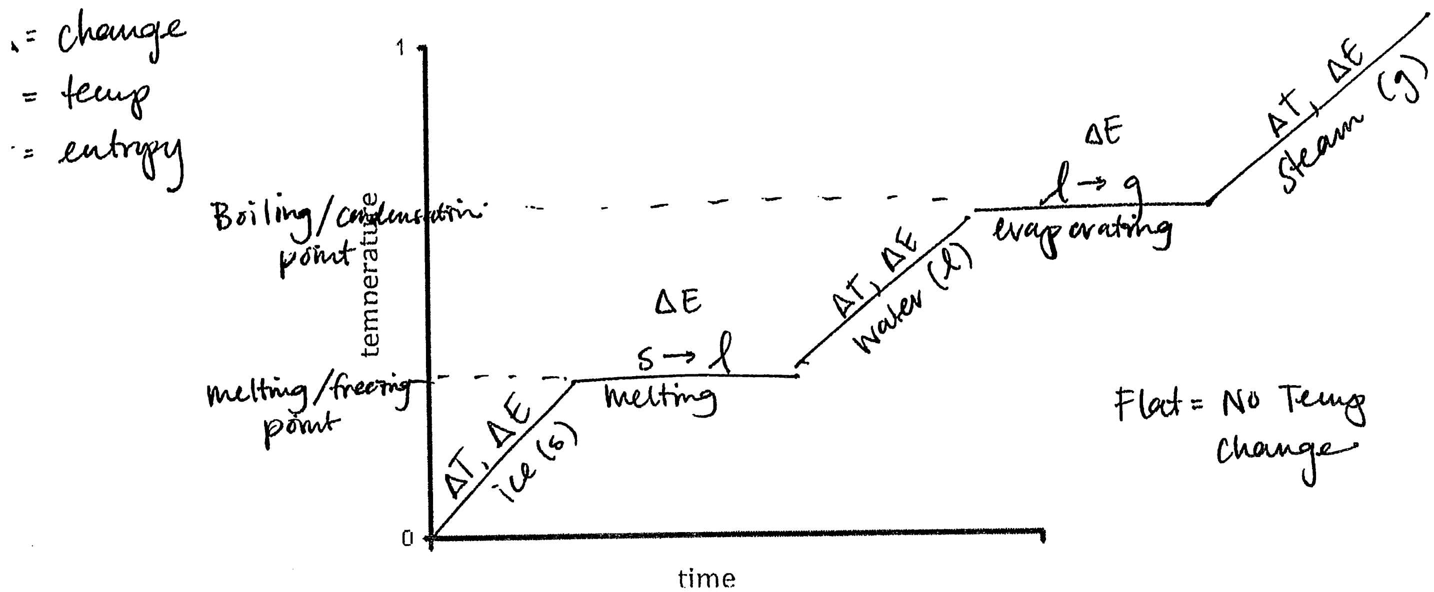
Explain how heat is transferred between molecules in a fluid (liquid or gas).

Heating and Cooling Curves

What happens to the temperature of a block of ice when you put a Bunsen burner underneath it? Predict what the graph would look like:



You might think that the temperature goes up smoothly, but that's not what happens. The graph of temperature against time is called a heating curve. Let's look at the heating curve for water.



Notice that, in general, the temperature goes up the longer the heating continues.

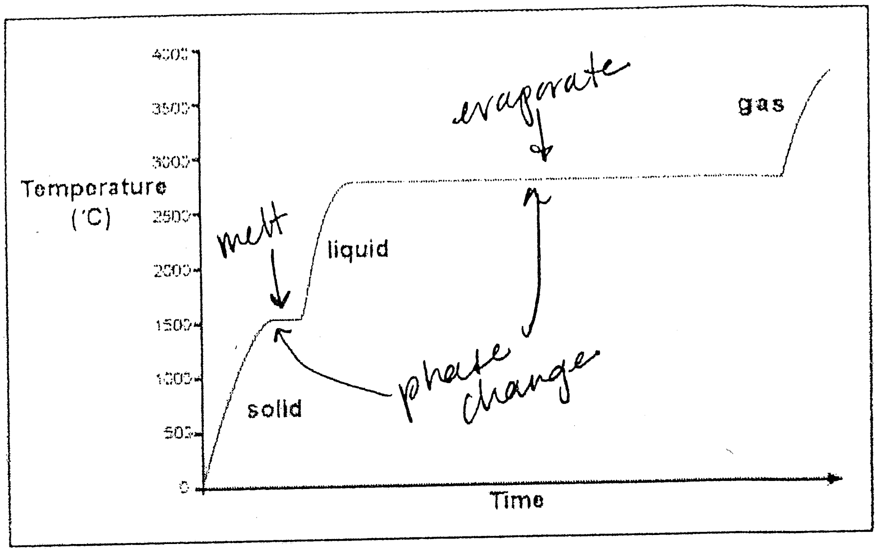
However, there are two horizontal flat parts to the graph.

