- The following reaction takes place. You react 2.19 L of oxygen gas at 1.5 atm and 25 °C, which weighs 0.896 g with 1.35×10^{22} molecules of $C_8H_{18}(g)$. If you collect the $CO_2(g)$ and $H_2O(g)$ in a 45 mL vessel at 25 °C, what is the total pressure of the gasses in the vessel?
- You react 250 mL of 0.0105 M $H_2SO_4(aq)$ with 250 mL of 0.0105 M NaOH(aq). What is the pH of the resulting solution?
- The following reaction occurs. If you have 1.5 L of a 0.15 M solution of MnO_4^- reacting with 25.34 g of $C_2O_4^{2-}$, what mass of CO_2 will be produced?

  $$MnO_4^-(aq) + C_2O_4^{2-}(aq) \rightarrow CO_2(g) + Mn^{2+}(aq)$$

  (Not Balanced)
- Let us say you did not know the identity of gas 1. In order to determine the molecular weight of gas 1 you reacted magnesium sulfite with hydrochloric acid and collected the gas that was given off in a vessel labeled gas 2. You then determined the rate at which it takes for gas 2 to pass through a porous barrier. You determined that it took 5.34 mL/min for gas 2. If it takes 6.44 mL/min for gas 1 to pass through the same barrier, what is the molecular weight of gas ?
- In most of its ionic compounds, cobalt is either Co(II) or Co(III). One such compound, containing chloride ion and waters of hydration, was analyzed, and the following results were obtained.

  A 0.256 g sample of the compound was dissolved in water, and excess silver nitrate was added. The silver chloride was filter, dried, and weighed, and it had a mass of 0.308 g.

  A second sample of 0.416 g of the compound was dissolved in water, and an excess of sodium hydroxide was added. The hydroxide salt was filtered and heated in a flame, forming cobalt(III) oxide. The mass of cobalt(III) oxide formed was 0.145 g.

  How many water molecules can be extracted from 6.584×10^{-23} g of the cobalt containing compound?
- Determine the molecular formula of the unknown compound from the following information.
  a. The compound is 92.3 % carbon and 7.7% hydrogen
  b. When comparing the rate of effusion of this compound to methane (CH_4), methane effuses at a rate of 4.35 mL/min and the unknown compound at a rate of 1.97 mL/min.
-

#1

L.R.

$$2\,C_8H_{18} + 25\,O_2 \longrightarrow 16\,CO_{2(g)} + 18\,H_2O_{(g)}$$

1.35×10^{22} molec. → 0.0224 mols

2.19 L, 1.5 atm, 25°C → 0.134 mols

Since treating like all ideal we can say

34. Gases.

$$0.134 \text{ mols } O_2 \times \frac{34 \text{ mols Gas}}{25 \text{ mols } O_2} = 0.18224 \text{ mols Gas}$$

$$PV = nRT$$

$$P(0.045\,L) = 0.18224\,(0.082057)(298)$$

$$P = 99 \text{ atm}$$

#2

L.R.

$$H_2SO_4 + 2NaOH \rightarrow 2H_2O + Na_2SO_4$$

250 mL
0.0105 M
0.002625 mols

250 mL
0.0105 M
0.002625 mols NaOH $\times \frac{1 \text{ mol } H_2SO_4}{2 \text{ mols NaOH}}$

$pH = -\log [H^+]$ ← Molarity

$M = \frac{\text{mols}}{L}$

Use 0.0013125 ~~Use~~ H_2SO_4

Left 0.0013125 mols $H_2SO_4 \times \frac{2 \text{ mols } H^+}{1 \text{ mol } H_2SO_4} = 0.002625$ mols H^+

Total vol = 500 mL

$[H^+] = 0.00525$ M

$pH = 2.28$

#3 Balance Redox

$$16H^+ + 2MnO_4^- + 5C_2O_4^{2-} \longrightarrow 10CO_2 + 2Mn^{2+} + 8H_2O$$

L.R.

$2MnO_4^-$: 1.5 L, 0.15 M, ~~0.0~~ 0.225 mols

$5C_2O_4^{2-}$: 25.34 g, 0.288 mols

$$0.288 \text{ mols } C_2O_4^{2-} \times \frac{10 \text{ mols } CO_2}{5 \text{ mols } C_2O_4^{2-}} \times \frac{44 \text{ g } CO_2}{1 \text{ mol } CO_2} = 25.3 \text{ g } CO_2$$

#4

Gas 1

un

MW?

6.44 mL/min

Gas 2

$MgSO_3 + 2HCl \rightarrow SO_2 + MgCl_2 + H_2O$

$\therefore$ = SO_2

MW = 64 g/mol

5.34 mL/min

$$\frac{6.44}{5.34} = \sqrt{\frac{64}{x}}$$

$$1.4544 = \frac{64}{x}$$

$$x = 44 \text{ g/mol}$$

#5 $CoCl_x \cdot yH_2O$

A 0.256g ~~Mg~~ · Sample

0.308g $AgCl = 0.00215$ mols

$\therefore$ 0.0762g Cl^-

$$\frac{0.0762g\ Cl^-}{0.256g} \times 100 = 29.8\%\ Cl$$

B 0.416g Sample

0.145g $Co_2O_3 = 8.735 \times 10^{-4}$ mols

$\therefore$ 0.00175 mols Co = 0.103g Co

$$\frac{0.103g\ Co}{6.416g} \times 100 = 24.8\%\ Co$$

$\therefore$ 45.4 % H_2O

mols		($238 g/mol$)
0.839	Cl	$CoCl_2 \cdot 6H_2O$
0.420	Co	$6.584 \times 10^{-23} g = 2.766 \times 10^{-25}$ mols
2.5	H_2O	$\therefore 1.66 \times 10^{-24}$ mols H_2O

↳ $\therefore$ 1 molec H_2O

#6

	%	mols
C	92.3	7.692
H	7.7	7.7

$\therefore$ CH = EF

13 = EW

CH_4	u_H
4.35 mL/min	1.97 mL/min
16 g/mol	MW = ?

$$\frac{4.35}{1.97} = \sqrt{\frac{x}{16}}$$

$$4.88 = \frac{x}{16}$$

$$x = 78 \text{ g/mol}$$