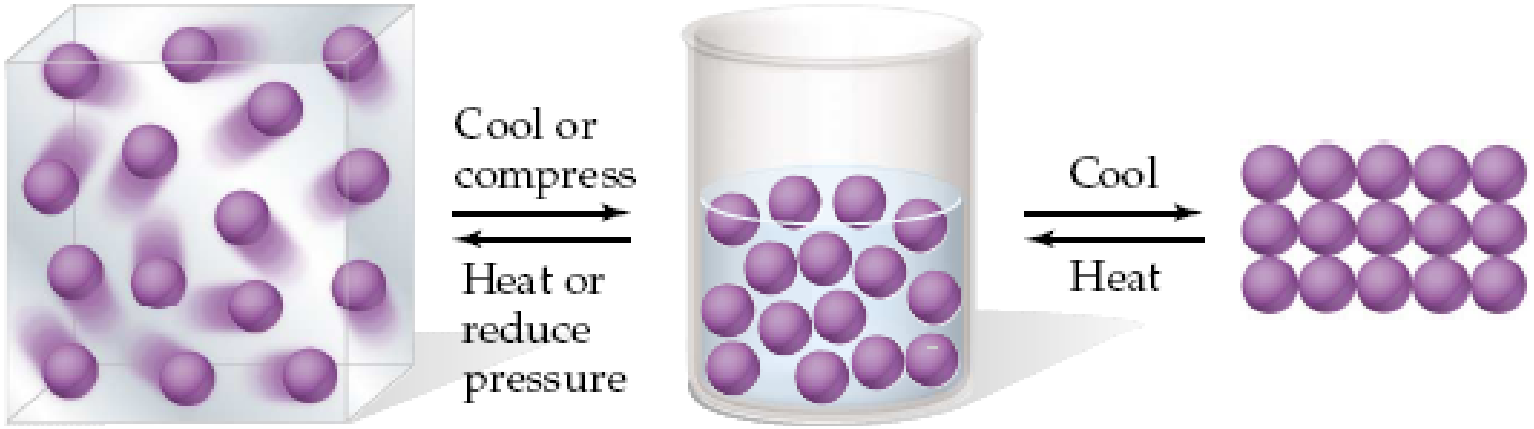
Ch 12 Part 2

Energy and Phase Changes



Gas

Total disorder; much empty space; particles have complete freedom of motion; particles far apart

Liquid

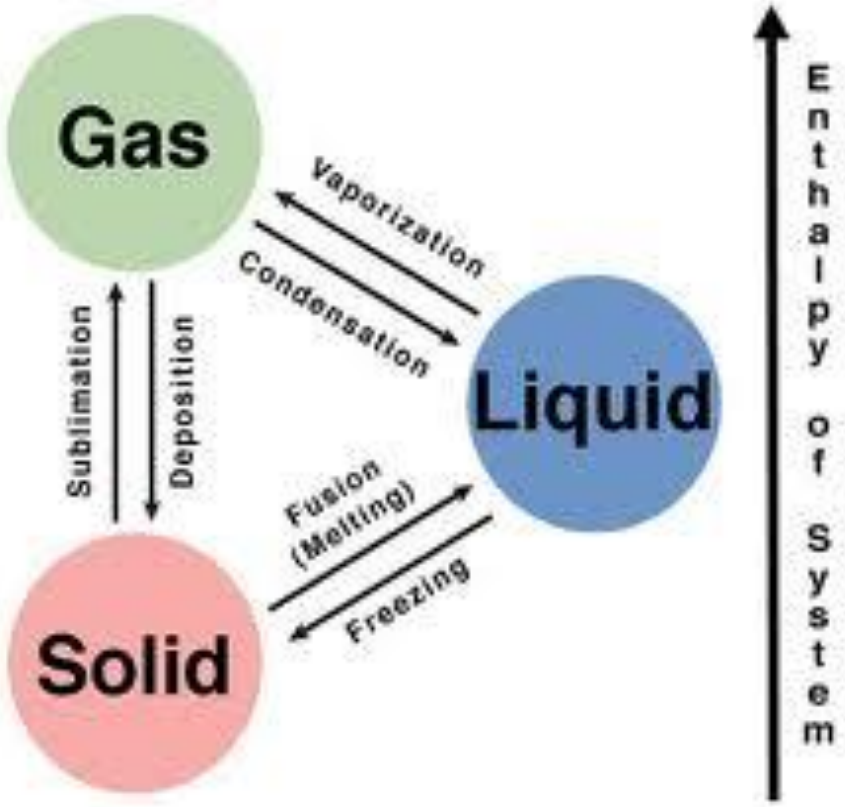
Disorder; particles or clusters of particles are free to move relative to each other; particles close together

