Chemistry
Gas Laws – All practice I

Name KEY
Date _____

1. What is the relationship between pressure and temperature?

   Directly related ⇒ As temp. goes up, pressure goes up

2. How many grams of $Cl_2(g)$ can be stored in a 10.0 L container at 1000 kPa and 30°C?

   $PV=nRT$ $\quad 1000\ kPa \cdot 10.0\ L = n \cdot 8.31 \cdot 303\ K$ $\quad n = 3.97\ mol \Rightarrow 4\ mol \left|\frac{70.9\ g}{1\ mol}\right. = 283.6\ g \Rightarrow$ 300g Cl_2

3. A gas with a pressure of 5.4 atm and at 25°C is raised to a new temperature of 78°C. What is the new pressure?

   $\frac{P_1}{T_1} = \frac{P_2}{T_2}$ $\quad \frac{5.4\ atm}{298\ K} = \frac{P_2}{351\ K}$ $\quad P_2 = 6.4\ atm$

4. A sample of argon gas is cooled and its volume went from 2.3 L to 3.8 L. If its final temperature was 45°C, what was the original temperature?

   $\frac{V_1}{T_1} = \frac{V_2}{T_2}$ $\quad \frac{2.3\ L}{T_1} = \frac{3.8\ L}{318\ K}$ $\quad T_1 = 192\ K$ ⇒ 190 K w/ sig figs

5. A gas with a pressure of 550 torr and at 110°C is raised to a new pressure of 760 torr. What is the new temperature?

   $\frac{P_1}{T_1} = \frac{P_2}{T_2}$ $\quad \frac{550\ torr}{383\ K} = \frac{760\ torr}{T_2}$ $\quad T_2 = 529\ K$ ⇒ 530 K w/ sig figs

6. 5.98 mL of an unknown gas weighs 0.081 g at STP. Calculate the molar mass of the gas. Can you determine the identity of this unknown gas?

   $PV=nRT$ $\quad 101.3\ kPa \cdot 5.98\times10^{-3}\ L = n \cdot 8.31 \cdot 273\ K$ $\quad n = 2.67\times10^{-4}\ mol$ $\quad \frac{0.081\ g}{2.67\times10^{-4}\ mol} = 303.3\ g/mol$

7. What is the relationship between pressure and volume?

   Inversely related ⇒ As pressure goes up, volume goes down

8. What is the atmospheric pressure if the partial pressures of nitrogen, oxygen, and argon are 77.75 kPa, 19.94 kPa, and 1.999 kPa, respectively?

   $P_{atm} = P_{N_2} + P_{O_2} + P_{Ar}$ $\quad P_{atm} = 77.75 + 19.94 + 1.999$ $\quad P_{atm} = 99.69\ kPa$

9. A gas at 355 torr has a volume of 850 mL. What pressure would you need to decrease the volume to 550 mL?

   $P_1V_1 = P_2V_2$ $\quad 355\ torr \cdot 850\ mL = P_2 \cdot 550\ mL$ $\quad P_2 = 550\ torr$

10. What is the relationship between volume and temperature?

    Directly related ⇒ As temperature goes up, volume goes down

11. At 150°C and 100 kPa, 1.00 L of a compound has a mass of 2.506 g. Calculate its molar mass.

    $PV=nRT$ $\quad 100\ kPa \cdot 1.00\ L = \left(\frac{2.506\ g}{x}\left|\frac{1\ mol}{x}\right.\right) \cdot 8.31 \cdot 423\ K$ $\quad 100 = \frac{8808.916}{x}$ $\quad x = 88.09\ g/mol$

12. A gas at 5°C occupies a volume of 7.5 L. What volume will the gas occupy at 100°C?

    $\frac{V_1}{T_1} = \frac{V_2}{T_2}$ $\quad \frac{7.5\ L}{278\ K} = \frac{V_2}{373\ K}$ $\quad V_2 = 1.0\times10^1\ L$

13. Oxygen at 25°C and 760 torr pressure occupies a volume of 21.2 L. What is the volume of oxygen gas at 133°C and 830 torr?

    $\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2}$ $\quad \frac{760\ torr \cdot 21.2\ L}{298\ K} = \frac{830\ torr \cdot V_2}{406\ K}$ $\quad V_2 = 26\ L$

14. An environmental testing lab uses a pump and cylinder to collect a sample of air near a leaking natural gas line. The lab finds the total pressure in their sample cylinder is 776.134 mm Hg. Analyzing the sample, they find it contains oxygen, nitrogen, and methane. What is the partial pressure of the methane in units of kPa if the partial pressure of the oxygen is 253.948 mm Hg and the partial pressure of the nitrogen is 515.30 mm Hg?

    $P_{Tot} = P_{O_2} + P_{N_2} + P_{CH_4}$ $\quad 776.134 = 253.948 + 515.30 + P_{CH_4}$ $\quad P_{CH_4} = 6.89\ mm\ Hg$

15. A toy balloon filled with air has an internal pressure of 1.25 atm (P_1) and a volume of 2.50 L (V_1). If the balloon is taken to the bottom of the ocean where the pressure is 95 atm (P_2), what will the new volume (V_2) of the balloon be? How many moles of gas does the balloon hold? Assume T = 285 K.

    $8.31\ \frac{L\cdot kPa}{K\cdot mol} \times \frac{1\ atm}{101.3\ kPa} = 0.0820$

    $P_1V_1 = P_2V_2$ $\quad 1.25\ atm \cdot 2.50\ L = 95\ atm \cdot V_2$ $\quad V_2 = 0.033\ L$

    then $PV=nRT$ $\quad 95\ atm \cdot 0.033\ L = n \cdot 0.0820\ \frac{L\cdot atm}{K\cdot mol} \cdot 285\ K$ $\quad n = 0.13\ mol$

    ← $(1.25 \cdot 2.50)$ gives same answer