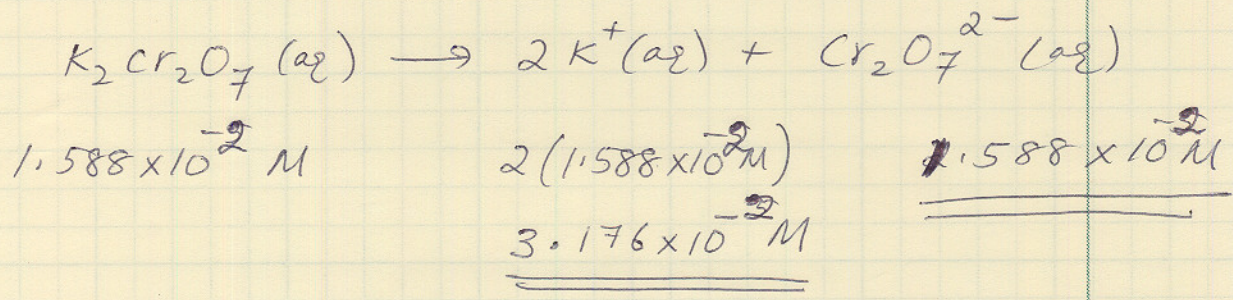


INTRODUCTION TO NATURAL SCIENCE
CHEMISTRY HW - WEEK 8 - FALL 2006

Chapter 5

(42) molar mass of $K_2Cr_2O_7 = 294.119 \text{ g/mol}$
moles of $K_2Cr_2O_7 = 2.3359 \times \frac{\text{mol}}{294.119}$
 $= 7.9389 \times 10^{-3} \text{ mol}$

molarity $= \frac{\# \text{ moles solute}}{\text{volume of solution}}$
 $= \frac{7.9389 \times 10^{-3} \text{ mol}}{500 \times 10^{-3} \text{ L}}$
 $= 1.5878 \times 10^{-2} \text{ M}$
 $= \underline{\underline{1.588 \times 10^{-2} \text{ M}}}$



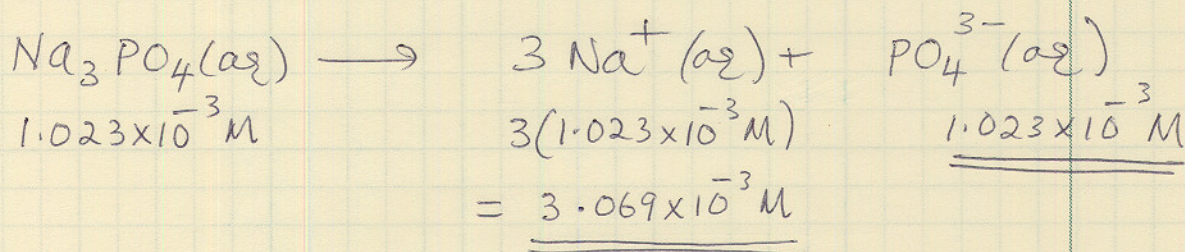
(44) molarity $= \frac{\# \text{ moles solute}}{\text{volume of solution}} \quad \left(M = \frac{n}{V} \right)$

$\Rightarrow n = M \cdot V$
 $\# \text{ moles of solute} = \left(1.023 \times 10^{-3} \frac{\text{mol}}{\text{L}} \right) (125 \text{ mL}) \times \left(\frac{\text{L}}{10^3 \text{ mL}} \right)$
 $= 1.27875 \times 10^{-4} \text{ mol}$

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$$\text{molar mass of Na}_3\text{PO}_4 = 163.87 \text{ g/mol}$$

$$\begin{aligned} \text{mass of Na}_3\text{PO}_4 &= 1.27875 \times 10^{-4} \text{ mol} \times \frac{163.87 \text{ g}}{1 \text{ mol}} \\ &= 2.0955 \times 10^{-2} \text{ g} \\ &= \underline{\underline{2.10 \times 10^{-2} \text{ g}}} \end{aligned}$$



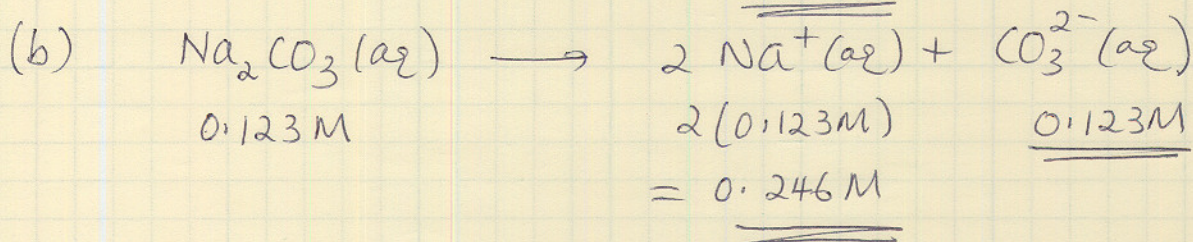
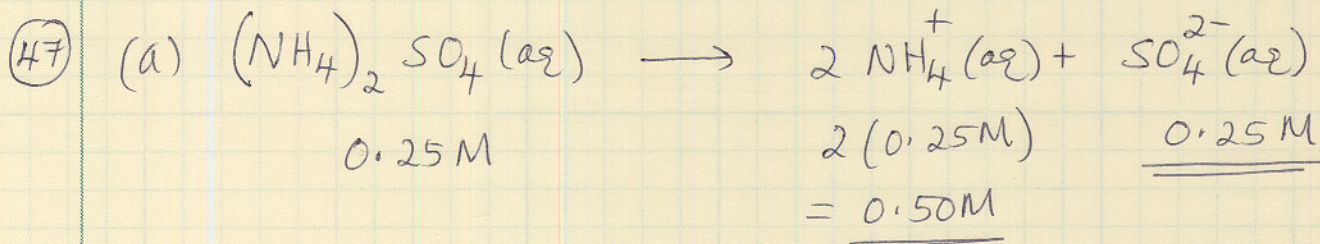
(46) Molar mass of $\text{KMnO}_4 = 157.996 \text{ g/mol}$