Crystalline solid

Ordered arrangement; particles are essentially in fixed positions; particles close together

Section 12.4 - Phase Changes

- Most substances can exist in 3 states depending on temp and pressure.
- Energy must be added or removed from a system in order for a change in phase – enthalpy.
- Energy required depends on strength of IMF's



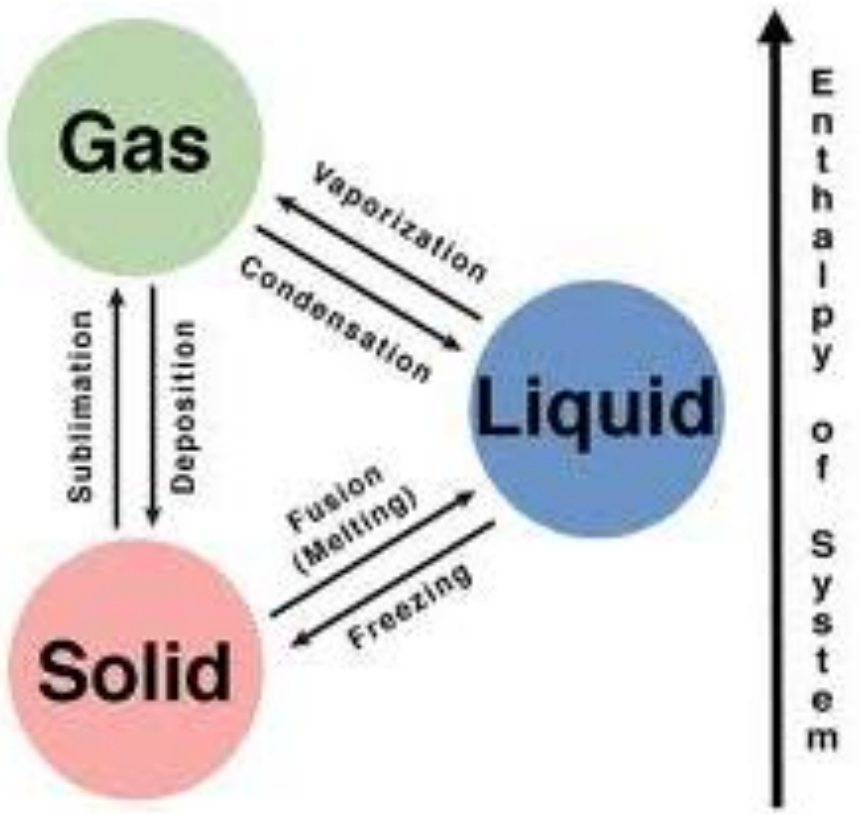
Endo and Exothermic

- Phase changes REQUIRING energy – endothermic
  - Reactions “feel” cold

- Phase changes that RELEASE energy – EXothermic
  - Energy EXits
  - Reactions “feel” warm

