



Kinetic Molecular Theory

Name: _____ Period: _____ Date: _____

I. MOLECULES IN MOTION:

A. _____ (KMT) = the idea that particles of matter are always in motion and that this motion has consequences.

- 1) theory developed in the late 19th century to account for the behavior of the atoms and molecules that make up matter
- 2) based on the idea that particles in all forms of matter are always in motion and that this motion has consequences
- 3) can be used to explain the properties of solids, liquids, and gases in terms of the energy of particles and the forces that act between them

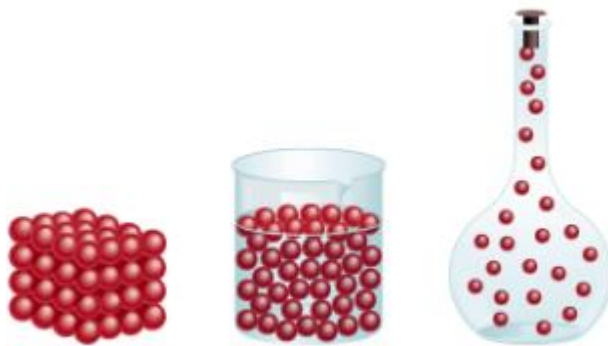
• 3 assumptions of KMT:

1. All _____ (solid, liquid, gas) is made of _____ (atoms, ions, molecules)

2. Particles are in constant _____ (electrons move)

- Particles of a _____ travel in completely *random* motion
- Particles of a _____ appear to vibrate around *moving* points
- Particles of a _____ appear to vibrate around *fixed* points

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3. _____ are perfectly _____ (no change in the total kinetic energy of 2 particles before and after their collision); No _____ of energy!

B. _____ (KE) = energy of motion

- Depends on the _____ of the object and its _____ (SPEED)

C. _____ = measure of kinetic energy (how fast molecules travel)

- _____ in temperature means a *decrease* in particle speed (i.e. a *decrease* in kinetic energy)
- _____ in temperature means an *increase* in particle speed (i.e. an *increase* in KE)

⇒ _____ (K) = temperature scale used in Kinetic study

⇒ _____ = (0 K or - 273 °C) temperature in which all molecular motion stops

- Convert between °C and K:

Practice:

- 86 K = _____
- 23 °C = _____
- 533K = _____
- -90 °C = _____

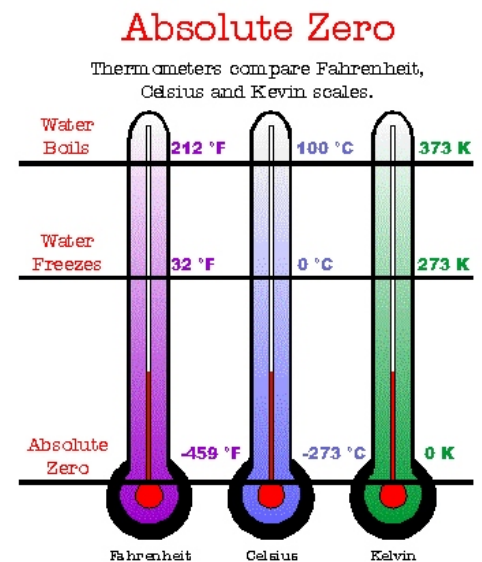
D. _____ = Standard Temperature & Pressure @ sea level

Standard Temperatures:

- 0 °C
- 273 K

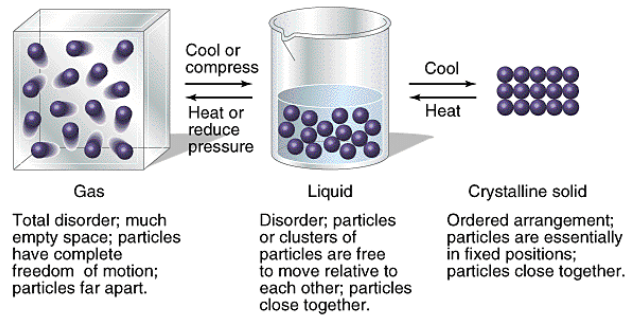
Standard Pressures:

- 101.3 KPa (kilopascal)
- 1 atm (atmosphere)
- 760 mm Hg (millimeters of mercury)
- 760 torr



E. States of Matter:

- 1) Solid
- 2) Liquid
- 3) Gas
- 4) _____ = (4th state of matter) heated to very high temperatures, the collisions between particles are so _____ that electrons are knocked away from atoms.