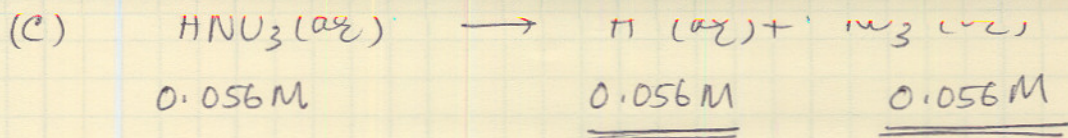
$$\text{moles of KMnO}_4 = 322 \text{ g} \times \frac{\text{mol}}{157.996 \text{ g}} = 2.0380 \text{ mol}$$

$$\text{Volume of solution} = \frac{\# \text{ moles of solute}}{\text{molarity}}$$

$$= \frac{2.0380 \text{ mol}}{2.06 \text{ (mol/L)}} = \underline{\underline{0.98933 \text{ L}}}$$

$$= \underline{\underline{0.989 \text{ L}}}$$





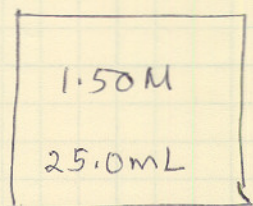
(49) Molar mass of $\text{Na}_2\text{CO}_3 = 105.959 \text{ g/mol}$

$$\begin{aligned} \# \text{ moles } \text{Na}_2\text{CO}_3 &= (\text{molarity}) \times (\text{volume of solution}) \\ &= \left(0.0200 \frac{\text{mol}}{\text{L}}\right) \left(500. \times 10^{-3} \text{ L}\right) \\ &= 0.0100 \text{ mol} \end{aligned}$$

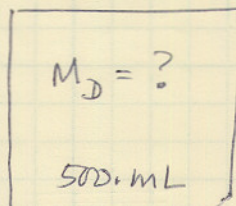
$$\begin{aligned} \text{mass of } \text{Na}_2\text{CO}_3 &= 0.0100 \text{ mol} \times \frac{105.959 \text{ g}}{1 \text{ mol}} \\ &= 1.05959 \text{ g} \\ &= 1.059 \text{ g} \end{aligned}$$

Weigh out 1.059 g of Na_2CO_3 . Transfer quantitatively into the 500. mL volumetric flask. Add some DI water and swirl to dissolve the solid. Then add enough DI water to make up to the mark. Cap and invert the flask a few times to mix the contents.

(51)



Conc. HCl



dilute HCl

$$\left(\# \text{ of moles HCl taken from conc. } \overset{\text{solution}}{\cancel{\text{HCl}}} \right) = \left(\# \text{ of mol HCl in dilute solution} \right)$$

$$M_c \cdot V_c = M_D \cdot V_D$$

$$\begin{aligned} \therefore M_D &= \frac{M_c V_c}{V_D} = \frac{\left(1.50 \frac{\text{mol}}{\text{L}}\right) (25.0 \text{ mL})}{(500. \text{ mL})} \\ &= \underline{\underline{0.0750 \text{ M}}} \end{aligned}$$

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$$\begin{aligned} V_c &= 4.00 \text{ mL} \\ M_c &= 0.0250 \text{ M} \end{aligned}$$

conc. solution

$$\begin{aligned} M_D &= ? \\ V_D &= 10.00 \text{ mL} \end{aligned}$$

dilute soln.

moles of CuSO_4 in conc. solution= # moles of CuSO_4 in dilute solution

$$M_c \cdot V_c$$

$$= M_D \cdot V_D$$

$$M_D$$

$$= \frac{M_c V_c}{V_D} = \frac{\left(0.0250 \frac{\text{mol}}{\text{L}}\right) (4.00 \text{ mL})}{(10.00 \text{ mL})}$$

$$= \underline{\underline{0.0100 \frac{\text{mol}}{\text{L}}}}$$

54 moles of $\text{K}_2\text{Cr}_2\text{O}_7$ in the desired solution = (molarity) (volume of solution)

$$= \left(0.500 \frac{\text{mol}}{\text{L}}\right) (300. \times 10^{-3} \text{ L})$$

$$= \underline{\underline{0.150 \text{ mol}}}$$

(54)

method (a)30.0 mL of 1.50 M $K_2Cr_2O_7$

$$\left. \begin{array}{l} \# \text{ moles } K_2Cr_2O_7 \text{ in this} \\ \text{solution} \end{array} \right\} = \left(\frac{1.50 \text{ mol}}{L} \right) (30.0 \text{ mL}) \times \left(\frac{L}{10^3 \text{ mL}} \right)$$

$$= 0.0450 \text{ mol}$$

When you add 270. mL of water, total volume \neq 300 mL
 This method cannot work.

