Total = 63pts

Name:_____ Class:_____ Date:_____

GAS LAWS WORKSHEET (66 points)

Show all work and formulas. Circle your final answer with units. (3pts each)

1. A gas occupies 3.5L at 2.5 mm Hg pressure. What is the volume at 10 mm Hg at the same temperature?

$V_1 = 3.5L$
$P_1 = 2.5mmHg$
$V_2 = ?$
$P_2 = 10\ mmHg$

$P_1V_1 = P_2V_2$
$3.5(2.5) = V_2(10)$
$V_2 = 0.88L$

2. A constant volume of oxygen is heated from 100°C to 185°C. The initial pressure is 4.1 atm. What is the final pressure?

$T_1 = 100°C = 373K$
$T_2 = 185°C = 458K$
$P_1 = 4.1$
$P_2 = ?$

$\frac{P_1}{T_1} = \frac{P_2}{T_2}$ $\quad \frac{4.1}{373} = \frac{P_2}{458}$

$P_2 = 5.0\ atm$

3. A sample of 25L of NH_3 gas at 10°C is heated at constant pressure until it fills a volume of 50L. What is the new temperature in °C?

$V = 25L$
$T = 10°C = 283K$
$\frac{V_2}{T_2} = \frac{50}{?}$

$\frac{V_1}{T_1} = \frac{V_2}{T_2}$ $\quad \frac{25}{283} = \frac{50}{T_2}$

$T_2 = 566K - 273 = 293°C$

4. A certain quantity of argon gas is under 16 torr pressure at 253K in a 12L vessel. How many moles of argon are present?

$P = 16\ torr = .021\ atm$
$T = 253K$
$V = 12L$

$PV = nRT$
$.021(12) = n(0.0821)(253)$
$n = 0.012\ mol$

5. An unknown gas weighs 34g and occupies 6.7L at 2 atm and 245K. What is its molecular weight?

$mass = 34g$
$V = 6.7L$
$P = 2$
$T = 245K$

$mw = \frac{mRT}{PV}$

$= \frac{34(0.0821)(245)}{.2(6.7)}$

$mw = 51\ g/mol$

5

(3)

6. An ideal gas occupies 400ml at 270 mm Hg and 65°C. If the pressure is changed to 1.4 atm and the temperature is increased to 100°C, what is the new volume?

$V_1 = 400ml$
$P_1 = 270mmHg$
$T_1 = 65°C = 338k$
$P_2 = 1.4atm$
$T_2 = 100 = 373$
$V_2 = ?$

$\frac{P_1V_1}{T_2} = \frac{P_2V_2}{T_2}$

$\frac{.35(400)}{338} = \frac{1.4(V)}{373}$ $= 110mL$

7. What is the volume of 23g of neon gas at 1°C and a pressure of 2 atm?

(3)

$V = ?$
$m = 23g$
$mw = 20.2$
$T = 1°C = 274k$
$P = 2atm$

$mw = \frac{mRT}{PV}$ $20.2 = \frac{23(.0821)(274)}{2V}$

$V = 12.8L$

8. If 11 moles of HCl gas occupies 15L at 300°C, what is the pressure in torr?

(3)

$n = 11$
$V = 15$
$T = 300 + 273 = 573$
$P = ?$

$PV = nRT$
$P(15) = 11(0.0821)(573)$
$P = 34atm \cdot \frac{760torr}{1atm} =$ [illegible]

9. The pressure is 6.5 atm, 2.3 mole of Br_2 gas occupies 9.3 L . What is the temperature in °C?

(3)

$P = 6.5atm$
$n = 2.3$
$V = 9.3$
$T = °C$

$PV = nRT$
$6.5(9.3) = 2.3(.0821)(T)$
$\frac{60.45}{.188} = T$ $T = 321°C - 273$
$T = 48°C$

10. A 600mL balloon is filled with helium at 700mm Hg barometric pressure. The balloon is released and climbs to an altitude where the barometric pressure is 400mm Hg. What will the volume of the balloon be if, during the ascent, the temperature drops from 24 to 5°C?

(3)

$V = 600ml$
$P_1 = 700mmHg$
$P_2 = 400mmHg$
$V_2 = ?$
$T_1 = 24°C = 297$
$T_2 = 5°C = 278k$

$\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2}$

$\frac{700(600)}{297} = \frac{400(V)}{278}$

$V = 982ml$

11. In an autoclave, a constant amount of steam is generated at a constant volume. Under 1.00 atm pressure the steam temperature is 100°C. What pressure setting should be used to obtain a 165°C steam temperature for the sterilization of surgical instruments?

(3)

$P = 1\,atm$

$T_1 = 100°C = 373K$

$T_2 = 165°C = 438K$

$P_2 =$

$\frac{P_1}{T_1} = \frac{P_2}{T_2} \quad \frac{1}{373} = \frac{P_2}{438}$

$P_2 = 1.174\,atm$

12. A quantity of gas exerts a pressure of 98.6 kPa at a temperature of 22°C. If the volume remains unchanged, what pressure will it exert at -8°C?

