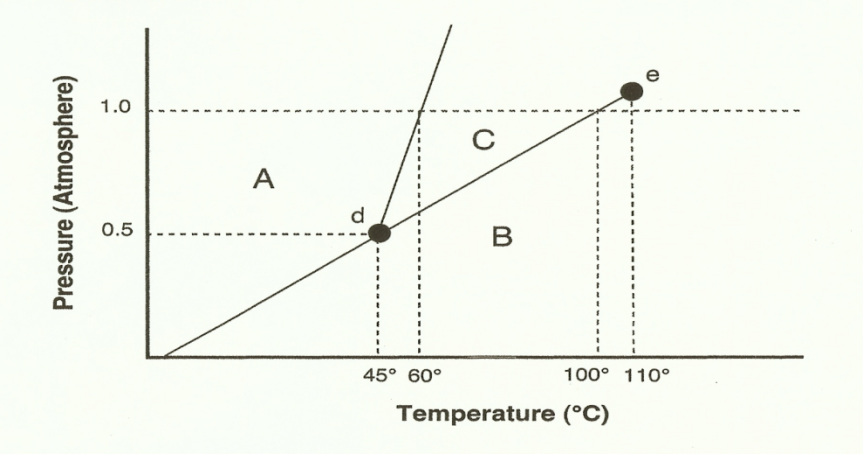
Unit 7

Understand and be able to analyze the phase change diagram.



a) What phase change is happening when a substance goes from area A to C?
Fusion/Melting

b) What state of matter is the substance in area A? Area B? Area C?
A – Solid B- Gas C - Liquid

c) At standard pressure (1.0 atm) what temperature is need for the substance to vaporize?
100°C

d) At 100 °C and a pressure below standard, what phase is this substance in?
Gas

e) If that substance cooled from 100°C to 35°C, what phase change(s) would occur? Are these endothermic or exothermic?
At 1 atm – the substance would go from boiling to freezing. So, from a gas/liquid to a solid.
This would be an exothermic reaction.

Know how to convert between temperatures and pressures.

Convert the following pressures:

a) Convert 475 mm Hg into atm.

$$\frac{475\ mm\ Hg}{1} \times \frac{1\ atm}{760\ mm\ Hg} = 0.625\ \text{atm}$$

b) The pressure of a tire is measured as 29.4 psi. What is this pressure in torr?

$$\frac{29.4\ psi}{1} \times \frac{760\ torr}{14.7\ psi} = 1520\ \text{torr}$$

c) How is 2 atm expressed in kPa?

$$\frac{2\ atm}{1} \times \frac{101.3\ kPa}{1\ atm} = 202.6\ \text{kPa}$$

Convert the following temperatures:

d) 48°C to Kelvin
48°C + 273 = 321 K

e) 321.5 Kelvin to °C
321.5 K – 273 = 48.5°C

Know the basics about gasses.

a) What are the common characteristics of gases?
Molecules moving very quickly, molecules very far apart, gases expand to fill their container, no fixed volume, no fixed shape, are said to be "fluids"

b) What is STP? What is the temperature and pressure?
STP is standard temperature and pressure.
Standard Temperature: 273K or 0°C
Standard Pressure: 1 atm = 760 mm Hg = 760 torr = 101.3 kPa = 14.7 psi

c) Gases expand to fill their containers.

d) Gases have greater/**less density** to their equivalent liquid or solid.

e) Gas particles, compared to liquid, are moving **faster**/slower.

f) A collision of gas particles with container walls is known as the pressure of the gas.

g) At the same temperature, small molecules move **faster**/slower than large molecules.

Know how to identify the gas law and solve the problem.

a) A sample of oxygen occupies a volume of 250.0 mL at 740.0 torr. What volume will it occupy at 2.4 atm?
$P_1V_1 = P_2V_2$ (250mL)(740 torr) = (V_2)(1520 torr) V_2 = 121.7 mL

$\frac{2.4\ atm}{1} \times \frac{760\ torr}{1\ atm} = 1520$ torr

b) A gas has a pressure of 6.58 kPa at 540 K. What will the pressure be at 210 K if the volume remains constant?

$\frac{P_1}{T_1} = \frac{P_2}{T_2}$ $\frac{6.58\ kPa}{540\ K} = \frac{P_2}{210K}$ P_2 = 2.55 kPa

c) A gas with a volume of 4.0 L at 90.0 kPa expands until the pressure drops to 20.0 kPa. What is the new volume if the temperature remains constant?
$P_1V_1 = P_2V_2$ (4.0 L)(90.0 kPa) = (V_2)(20.0 kPa) V_2 = 18 L

d) A gas with a volume of 3.00 x 10^2 mL at 150°C and 1.7 atm is heated until its volume is 6.00 x 10^3 mL. What is the new temperature of the gas if the pressure decreased to 1.0 atm during the heating?
$\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2}$ $\frac{(300\ mL)(1.7\ atm)}{423\ K} = \frac{(6000\ mL)(1.0)}{T_2}$ T_2 = 4976.47 K = 4703.47 °C

e) Calculate the quantity of gas, in moles, if 6.38 L is occupied at 35°C and 955 mm Hg.
PV = nRT $n = \frac{PV}{RT} = \frac{(1.26\ atm)(6.38\ L)}{(0.082)(308)} = 0.318$ moles

f) What is the volume of a gas, in liters, if 2.95 moles is at 0.76 atm and 52°C?
PV = nRT $V = \frac{nRT}{P} = \frac{(2.95\ moles)(325\ K)(0.082)}{(0.76\ atm)} = 103.44$ Liters

g) Compare the rate of effusion of sulfur dioxide with that of chlorine gas at the same temperature and pressure.
SO_2 – 64.07 g/mol effusion = $\sqrt{\frac{70.9}{64.07}}$ = chlorine gas effuses 1.05 times faster
Cl_2 – 70.9 g/mol

h) What is the total pressure of a gas mixture if it contains 20 torr of HCl gas and 730 torr of Ne gas?
Total pressure is 750 torr.