Gas Law test 2010 Chapter 10 Version 2  Name

Directions Show all work. No work = No credit!

1. How many kPa is equivalent to 3.01 torr?

\[
\frac{3.01 \text{ torr}}{1} \times \frac{101.325 \text{ kPa}}{760 \text{ torr}} = 0.401 \text{ kPa}
\]

2. Given a gas with a volume of 252 mL at 63°C, find the new temperature if the volume changes to 452 mL.

\[
\frac{252 \text{ mL}}{83.6 \text{ K}} \xrightarrow{\text{a convT}} \frac{452 \text{ mL}}{X \text{ K}} \xrightarrow{\text{a arr}} \frac{2.03 \text{ K}}{2 \text{ arr}}
\]

3. Given a gas with a volume of 2.82 L at STP. Find the new pressure at 193 K and 1.72 L.

\[
\frac{(1 \text{ atm})(2.82 \text{ L})}{273 \text{ K}} \xrightarrow{\text{1 SP}} \frac{x \text{ atm}}{193 \text{ K}} \xrightarrow{\text{3 arr}} \frac{1.16 \text{ atm}}{} \xrightarrow{\text{3 arr}} \frac{881 \text{ mmHg}}{1 \text{ torr}} \xrightarrow{\text{or}} \frac{117 \text{ kPa}}{\text{1 arr}}
\]

4. Find the volume of a gas where 150.2 mL at 45°C and 305 kPa changes to STP.

\[
\frac{(305 \text{ kPa})(150.2 \text{ mL})}{318 \text{ K}} \xrightarrow{\text{3 arr}} \frac{(101.325 \text{ kPa})x}{273 \text{ K}} \xrightarrow{\text{1 SP}} \frac{388 \text{ mL}}{\text{3 arr}} \xrightarrow{\text{3 arr}} \frac{58 \text{ mL}}{\text{5 SF} .5 \text{ U}}
\]

5. Use the Ideal Gas law to find the number of moles when 323 mL is at STP.

\[
\frac{PV}{nRT} = \frac{1 \text{ atm})(0.323 \text{ L})}{(0.0821 \text{ L atm mol}^{-1} \text{ K}^{-1})(273 \text{ K})} = \frac{0.0144 \text{ mol}}{3 \text{ alg} \ x \text{ conv mL} \to \text{ L} \ x \text{ STP}}
\]

6. Use the Ideal Gas Law to find the pressure when 19.2 grams of nitrogen occupies a volume of 15.00 L at 63°C.

\[
\frac{PV}{nRT} = \frac{(19.2 \text{ g})(0.0821 \text{ L atm mol}^{-1} \text{ K}^{-1})(336 \text{ K})}{(28.08 \text{ g mol}^{-1})(15.00 \text{ L})} = \frac{1.26 \text{ atm}}{3 \text{ alg} \ x \text{ g/mm} \text{ (in eq or separate} \text{) \ x \text{ IT}}
\]

\[
\frac{P}{nRT} = \frac{(19.2 \text{ g})(0.0821 \text{ L atm mol}^{-1} \text{ K}^{-1})(15.00 \text{ L})}{(28.08 \text{ g mol}^{-1})(1 \text{ K})} = \frac{0.0144 \text{ mol}}{3 \text{ alg} \ x \text{ g/mm} \text{ (in eq or separate} \text{) \ x \text{ IT}}
\]
7. Use the Ideal Gas Law to find the Density of Krypton gas at STP.

\[ D = \frac{mm \cdot P}{R \cdot T} = \frac{(83.80 \, \text{g/mol})(1 \, \text{atm})}{(0.0821 \, \text{L atm/mol K})(273 \, \text{K})} = 3.74 \, \text{g/L} \]

3alg. \( \frac{2 \, \text{mm}}{1 \, \text{T}} \) 5SF. 5U

8. Find the molar mass of an unknown gas collected in a flask of 754 mL at a pressure of 503 mm Hg and at 54°C. The mass of the gas is found to be 1.973 g.

\[ PV = \frac{mm \cdot R \cdot T}{PV} = \frac{1.973 \, \text{g}}{(0.0821 \, \text{L atm/mol K})(327 \, \text{K})} \]

\[ (0.462 \, \text{atm})(0.764 \, \text{L}) \]

106.9 g/mol

9. Calculate the rate of effusion of hydrogen to that of nitrogen.

\[ \sqrt{\frac{38.02 \, \text{g/mol}}{2.02 \, \text{g/mol}}} = \frac{3.72 \, \text{(H₂)}}{1 \, \text{(N₂)}} \]

3.72: 1 or - 2ans.

1: 2.69 - or - 

Ha is 3.72x's faster

10. What is the ratio of effusion of carbon tetrachloride to fluorine gas?

\[ \sqrt{\frac{154 \, \text{g/mol}}{38 \, \text{g/mol}}} = \frac{2.01 \, \text{(F₂)}}{1 \, \text{(CCl₄)}} \]

1: 2.01 - or - 

0.497: 1 - or - 2ans

F₂ is 2.01x's faster

11. What is the molar mass of a gas that diffuses one third as fast as helium?

He: 4.0 g/mol 

\[ \sqrt{\frac{X}{4.09 \, \text{g/mol}}} = \frac{3}{1} \]

36.7 g/mol

2eq. 3 substitution 2answer

12. Given that two gases are in a room, at the same temperature. Given that one gas is chlorine and one gas is oxygen, which one would you expect to diffuse faster? EXPLAIN your answer (no credit without explanation).

Same temp means same (constant) KE

2 exp \( \text{At} \@ \text{same T, smaller MM faster.} \)

\( \frac{2 \, \text{mm}}{1 \, \text{mm}} \)

\( \text{Cl₂} = 71 \, \text{g/mol} \)

\( \text{O₂} = 32 \, \text{g/mol} \)

\( \text{O₂} \) faster 1 final ans.