These happen when there is a Change of State. The flat areas are also called phase changes.

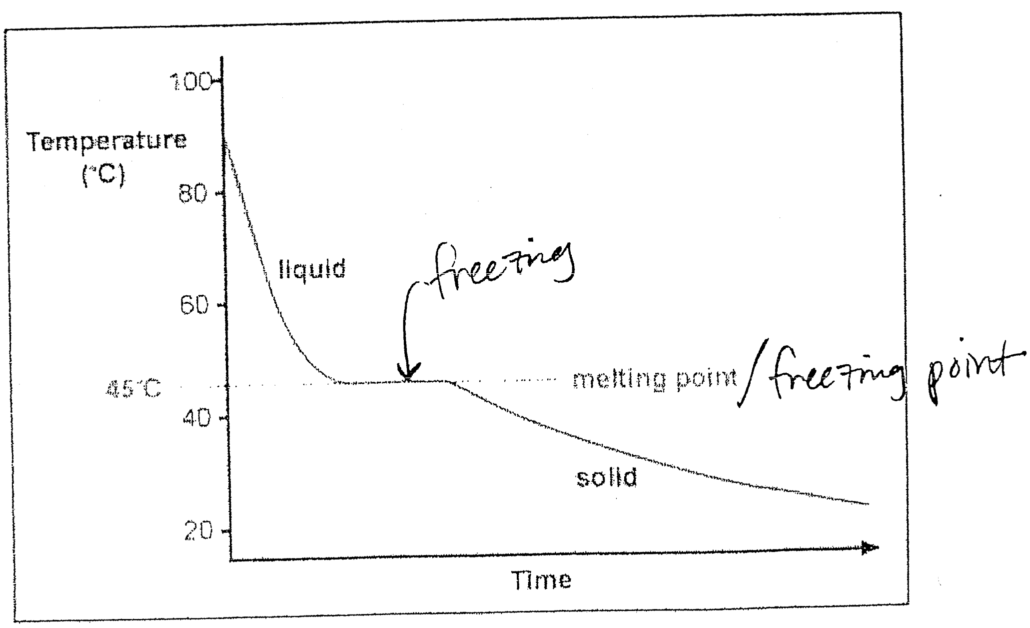
The first change of state is melting (changing from a solid to a liquid). The temperature stays the same while a substance melts. For water, this temperature is 0°C because the melting point (freezing point) for water is 0°C.

The second change of state is evaporation -(changing from a liquid to a gas). The temp stays the same while a substance boils. For water, this temperature is 100°C because the boiling point (condensation point) for water is 100°C.

Different substances have different melting points and boiling points, but the shapes of their heating curves are very similar. For example, this is the heating curve for iron, a metal that melts at 1538°C and boils at 2861°C.



Heating curves show how the temperature changes as a substance is heated up. Cooling curves are the opposite. They show how the temperature changes as a substance is cooled down. Just like heating curves, cooling curves have horizontal flat parts where the state changes from gas to liquid, or from liquid to solid.



***Note- The melting and freezing occur at the same temperature.

During freezing, energy is removed (EXOTHERMIC) and during melting, energy is absorbed (ENDOTHERMIC).

Energy and Entropy Lab

Pre-Lab Questions

As heat energy is removed from a liquid, the temperature ________________________. The entropy also ________________________. If energy is continuously removed from a liquid, the liquid eventually will undergo a phase change from a liquid to a solid, called ____________________. During a phase change, the **TEMPERATURE** of a substance ____. Entropy, however, will continue to ________________________.

As heat energy is added to a solid, the temperature ____________________. The entropy also ____________________. If energy is continuously added, the solid will eventually undergo a phase change from a solid to a liquid, called____________________. During a phase change, the **TEMPERATURE** of a substance ________________________ ________________________. Entropy, however, will continue to ____________________________.

