Unit 8B – Manometers/Gas Laws/Gas Stoichiometry/Phase Changes & Diagrams/IMF's Twitter Review Questions

U8B-1: A gas occupies 12.3 liters at a pressure of 40.0 mmHg. What is the volume when the pressure is increased to 60.0 mmHg?

- Answer: Boyle's Law → V_2 = 8.20 L (8.20×10^3 mL)

U8B-2: A gas syringe contains 42.3mL of gas at 98.15 °C. Determine volume that the gas will occupy if temperature is decreased to -18.50 °C.

- Answer: Charles's Law → V_2 = 29.0 mL

U8B-3: Sample of N2 inside a container at 20.0 °C & 3.00 atm is placed inside a 50.0 °C oven. What's the pressure after temp is increased?

- Answer: Gay-Lussac's Law → P_2 = 3.31 atm

U8B-4: The volume of gas at STP was recorded as 488.8 mL. What volume would same gas occupy when subjected to 100.0 atm and -245.0 °C?

- Answer: Combined Gas Law → V_2 = 0.5013 mL

U8B-5: At what pressure would 0.150 mole of nitrogen gas at 23.0 °C occupy 8.90 L?

- Answer: Ideal Gas Law → P = 0.410 atm / 311 mmHg / 41.5 kPa

U8B-6: A tank holds 3 gases: O2, CO2, & He. O2 is 2.00atm, CO2 is 3.00atm, & total pressure is 9.00atm. What's the pressure (mmHg) of He?

- Answer: Dalton's Law Partial Pressure → P_{He} = 3040 mmHg (3.04×10^3 mmHg)

U8B-7: CO2 is collected over H2O at 25°C. Pressure of CO2 is 635mmHg & H2O vapor pressure is 24.0mmHg. Find the atmospheric pressure (kPa)?

- Answer: Collecting Gas over H_2O → P_{atm} = P_{gas} + P_{H2O} → P_{atm} = 87.8 kPa

U8B-8: A gas is collected over H2O at 20.0°C, H2O vapor pressure of 2.3 kPa, & atmospheric pressure of 102 kPa. What's the pressure of gas?

- Answer: Collecting Gas over H_2O → P_{gas} = P_{atm} − P_{H2O} → P_{gas} = 99.7 kPa

U8B-9: Mercury level is 125mm higher on atmospheric arm of manometer. What's the gas pressure (in atm) if atmospheric pressure is 735 mmHg?

- Answer: P_{gas} = P_{atm} + "h" → P_{gas} = 1.13 atm

U8B-10: Atmospheric pressure in a manometer is 95.0 kPa, and mercury rises 65.0 mm higher on gas arm. What's the gas pressure in mmHg?

- Answer: $P_{gas} = P_{atm} - "h" \rightarrow P_{gas} = 648$ mmHg

U8B-11: How many moles of gas are contained in a balloon if the volume is 3.25 L at 0.750 atm and 21.0°C?

- Answer: Ideal Gas Law $\rightarrow n = 0.101$ mol

U8B-12: How many liters of CO2 will be produced by burning 5.60 L of methane gas (CH4) at STP?   CH4(g) + O2(g) $\rightarrow$ CO2(g) + H2O(g)

- Answer: Gas Stoich - STP $\rightarrow$ Can use vol ratio/gas stoich/PV=nRT $\rightarrow$ 5.60 L CO_2

U8B-13: If 2.40 L of H2 gas is produced at 25.0°C & 2.5 atm, what mass of magnesium should be used?   Mg(s) + HCl(aq) $\rightarrow$ MgCl2(aq) + H2(g)

- Answer: Gas Stoich @ Non-STP $\rightarrow$ Can only use PV=nRT $\rightarrow$ 5.96 g Mg

U8B-14: Identify the substance type AND IMF type of the following:
A) Fe
B) Al2S3
C) PCl3
D) H2

- Answer:
  - A) Metallic Solid $\rightarrow$ Metallic (M)
  - B) Ionic $\rightarrow$ Ion-Dipole (I-D)
  - C) Polar Covalent (PC) $\rightarrow$ Dipole-Dipole (D-D)
  - D) Non-Polar Covalent (NPC) $\rightarrow$ London Dispersion Force (LDF)

U8B-15: Refer to #14
A) Which would have lowest MP?
B) Which has cations in a sea of e-?
C) Which has bond of unequal sharing of electrons?

