KINETIC THEORY OF MATTER

Solid

Liquid

Gas

Chapter 13 in Prentice Hall Chemistry

WHAT DO WE KNOW?

What happens to a solid, liquid, and gas when you...

1) Place it on a table (no container)
2) Try to pour it from a beaker
3) Press down on it with your hand

Ripley's Believe It or Not!

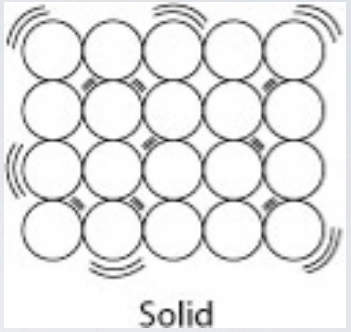
Believe it or not, these observations are all related to the molecular structure

SOLIDS

Macro Scale

They vibrate in place, but do not move around

Molecular Scale



Maintains shape regardless of container

Not easily poured

Dense

Highly ordered

Low compressibility

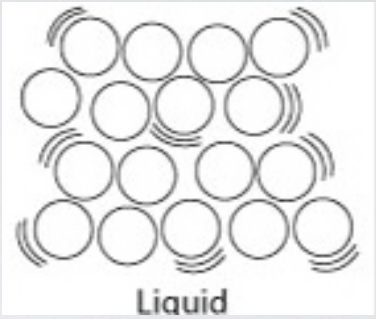
Molecules close together

LIQUIDS

Macro Scale

They vibrate and can flow within the confines of a container

Molecular Scale



Takes the shape of the container

Greater compressibility than solid

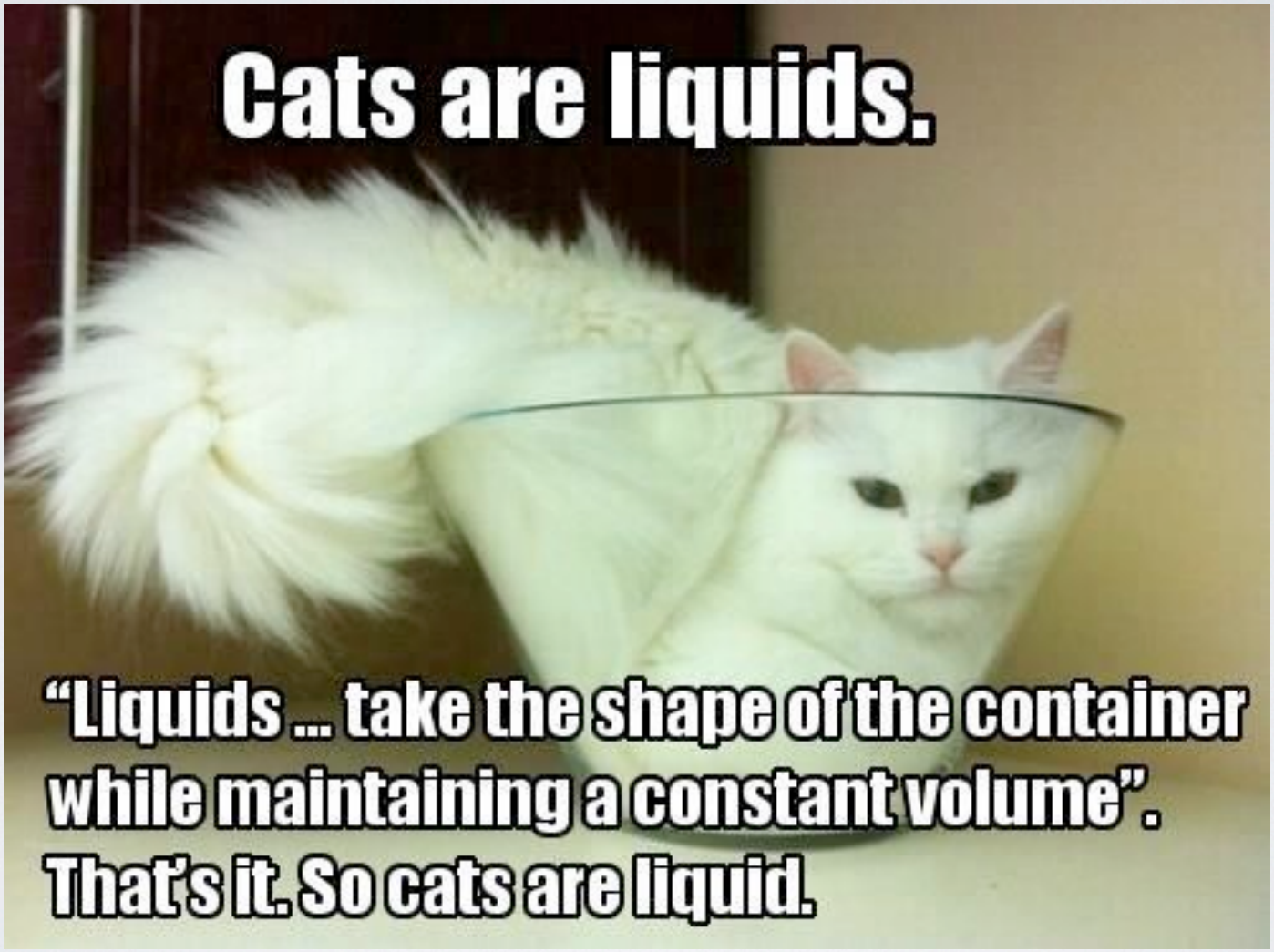
Can flow easier than solids

Greater disorder with more "empty space"