Freezing a Liquid

1. Fill one beaker ¾ full of water.
2. Get a test tube from your instructor that has liquid sodium thiosulfate pentahydrate. Be sure to do the next steps very quickly!!
3. Clamp the test tube above the cold-water bath as shown in the demo on the front counter.
4. Record the temperature of the solid at time 0. Quickly put the test tube in the cold-water bath. Using the thermometer, gently stir the liquid and record the temperature and make observations every 15 seconds.
5. **When the temperature of the liquid is 50°C, add the crystal to the test tube.** Continue recording temperature readings every 15 seconds. Continue to stir the liquid until it becomes a solid. DO NOT TRY TO MOVE THE THERMOMETER ONCE IT IS A SOLID!!!
6. Continue to read and record the temperature of the solid until you fill the data table.

Cooling Data					
Time (s)	Temp ºC	Observations	Time (s)	Temp ºC	Observations
:00			3:30		
:15			3:45		
:30			4:00		
:45			4:15		
:60			4:30		
1:15			4:45		
1:30			5:00		
1:45			5:15		
2:00			5:30		
2:15			5:45		
2:30			6:00		
2:45			6:15		
3:00			6:30		
3:15			6:45		

Clean Up

7. Put the test tube containing the substance in the beaker of warm water on your teacher's desk. DO NOT TRY TO REMOVE THE THERMOMETER!
8. See post-lab steps on following page for further instructions.

Melting a Solid

1. Fill one beaker ¾ full of water.
2. Clamp the test tube above the hot water bath beaker. Heat the water in the beaker to 60º - 65º. Do not allow the temperature to get above 65°C.
3. Record the temperature of the solid at time 0. Quickly put the solid in the hot water bath and record the temperature at 15 second intervals. Begin to stir with the thermometer as soon as it begins to soften. Continue to record until the data table is filled.

Heating Data					
Time (s)	Temp ºC	Observations	Time (s)	Temp ºC	Observations
:00			3:30		
:15			3:45		
:30			4:00		
:45			4:15		
:60			4:30		
1:15			4:45		
1:30			5:00		
1:45			5:15		
2:00			5:30		
2:15			5:45		
2:30			6:00		
2:45			6:15		
3:00			6:30		
3:15			6:45		

Clean-Up

4. Put the test tube containing the substance in the beaker on your teacher's desk.

Post-Lab All Groups

1. Your group will pair up with a group that did the opposite process (melting or freezing) and exchange data.
2. Then you must graph the results of BOTH data sets on the graph paper on the lab handout you must get from your instructor. Make sure your graph is a LINE GRAPH (NOT A BAR GRAPH!) and includes labels on each axis and a title.
3. Label the warming and cooling curves with the following: liquid only, solid only, solid/liquid. Circle the portion of the graphs where a phase change occurs.

Energy and Entropy Lab Analysis

DIRECTIONS: After completing the lab, exchanging your data with another group, AND graphing both data sets on the graph paper, complete the following questions.

1. During the freezing process, what was happening to the TEMPERATURE? ______________________________
2. During the freezing process, **EXPLAIN how and why ENTROPY was changing** – i.e. What is happening to the substance on the molecular level? Hint, look at page 16 in your packet (the first page of the lab).
3. According to YOUR graph, what is the **freezing point** of sodium thiosulfate pentahydrate? ________________
4. According to YOUR graph, what is the **melting point** of sodium thiosulfate pentahydrate? ________________
5. Refer to the cooling curve. For each of the three parts of the curve, write a sentence to describe what is happening to the **temperature** AND the **entropy**.
    a. Cooling a liquid:
    b. Freezing:
    c. Cooling a solid:

energy must be released to pack molecules in a gaseous state together to form a liquid	a mixture that does not appear exactly the same throughout	one or more new substances with properties unique from its starting material	a state of matter with fixed volume, but no fixed shape, and intermediate entropy
a physical change between two states of matter	energy is absorbed to separate particles in a liquid state to form a gas	a state of matter with fixed volume, fixed shape, and low entropy	energy is released
a property of matter that can only be observed when substances interact with each other	energy must be absorbed to separate particles in a solid state to form a gas	the transfer of heat between particles in a solid caused by a temperature difference between the particles	a change that affects only the physical properties and does not change the substance
energy must be absorbed to separate particles in a solid state to form a liquid	energy is released so particles in a liquid state can pack together to form a solid	any property of matter that can be measured without changing the substance	made of two or more kinds of atoms chemically bonded together

the particles in a solid are held tightly in a rigid structure with a pattern	contains only one kind of particle	a mixture that appears exactly the same throughout	a solid formed by a chemical reaction that "falls" out of solution
a state of matter with no fixed volume and no fixed shape, and high entropy	energy is absorbed	something that has mass and takes up space	made of only one kind of atom
a measure of disorder or randomness of a system	two or more pure substances that are physically combined	movement within a fluid caused by the tendency of hotter, therefore less dense material to rise and colder, more dense material to sink	