- Atoms are made up of _____ electrons and ions of the element.
- Don't happen *regularly* on Earth
- Takes a special environment to keep plasmas going
- Ex: _____ -

ELECTRICITY IN

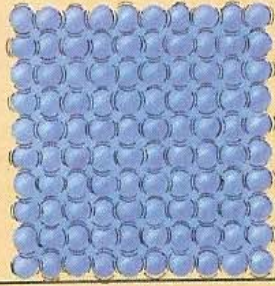


ELECTRICITY OUT

- Inside the long tube is a gas and electricity flows through the tube when the light is turned on. The charging and exciting of the atoms creates glowing plasma inside the bulb
- Ex: _____ -
 - Large balls of gases at really high temperatures. The high temperatures charge up the atoms and create plasma.
- *Note: Fluorescent lights are cold compared to really hot stars. They are still both forms of plasma, even with different physical characteristics.*

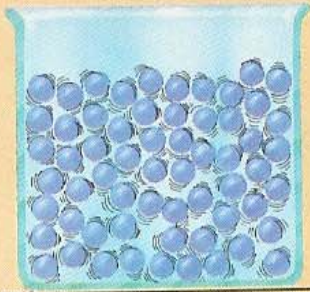
F. Summary of the 4 PHASES of Matter:

<u>Phase</u>	<u>Shape</u>	<u>Volume</u>	<u>Avg. Kinetic Energy</u>
	Definite	Definite	Slow
	Not Definite	Definite	Medium
	Not Definite	Not Definite	Fast
	Not Definite	Not Definite	Violent



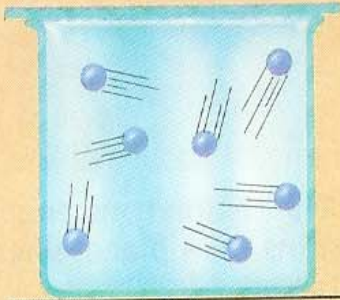
Solid

decreasing temperature \updownarrow increasing temperature



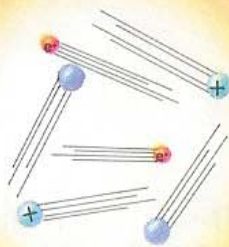
Liquid

decreasing temperature \updownarrow increasing temperature



Gas

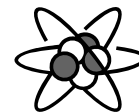
decreasing temperature \updownarrow increasing temperature



Plasma

This picture shows how increasing or decreasing the temperature affects the particles of solids, liquids, gases, and plasmas.

Kinetic Molecular Theory (KMT) Worksheet



Name: _____ Period: _____ Date: _____

Directions: Answer the following questions completely and concisely.

1. What is kinetic energy?
2. Describe the 3 assumptions of the KMT (Kinetic Molecular Theory).
3. According the KMT, “collisions between particles are perfectly elastic”. What does that mean?
4. Describe the particle motion of solids, liquids, and gases.
5. How would **increasing** the temperature affect kinetic energy of molecules?
6. How would **decreasing** the temperature affect kinetic energy of molecules?