Molecules still relatively close

Molecules "flow" over one another

The Feline Paradox

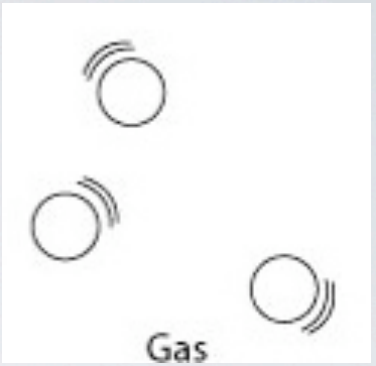


GASES

Macro Scale

They separate and move rapidly without running into one another

Molecular Scale



Takes the shape of the container

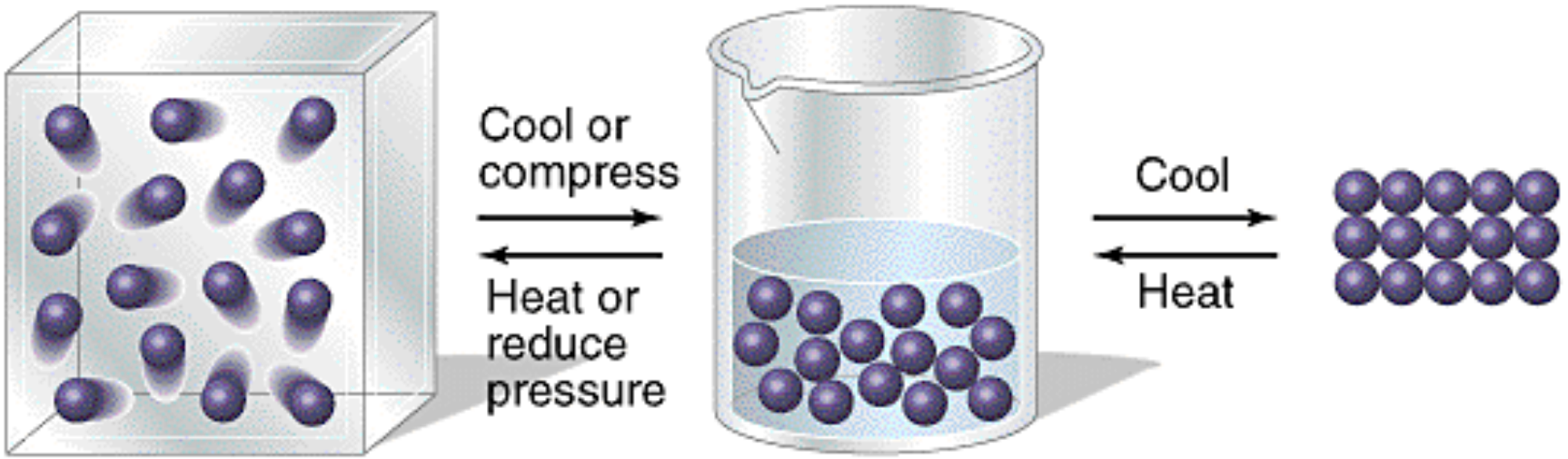
Highest compressibility

Low density

Undergoes rapid and random motion

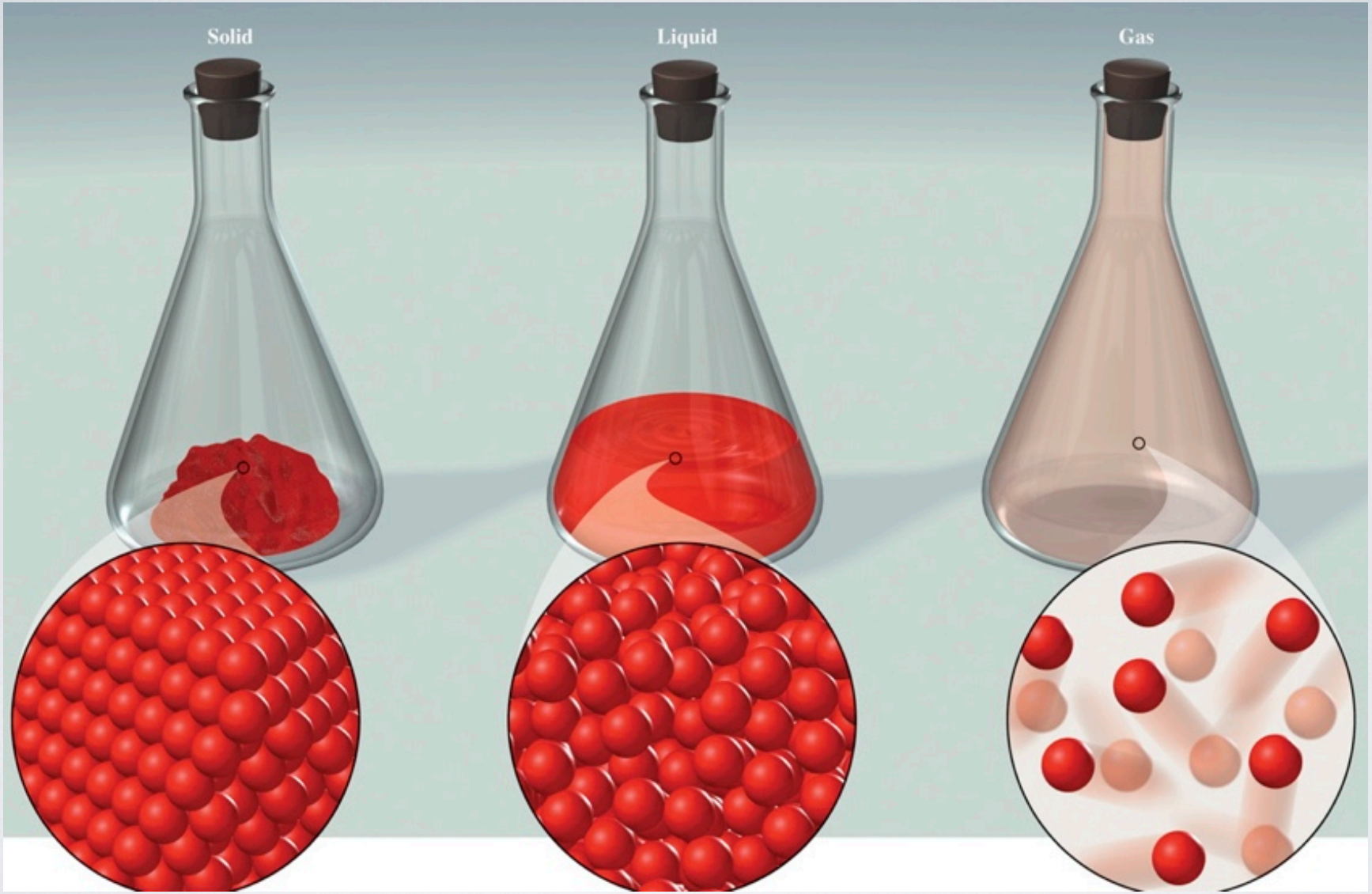
Molecules are far apart are rarely interact