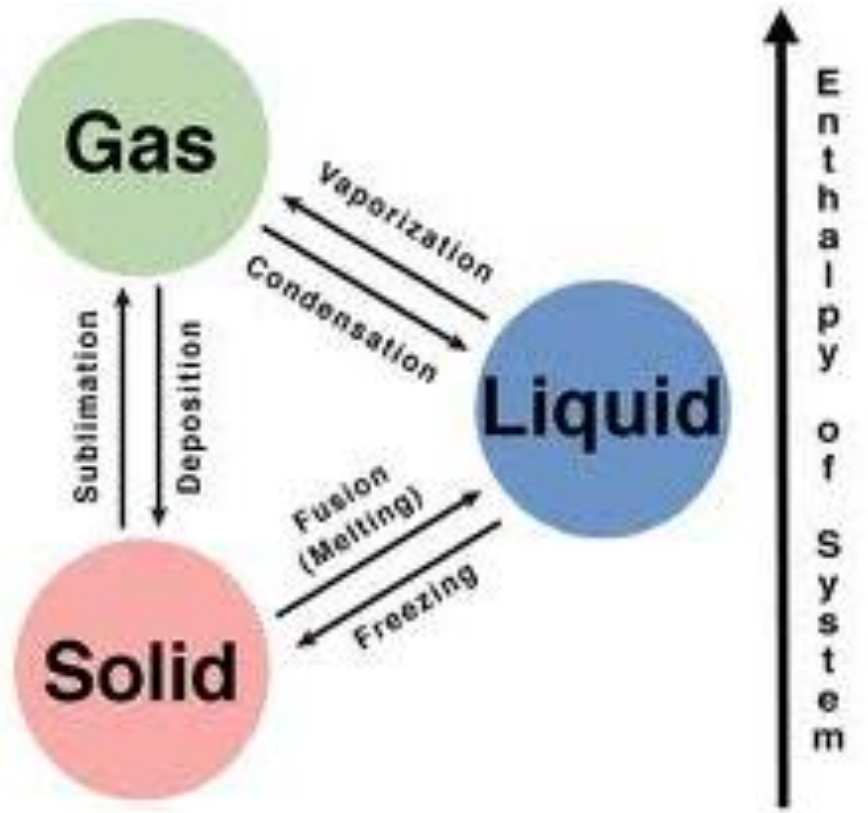
Melting (endothermic)

- Energy required to melt a solid depends on the IMF's keeping the solid together.
  - Does water have strong IMF's?
- Melting point – temperature at which the IMF's of a solid are broken; becomes a liquid.

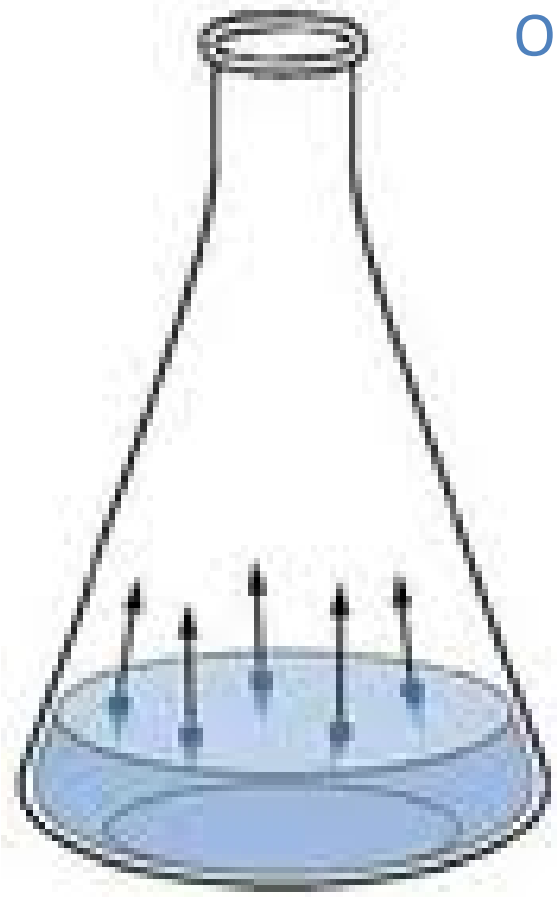


Vaporization (endothermic)

- After melting, if energy is increased, the kinetic energy of the liquid increases until it vaporizes.
- Vaporization – liquid changes entirely to a gas.
- Evaporation – GRADUAL increase in energy where vaporization only happens at the surface.