7. Compare the average kinetic energies of solids, liquids, gases, and plasma.
8. What happens at absolute zero?
- a. What temperatures are considered absolute zero? _____
9. What does STP stand for? _____
10. List the standard temperatures.
11. List the standard pressures.
12. _____ would contain atoms made up of free electrons and ions of the element.
13. Where could you find the fourth state of matter, plasma? _____
14. How are Kelvin and Celsius related? (write the equation showing this relationship) _____
15. Conversions:
- | | |
|------------------------------------|--|
| a. $137^{\circ}\text{C} =$ _____ K | d. $93\text{ K} =$ _____ $^{\circ}\text{C}$ |
| b. $23^{\circ}\text{C} =$ _____ K | e. $497\text{ K} =$ _____ $^{\circ}\text{C}$ |
| c. $121^{\circ}\text{C} =$ _____ K | f. $270\text{ K} =$ _____ $^{\circ}\text{C}$ |

Class: Academic Chemistry B -PA Standard: Explain the relationship between the physical properties of a substance and its molecular or atomic structure.

Unit Essential Question(s):

How can you describe the
3 assumptions of KMT
(kinetic molecular
theory)?

**Optional
Instructional Tools:**

Guided Notes
Demo Materials: Rubberband
Beaker + food coloring

Concept

KMT

Concept

Concept

Concept

Lesson Essential Questions:

1) How can you describe particle spacing and motion of a solid, liquid, and gas?

Lesson Essential Questions:

Lesson Essential Questions:

Lesson Essential Questions:

Vocabulary:

KMT
Kinetic Energy
Temperature
Kelvin
Absolute Zero
STP values
Solids
Liquids
Gases
Plasma

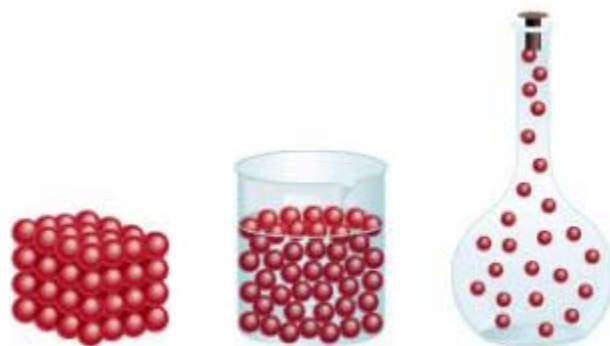
Vocabulary:

Vocabulary:

Vocabulary:

Kinetic Molecular Theory Vocabulary:

- 1) **Kinetic Molecular Theory** (KMT) = the idea that particles of matter are always in motion and that this motion has consequences. Here are the following assumptions of KMT:
 - a. All matter (solid, liquid, gas) is made of particles (atoms, ions, molecules)
 - b. Particles are in constant motion (electrons move)
 - c. Collisions are perfectly elastic (no change in the total kinetic energy of 2 particles before and after their collision); No loss of energy!
- 2) **Kinetic energy** (KE) = energy of motion
- 3) **Temperature** = measure of kinetic energy (how fast molecules travel)
- 4) **Kelvin (K)** = temperature scale used in Kinetic study
 - Converting between °C and K: **$K = ^\circ C + 273$**
- 5) **Absolute Zero** = (0 K or - 273°C) temperature in which all molecular motion stops
- 6) **STP** = Standard Temperature & Pressure at sea level
 - ❖ **Standard Temperatures:**
 - 0°C
 - 273 K
 - ❖ **Standard Pressures:**
 - 101.3 KPa (kilopascal)
 - 1 atm (atmosphere)
 - 760 mm Hg (millimeters of mercury)
 - 760 torr
- 7) **Solids** = particles vibrate around a fixed point
- 8) **Liquids** = particles vibrate around moving points
- 9) **Gases** = particles are in completely random motion
- 10) **Plasma** = particles have very violent motion that knocks electrons away from atoms
- 11) *Summary of the 4 PHASES of Matter:*



<u>Phase</u>	<u>Shape</u>	<u>Volume</u>	<u>Avg. Kinetic Energy</u>
<u>Solid</u>	Definite	Definite	Slow
<u>Liquid</u>	Not Definite	Definite	Medium
<u>Gas</u>	Not Definite	Not Definite	Fast
<u>Plasma</u>	Not Definite	Not Definite	Violent