TAKE A CLOSER LOOK...

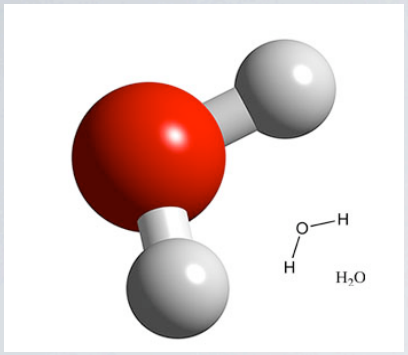


Gas	Liquid	Crystalline solid
Total disorder; much empty space; particles have complete freedom of motion; particles far apart.	Disorder; particles or clusters of particles are free to move relative to each other; particles close together.	Ordered arrangement; particles are essentially in fixed positions; particles close together.

TAKE A CLOSER LOOK...



http://chemistry.umeche.maine.edu/~amar/spring2010/phasesofmatter.html



POETRY IN MOTION

You could demonstrate molecular motion with a group of 5-6 people

Solids: Hold hands, cannot move feet (shake back and forth in place)

Liquids: Hold hands, can move feet (flow in and out)

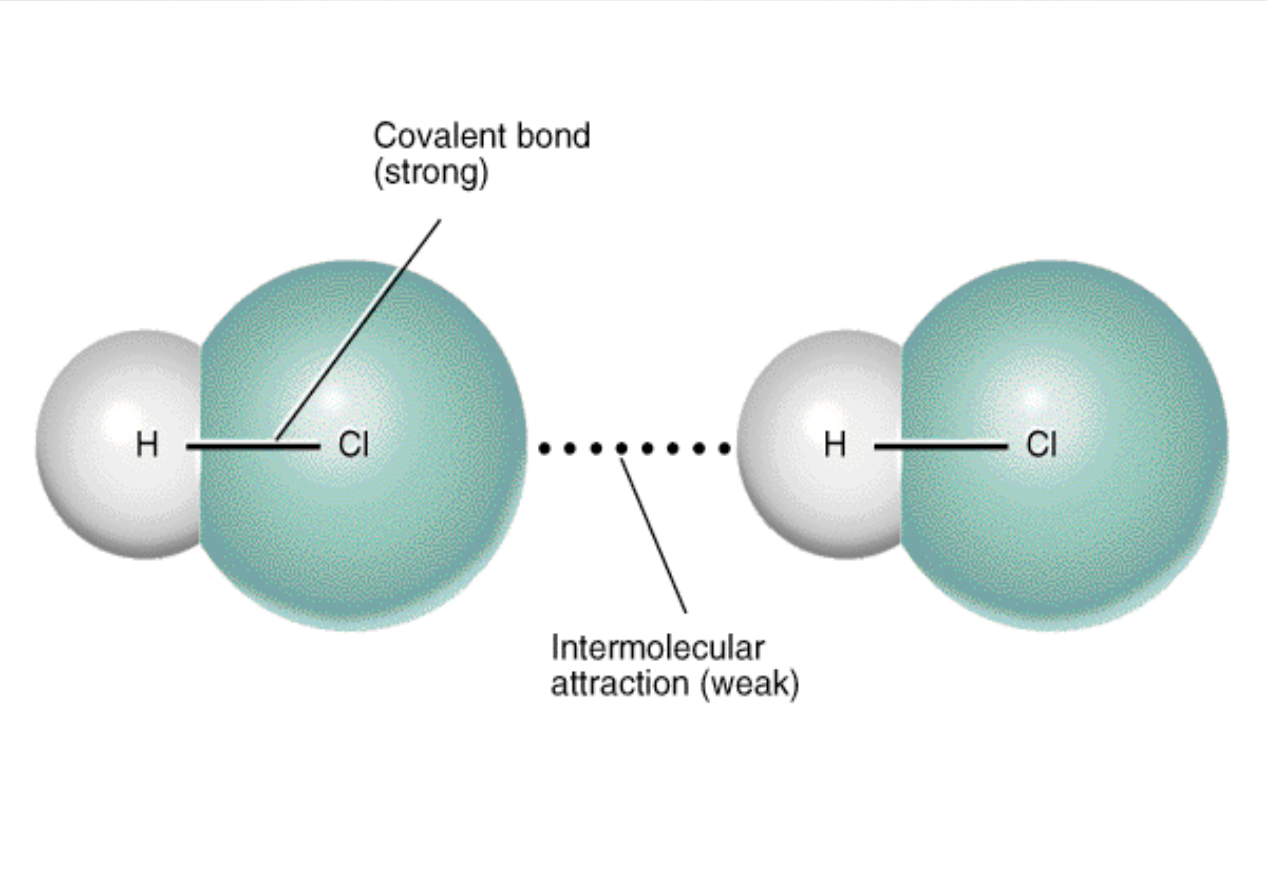
Gases: Completely detached, move quickly in any random direction

USE THE FORCE…

IF MOLECULES MOVE, WHY STICK TOGETHER???

Intramolecular Forces
-Hold ***atoms*** together

Intermolecular Forces
-Keep ***molecules*** together
in solids and liquids



WHAT CAUSES CHANGE OF STATE?

What could possibly overcome the force???

vs.

TURN UP THE HEAT!

Adding energy in the form of heat will overpower intermolecular forces and cause ice to turn to water, and eventually steam.

Intermolecular force holding H_20 in solid

+

→

+

Intermolecular force has been defeated

A NUMBERS GAME

H_20 (s) → H_20 (l) energy req. = 6 kJ/mol

H_20 (l) → H_20 (g) energy req. = 41 kJ/mol

Checkpoint:

Why does it take more energy to go from a liquid to a gas phase?

IT'S NOT GETTING HOT IN HERE???

When you first add heat to ice at 0^0C, the temperature of the ice does not rise.

Group Discussion:

What you think happened to the heat energy? Did the energy disappear???

ONE THING AT A TIME...

The heat energy is used to free water molecules from the solid structure. Since the energy is being used to change the state of the ice, it cannot be used to increase the temperature

NAME THAT CHANGE!

Solid to liquid?

Solid to gas?

Liquid to solid?