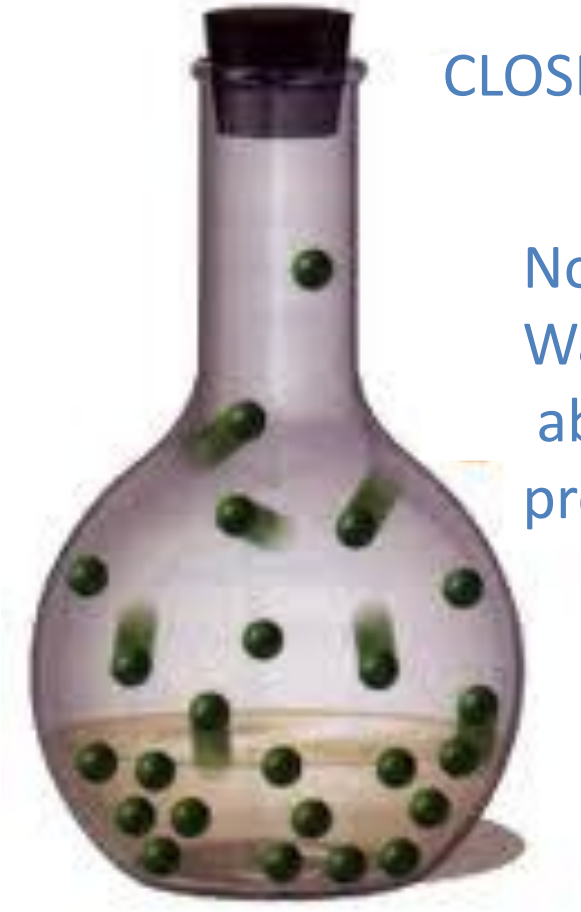
Vaporization and Evaporation



OPEN container

Liquid can escape and evaporation occurs!