(3)

$P_1 = 98.6\,kPa$

$T_1 = 22°C = 295K$

$P_2 = ?$

$T_2 = -8°C = 265K$

$\frac{P_1}{T_1} = \frac{P_2}{T_2} \quad \frac{98.6}{295} = \frac{P_2}{265}$

$P = 0.875\,atm$

88.57 kPa

13. Iron (II) sulfide reacts with hydrochloric acid as follows:

$$FeS(s) + 2\,HCl(aq) \rightarrow FeCl_2(aq) + H_2S(g)$$

(3)

What volume of H_2S, measured at 30°C and 95.1 kPa, will be produced when 132 g of FeS reacts?

$T = 30°C = 303$

$95.1\,kPa \times \frac{1\,atm}{101.32\,kPa} \Rightarrow P = 95.1\,kPa = 0.938\,atm$

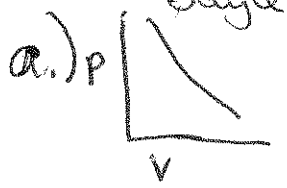
$m = 132\,g\,FeS$

14. For a mole of ideal gas, sketch graphs of

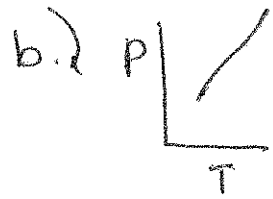
(6) 1 per graph

a. P vs. V at constant T.
b. P vs. T at constant V.
c. V vs. T at constant P.

a.) Boyle



b.)



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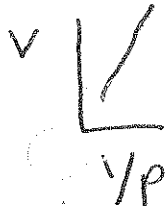

c)

$132\,g\,FeS \times \frac{1\,mol\,FeS}{87.8\,g\,FeS} \times \frac{1\,mol\,H_2S}{1\,mol\,FeS} = 1.5\,mol\,H_2S$ ∴ n

$PV = nRT$

$0.938(V) = 1.5(0.0821)(303)$

$V = 39.78\,L$

(12)

15. If I have 5.6 liters of gas in a piston at a pressure of 1.5 atm and compress the gas until its volume is 4.8 L, what will the new pressure inside the piston be?

(3)

$V = 5.6L$
$P = 1.5 atm$
$V_2 = 4.8L$

$P_1V_1 = P_2V_2$

$1.5(5.6) = X(4.8)$

$1.8atm = X$

16. If I have 45 liters of helium in a balloon at 25^0 C and increase the temperature of the balloon to 55^0 C, what will the new volume of the balloon be?

(3)

$V = 45L$
$T = 25°C = 298K$
$T_2 = 55°C = 328K$
$V_2 = ?$

$\frac{V_1}{T_1} = \frac{V_2}{T_2}$

$\frac{45}{298} = \frac{V_2}{328}$

$V_2 = 50L$

17. How many moles of gas does it take to occupy ~~120 liters~~ at a pressure of 2.3 atmospheres and a temperature of 340 K?

(3)

$n =$
$V = 120L$
$P = 2.3 atm$
$T = 340K$

$PV = nRT$

$2.3(120) = n(0.821)(340)$

$n = 9.89$ mols

18. If I initially have 4.0 L of a gas at a ~~pressure of 1.1 atm~~, what will the volume be if I increase the pressure to 3.4 atm?

(3)

$V = 4L$
$P = 1.1 atm$
$V_2 = ?$
$P_2 = 3.4 atm$

$P_1V_1 = P_2V_2$

$1.1(4) = 3.4(V_2)$

$V_2 = 1.29L$

19. If a gas B effuses four times as fast as gas A. What is the ratio of the molar masses (A/B).

4B : 1A

(3)

$$\frac{\text{rate A}}{\text{rate B}} = \sqrt{\frac{M_b}{M_A}}$$

$$\left(\frac{4}{1}\right)^2 = \left(\sqrt{\frac{m_b}{m_a}}\right)^2$$

$$\frac{16}{1} = \frac{b}{a}$$

$\therefore$ 16 : 1 A/B

20. What volume of oxygen could be prepared at 750 torr and 123 °C from 63.7 g of $KClO_3$. According to the following equation.

$$2KClO_3\ (s) \rightarrow 2KCL\ (s) + 3O_2\ (g)$$

(3)

$$63.7\ g\ KClO_3 \times \frac{1\ mol\ KClO_3}{122.6\ g\ KClO_3} \times \frac{3\ mol\ O_2}{2\ mol\ KClO_3} = 0.78\ mol\ O_2 = n$$

$\therefore PV = nRT$

$0.99\ atm(V) = 0.78(0.0821)(396)$

$V =$ 25.6 L

21. Determine the molar mass of a gas if a 4.23 g sample of the gas occupies 4.00 L at 27 °C and a pressure of 715 torr.

(3)

$m = 4.23$

$V = 4$

$T = 300$

$P = 0.9407$

$$MW = \frac{mRT}{PV}$$

$$= \frac{4.23(0.0821)(300)}{0.9407(4)}$$

$mw = 27.7\ g/mol$