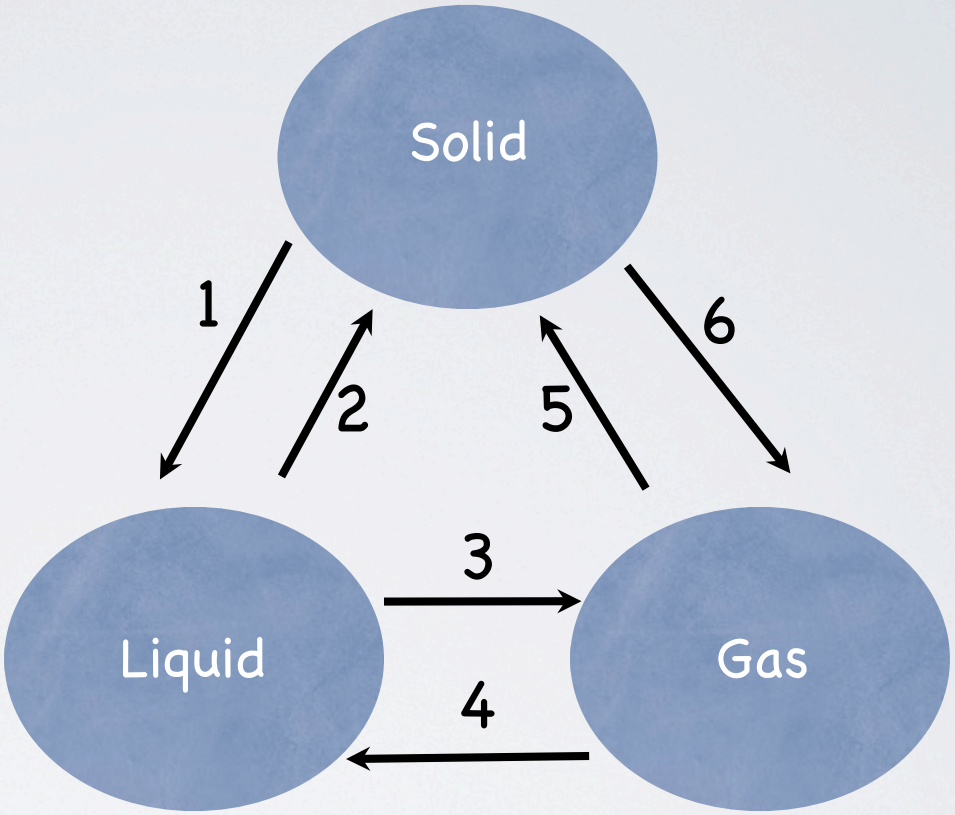
Liquid to gas?

Gas to liquid?

Gas to solid?

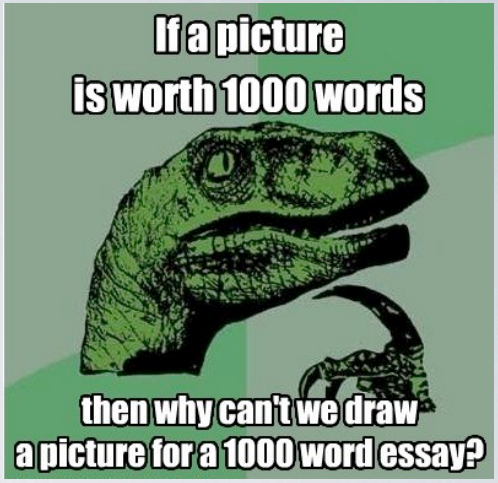
NAME THAT CHANGE!

1) Melting
2) Freezing
3) Evaporation
4) Condensation
5) Deposition
6) Sublimation



Can you come up with an example of each?