Vaporization and Evaporation



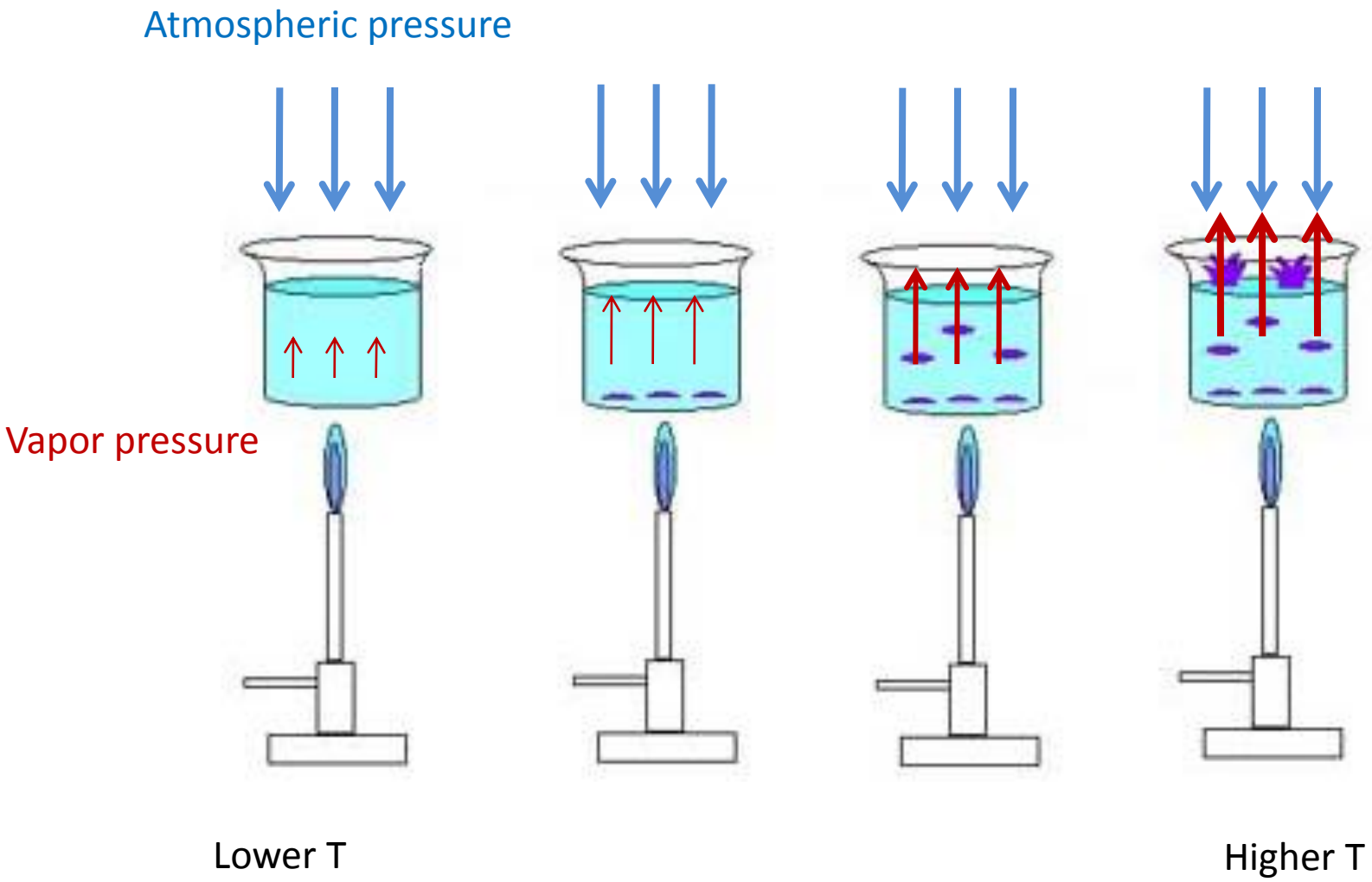
CLOSED container

No evaporation!
Water vapor will collect above liquid and exert pressure on the liquid

VAPOR PRESSURE

BOILING POINT – the temperature at which the vapor pressure equals the atmospheric pressure

Boiling point will change depending on atmospheric pressure!



Question!

Does the boiling point of water increase or decrease at high altitudes?

Sublimation (endothermic)

- Solid phase to gas phase – no liquid!
- DRY ICE!

Freezing (exothermic)

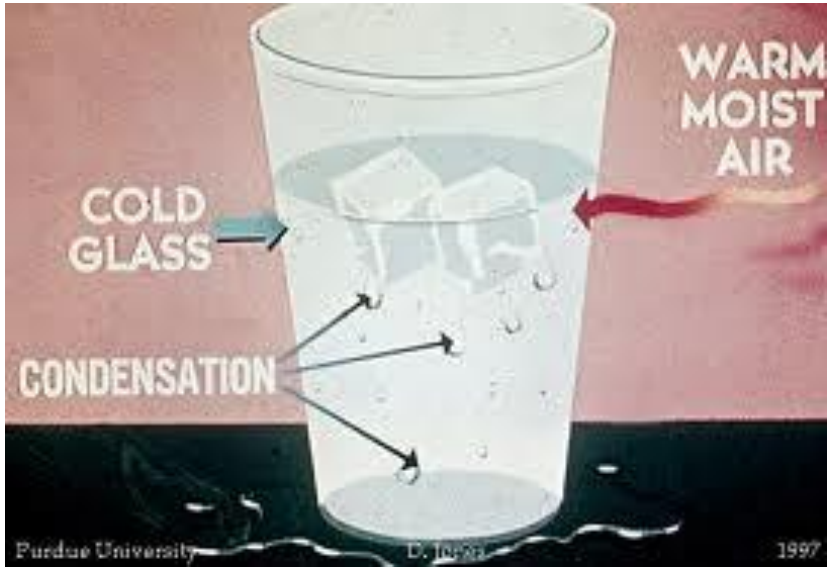
- Temperature (kinetic energy) decreases – stuff stops moving around so fast! (energy EXits!)
- Soon, the molecules slow down enough for IMF's to take over – they get stuck in a structure!
- At the freezing point

water get's trapped in a hydrogen bonding network and becomes a solid!

Condensation (exothermic)

- Energy lost by gas molecules and when enough energy is removed IMF's take over and you have a liquid!

- Keeps the coaster companies in business…



Deposition (exothermic)

- Gas forms a solid due to a large energy loss.

- Frost

Energy for Phase Changes?

- Do you think it requires more/less/the same energy to boil 10 g of water as it does to melt 10 g of ice?

Warm Up

- Stoich Review!

3 g of magnesium ribbon is burned with oxygen. How many grams of magnesium oxide is produced?