- Answer:
  - A) H_2 (D)
  - B) Fe (A)
  - C) PCl_3 (C)

U8B-16: Identify the substance type AND IMF type of the following:
A) BF3
B) FeCl3
C) Cgraphite
D) H3N

- Answer:
  - A) Non-Polar Covalent (NPC) $\rightarrow$ London Dispersion Force (LDF)
  - B) Ionic $\rightarrow$ Ion-Dipole (I-D)
  - C) Network Solid $\rightarrow$ Network Covalent (NC)
  - D) Polar Covalent (PC) $\rightarrow$ Hydrogen Bond (H-B)

U8B-17: Refer to #16
A) Which would have highest BP?
B) Which has e- transfer as cause of bonding?
C) Which has weakest IMF?

- Answer:
    - A) $C_{graphite}$ (C)
    - B) $FeCl_3$ (B)
    - C) BF_3 (A)

U8B-18: Under what conditions of temperature AND pressure is the behavior of real gases most like that of ideal gases?

- Answer: Real Gas → Ideal Gas = high temp / low pressure

U8B-19: How would you best describe the relationship of pressure and temperature? (Direct or Inverse)

- Answer: Direct Relationship (Gay-Lussac's Law)

U8B-20: A tank with a volume of 6.50 L contains 1.20 moles of O2 gas at 3.25 atm. Calculate the temperature (in °C) of O2 gas in tank.

- Answer: $PV=nRT$ → T (°C) = -58.6 °C

U8B-21: What is true about the temperature during a phase change?

- Answer: Temperature remains constant as the potential energy is used to break the bonds

U8B-22: During which phase (s,l,g) does a substance have the least amount of kinetic energy?

- Answer: Solid → lowest temperature (particles closest together)

U8B-23: During which phase (s,l,g) would the motion of particles be the greatest?

- Answer: Gas → highest temperature (particles farthest from each other)

U8B-24: Describe what happens to the arrangement of particles as a substance transitions from a solid to a liquid.

- Answer: s → l = melting ; Therefore, solid loses its orderly arrangement of particles, and particles begin to move farther apart from each other due to increased kinetic energy

U8B-25: The normal melting or boiling point of any substance is always set to what pressure?

- Answer: Normal MP/BP = 1.00 atm / 760 mmHg / 760 Torr / 101.3 kPa

U8B-26: What is the process called when transitioning from a gas to a liquid?

- Answer: g → l = condensation

U8B-27: Above what temperature is it impossible to exist as a liquid?
A) Beyond critical point
B) Below critical point
C) At triple point

- Answer: A – Beyond critical point

U8B-28: What is true about the triple point?

- Answer: All three phases co-exist (at equilibrium) at set temp and pressure

U8B-29: What is unique about the sublimation and deposition phase changes?

- Answer: Substance never enters into the liquid state

U8B-30: According to the kinetic molecular theory, what is true about the collisions between molecules in a gas?

- Answer: Perfect elastic collisions (law of conservation of energy)

U8B-31: Why does the pressure inside a container of gas increase as more gas is added to the container?

- Answer: Increase # gas particles = Increase # collisions between particles and container wall

U8B-32: According to the kinetic molecular theory, what happens to the motion of gas particles as temperature increases?

- Answer: Increase temp = Increase kinetic energy = Gas particles move faster

U8B-33: Gases behave differently based on the conditions of what four (4) variables?

- Answer: Pressure, volume, temperature, # moles of gas

U8B-34: What variable is kept constant in Boyle's Law?

- Answer: Temperature

U8B-35: According to Avogadro's Law, how many liters of gas at STP is in one mole of that gas?

- Answer: 1 mol = 22.4 L gas at STP