method (b)

$$\begin{array}{l} 250. \text{ mL} = V_C \\ 0.600 \text{ M} \\ = M_C \end{array}$$

conc. solution

$$\begin{array}{l} 300. \text{ mL} = V_D \\ M_D = ? \end{array}$$

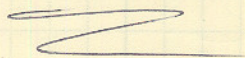
dilute solution

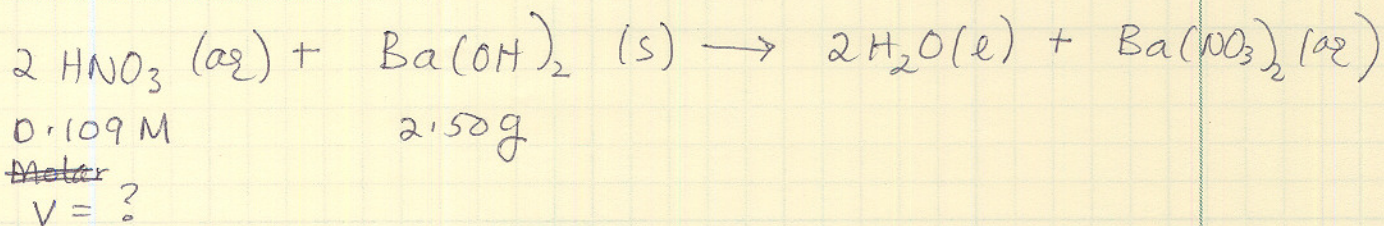
moles $K_2Cr_2O_7$ in conc. solution = # moles $K_2Cr_2O_7$ in dilute solution

$$M_C \cdot V_C = M_D V_D$$

$$M_D = \frac{M_C V_C}{V_D} = \frac{(0.600 \text{ M})(250. \text{ mL})}{(300. \text{ mL})} = \underline{0.500 \text{ M}}$$

This will provide us with a $K_2Cr_2O_7$ solution of 0.500 M concentration that has a volume of 300. mL. Method (b) works.





molar mass of $\text{Ba}(\text{OH})_2 = 171.323 \text{ g/mol}$

moles of $\text{Ba}(\text{OH})_2 = 2.50 \text{ g} \times \frac{\text{mol}}{171.323 \text{ g}} = 1.459 \times 10^{-2} \text{ mol}$

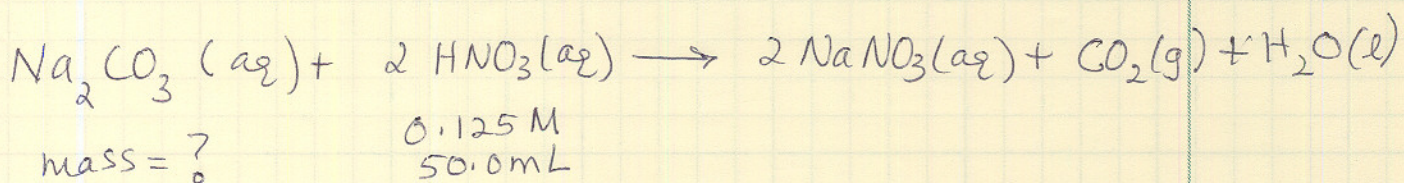
$1.459 \times 10^{-2} \text{ mol Ba}(\text{OH})_2 \times \frac{2 \text{ mol HNO}_3}{1 \text{ mol Ba}(\text{OH})_2}$

$= 2.9185 \times 10^{-2} \text{ mol HNO}_3$

volume of $\text{HNO}_3 = \frac{\text{moles of HNO}_3}{\text{molarity of HNO}_3} = \frac{2.9185 \times 10^{-2} \text{ mol}}{0.109 \text{ mol/L}}$

$= 0.267749 \text{ L} \times \frac{1000 \text{ mL}}{\text{L}}$

$= 267.75 \text{ mL} = \underline{\underline{268 \text{ mL}}}$



moles of $\text{HNO}_3 = (\text{molarity}) \times (\text{volume})$
 $= \left(0.125 \frac{\text{mol}}{\text{L}}\right) \left(50.0 \times 10^{-3} \text{ L}\right)$
 $= 6.25 \times 10^{-3} \text{ mol}$

molar mass of $\text{Cl}_2 = 70.90 \text{ g/mol}$

mass of Cl_2

$$= 2.625 \text{ mol} \times$$

$$\boxed{\frac{70.90 \text{ g}}{1 \text{ mol}}}$$

$$= 186.113 \text{ g} = \underline{\underline{186 \text{ g}}}$$