- Mole fraction

5.67 g of O_2 gas is mixed with .15 moles of N_2 gas.

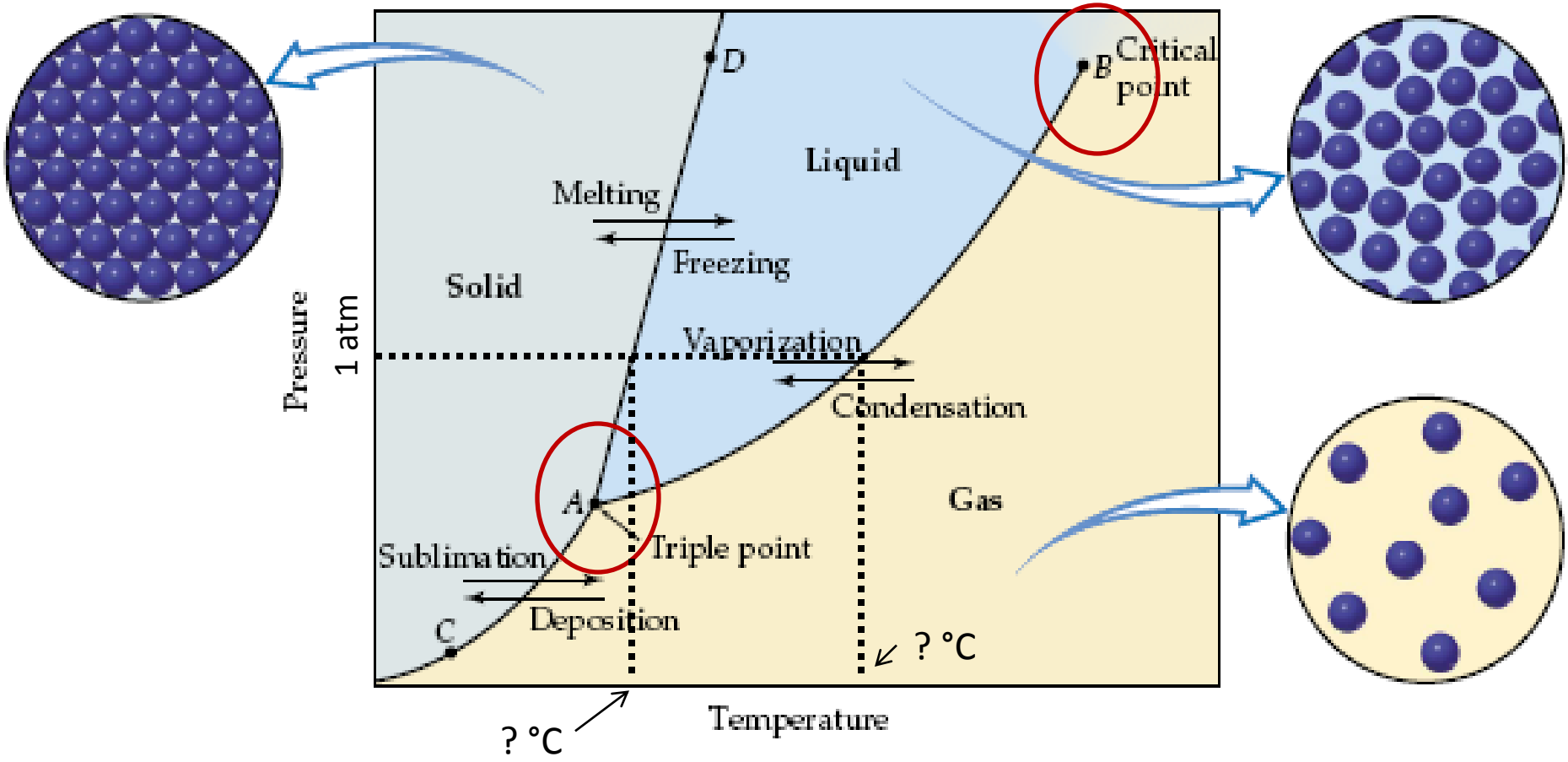
What is the mole fraction of each gas in the mixture?

Today's Agenda

- QOTD: What information can you extract from a phase diagram?

