25 pts

Chemistry 1A - **Key**
Gases

Name Key

1) A child receives a helium balloon in a shopping mall. When he goes outside during a snowstorm, the balloon decreases in size. Which gas law is this an example of?
A) Avogadro's Law; B) Ideal Gas Law;
C) Charles's Law; D) Boyle's Law; E) Dalton's Law

C (3)

2) A large balloon is initially filled to a volume of 25.0 L at 353 K and a pressure of 2575 mm Hg. What volume of gas will the balloon contain at 1.35 atm and 253 K?
A) 22.2 L; B) 87.5 L; C) 11.4 L; D) 45.0 L; E) 58.6 L (4)

D

$\frac{V_1P_1}{T_1} = \frac{V_2P_2}{T_2}$ $V_2 = \frac{V_1P_1T_2}{T_1P_2}$

$= \frac{(25.0\,L)(3.388\,atm)(258\,K)}{(353\,K)(1.35\,atm)}$

3) Determine the theoretical yield and the percent yield if 21.8 g of $K_2CO_3$ is produced from reacting 27.9 g $KO_2$ with 29.0 L of $CO_2$ (at STP). The molar mass of $KO_2$ = 71.10 g/mol and $K_2CO_3$ = 138.21 g/mol.

$$4\,KO_2(s) + 2\,CO_2(g) \rightarrow 2\,K_2CO_3(s) + 3\,O_2(g)$$

A) 27.1 g, 80.4% yield; B) 179 g, 12.2% yield; C) 91.7 g, 23.8% yield; D) 206 g, 10.6% yield; E) 61.0 g, 35.7% yield (6)

A

LR

$27.9\,g\,KO_2 \times \frac{1\,mol\,KO_2}{71.10\,g} \times \frac{2\,mol\,K_2CO_3}{4\,mol\,KO_2} = 0.1962\,mol\,K_2CO_3$

$n_{CO_2} = \frac{(0.082\,\frac{L\,atm}{mol\,K})(273\,K)}{(29.0\,L)(1\,atm)} \times \frac{2\,mol\,K_2CO_3}{2\,mol\,CO_2} = 1.2945$

$0.1962\,mol\,K_2CO_3 \times \frac{138.21\,g}{1\,mol\,K_2CO_3} = 27.117$

$\frac{21.8\,g}{27.1\,g} \cdot 100\% = 80.4\%$

PV=nRT

4) A 0.334 g sample of an unknown halogen occupies 109 mL at 398 K and 1.41 atm. What is the identity of the halogen? (4)

A) $Br_2$; B) $F_2$; C) $Cl_2$; D) $I_2$; E) Ge

C

$$n = \frac{(1.41\ atm)(0.109\ L)}{\left(0.082\ \frac{L \cdot atm}{mol \cdot K}\right)(398\ K)} = 0.004705\ mol$$

$$\frac{0.334\ g}{0.004705\ mol} = 70.9779\ g/mol$$

$Cl_2$

5) Determine the volume of $H_2S$ (at 375 K and 1.20 atm) needed to produce 55.0 g of S. Assume that there is excess $SO_2$ present. (4)

PV=nRT

$$2\ H_2S(g) + SO_2(g) \rightarrow 3\ S(s) + 2\ H_2O(g)$$

B

A) 44.0 L; B) 29.3 L; C) 22.7 L; D) 34.1 L; E) 66.0 L

$$55.0\ g\ S \times \frac{1\ mol\ S}{32.06\ g} \times \frac{2\ mol\ H_2S}{3\ mol\ S} = 1.143689\ mol\ H_2S$$

$$V = \frac{(1.143689\ mol\ H_2S)\left(0.082\ \frac{L \cdot atm}{mol \cdot K}\right)(375\ K)}{(1.20\ atm)}$$

PV=nRT

6) What pressure will 14.0 g of CO exert in a 3.5 L container at 75°C? (4)

A) 4.1 atm; B) 5.0 atm; C) 6.4 atm; D) 1.1 atm; E) 2.3 atm

A

$$14.0\ g\ CO \times \frac{1\ mol\ CO}{28.01\ g} = 0.49982\ mol\ CO$$

$$P = \frac{(0.49982\ mol\ CO)\left(0.082\ \frac{L \cdot atm}{mol \cdot K}\right)(348\ K)}{3.5\ L}$$