AP PROBLEM SET #2

1) a) Mg $1s^2\ 2s^2\ 2p^6\ 3s^2$

Ar $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6$

b) Valence for Mg and Ar are in same principle energy level, but Ar is smaller & has greater nuclear charge. ∴ Ionization energies are less for Mg. Removal of 3rd e^- from Mg is from $n=2$ level, ∴ e^- in this level experience a greater Z_{eff}.

c) Only $MgCl_2$ forms. Mg readily lose 2 e^- Ionization of Mg^{3+} is very high. E-affinity for Ar is low, and ionization of Ar is high.

D) Q Cl Very high 2nd ionization energy means only 1 valence e^-

2). a) $Na_2O_{(s)} + H_2O_{(l)} \rightarrow 2NaOH_{(aq)}$

$Na_2O_{(s)} + H_2O_{(l)} \rightarrow 2Na^+_{(aq)} + 2OH^-_{(aq)}$

b) $2C_2H_{6(g)} + 7O_{2(g)} \rightarrow 4CO_{2(g)} + 6H_2O_{(l)}$

c) $Co(NO_3)_{2(aq)} + 2NaOH_{(aq)} \rightarrow Co(OH)_{2(s)} + 2NaNO_{3(aq)}$

$Co^{2+}_{(aq)} + 2OH^-_{(aq)} \rightarrow Co(OH)_{2(s)}$

d) $CuCl_{2(aq)} + Na_2S_{(aq)} \rightarrow CuS_{(s)} + 2NaCl_{(aq)}$

Net ionic $Cu^{2+}_{(aq)} + S^{2-}_{(aq)} \rightarrow CuS_{(s)}$

e) $2Na_{(s)} + 2H_2O_{(l)} \rightarrow 2NaOH_{(aq)} + H_{2(g)}$

$2Na_{(s)} + 2H_2O_{(l)} \rightarrow 2Na^+_{(aq)} + 2OH^-_{(aq)} + H_{2(g)}$

3).

a) $M_1V_1 = M_2V_2$

$18.4M\,(V_1) = 5.20M\ \ 1L$

$V_1 = \dfrac{5.20\,\cancel{M}\ 1L}{18.4\,\cancel{M}}$

$V_1 =$ **.2826 L or 282.6 mL**

b) Assume 1 L.

density of conc. ($H_2SO_4 + H_2O$) $= \dfrac{1.84g}{mL}$

$D = \frac{m}{V}$

$1.84g = \dfrac{m}{1000mL} =$ **1840 g H_2SO_4 and water**

g total ↗

$18.4M = \dfrac{mol}{1L} = \dfrac{18.4\ mol\ H_2SO_4}{1} \left| \dfrac{98.1g}{1mol} \right. =$ **1805 g H_2SO_4**

Mass % $= \dfrac{part}{total} \times 100\%$ $\dfrac{g\ H_2SO_4}{g\ H_2SO_4 + water}$ **98.1% H_2SO_4**

c) $H_2SO_4 + 2NaHCO_3 \rightarrow Na_2SO_4 + 2H_2O + 2CO_2$

$10.5g\ NaHCO_3 \left| \dfrac{1mol\ NaHCO_3}{84.0g\ NaHCO_3} \right| \dfrac{1mol\ H_2SO_4}{2mol\ NaHCO_3} \left| \dfrac{1L}{5.20mol\ H_2SO_4} \right. =$ **0.0120 L of 5.2M H_2SO_4**

4) Lab Procedures

A) Graduated Cylinder (2) Stir Rod.
calorimeter (2 coffee cups nested)
temperature probe (or thermometer) (2)

B) Take initial temperature of 100mL of HCl
" " " " 110mL of NaOH.

Take highest temperature during reaction; until it levels off + starts dropping.

C) 1) Calculate moles of lim reactant (HCl in this case)

2) Calculate energy needed to raise total amount of H_2O the Δt $q = cm\Delta t$

3) $q_{water} = -q_{rxn}$

3) divide q_{rxn} by moles reacted.

D) Avg class lower than true value due to possible:

- energy loss to enviornment. (Lid was not tight)
- difference in reagent temp.
- absorption of energy by calorimeter
- Limitation of temperature precision. (thermometer)
- etc