- Phase Change Review
- Mole Fractions and Partial Pressures (homework)
- Phase diagrams and worksheet.

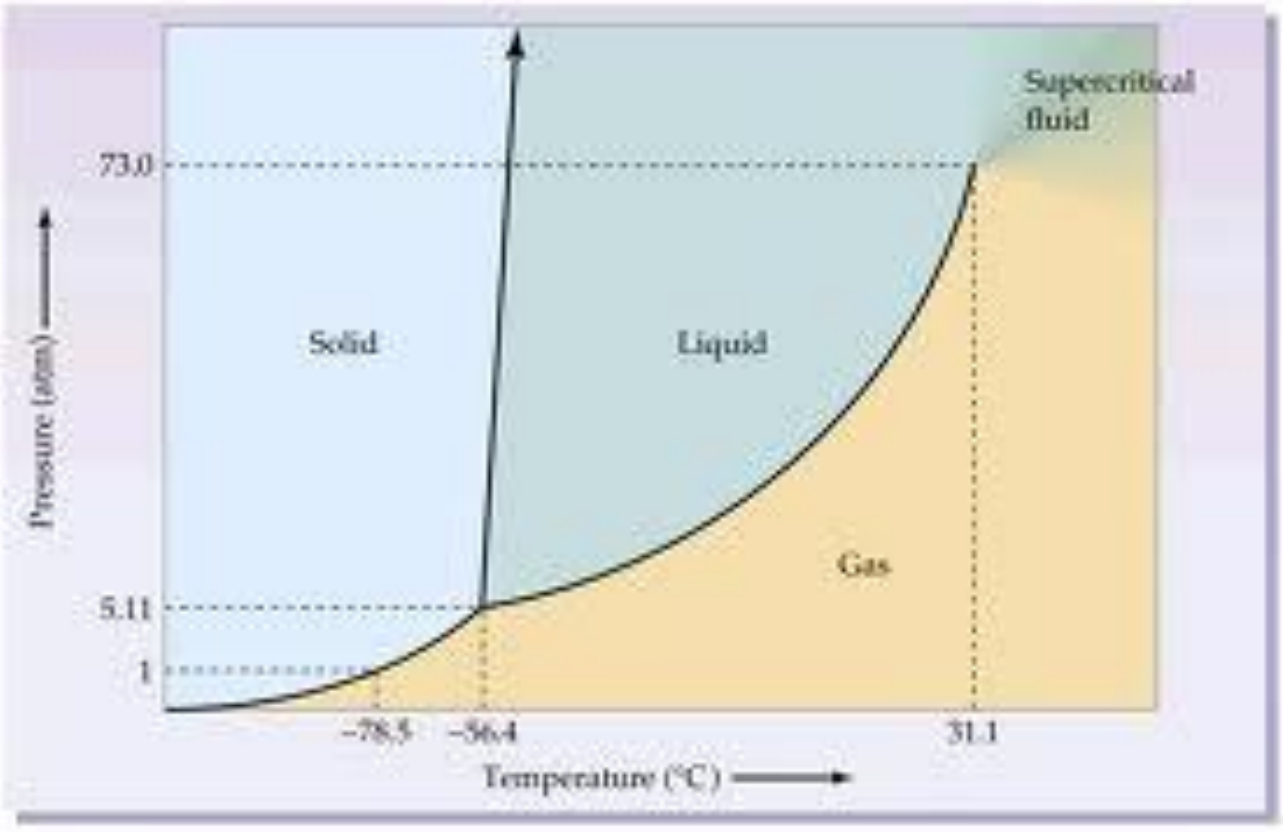
Phase Diagrams



Triple point – temp and pressure where all 3 phases coexist

Critical point – temp and pressure where liquid phase ceases to exist

Carbon Dioxide



What is the pressure in atm @ STP? Temperature @ STP?

What phase change will solid CO_2 undergo at STP?

Make a sketch!

- Sketch the phase diagram for Ammonia using the data below:

Points	Pressure (atm)	Temperature (K)
Triple Point	0.06	196
Critical Point	112	405.2
Boiling Point	1.0	239.5
Freezing Point	1.0	196