A PICTURE IS WORTH 1,000 WORDS

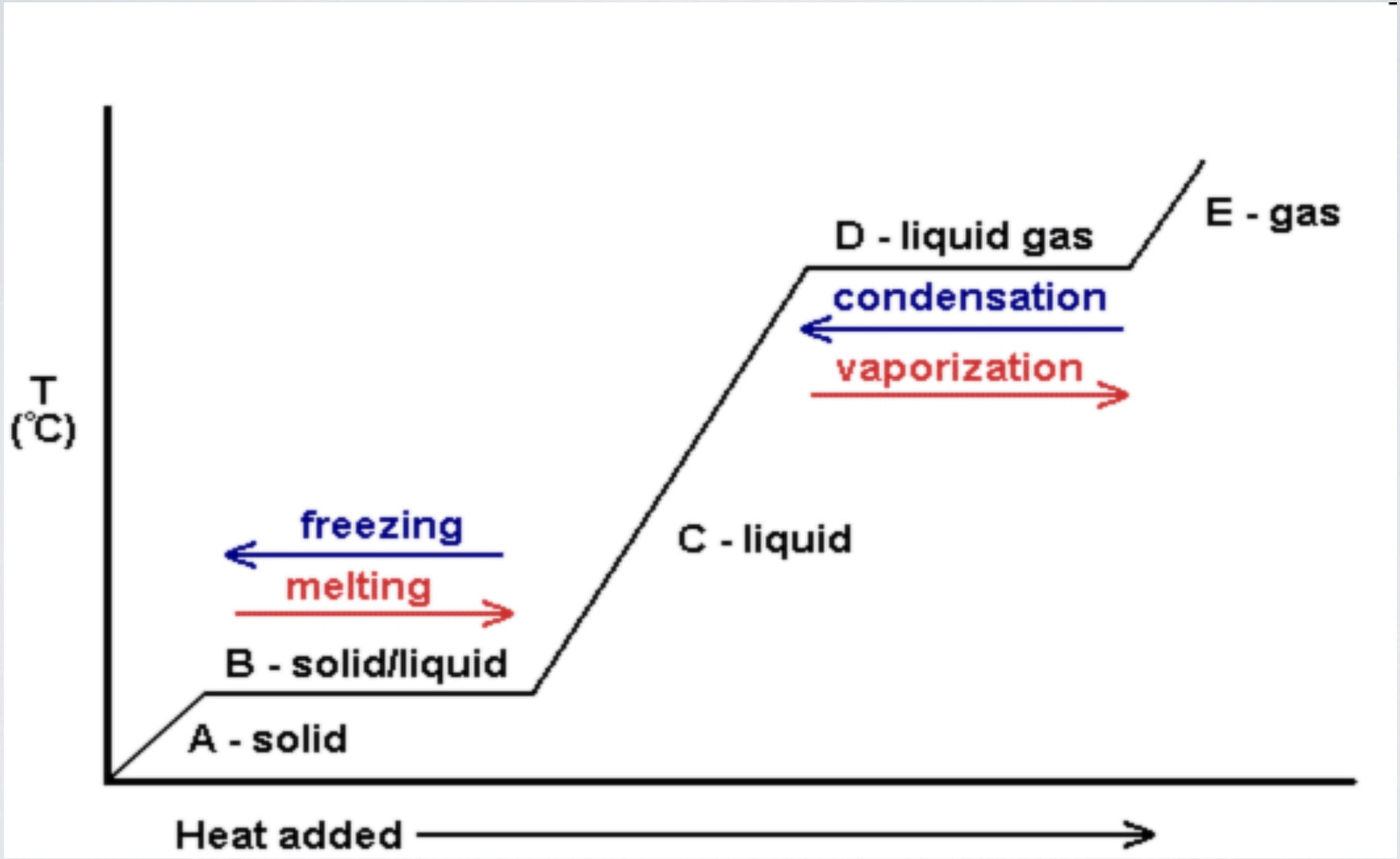


Checkpoint:

What would the heating of ice look like as a graph?

Create a graph with time on the x-axis and temperature on the y-axis from -10^0 to 140^0C. Assume the water starts as ice and is constantly heated.

HEATING CURVE FOR WATER



EXIT SLIP

Write your name on an index card, and answer the following questions before turning it in.

1) What causes molecules to stick together in the solid and liquid phases?

2) Describe the molecular motion for each phase of matter.

3) When adding heat energy to an ice cube, when will the temperature of the H_20 begin to rise?