INTRODUCTION TO NATURAL SCIENCE

WEEK 8 CHEMISTRY WORKSHOP

① oxid. #

	K	Mn	O_4
	+1	+7	−2
total	+1	+7	−8

	Ni	O_2
	+4	−2
	+4	−4

	Na_4	Fe	$(OH)_6$
	+1	+2	−2 +1
	+4	+2	−12 +6

	P_4	O_6
	+3	−2
	+12	−12

	Xe	O	F_4
	+6	−2	−1
	+6	−2	−4

	C_6	H_{12}	O_6
	0	+1	−2
	0	+12	−12

	NO_3^-	
	+5	−2
	+5	−6

	NH_4^+	
	−4	+1
	−4	+4

② $Cu(s) + 2\,Ag^+(aq) \longrightarrow 2\,Ag(s) + Cu^{2+}(aq)$

oxidation state: 0 → +1 (reduction) → 0 → +2 (oxidation)

Ag is reduced from +1 to zero oxidation state

Cu is oxidized from ∅ to +2 oxidation state

Cu is the reducing agent, Ag^+ is the oxidizing agent.

+1 | -1 ; -3 | +1 ; -3 | +1 | -1

-3 | +3 ; -3 | +4 | -1

This is not a redox reaction.

$$SiCl_4(\ell) + 2H_2O(\ell) \longrightarrow 4HCl(aq) + SiO_2(s)$$

+4 | -1 ; +4 | -4 ; +1 | -2 ; +2 | -2 ; +1 | -1 ; +4 | -2 ; +4 | -4

Not a redox reaction.

(3) Molar mass of $NaHCO_3$ = $[22.9898 + 1.008 + 12.011 + 3(15.99)]$ g/mol

= 83.9788 g/mol

$$5.623\text{ g } NaHCO_3 \times \frac{\text{mol}}{83.9788\text{ g}} = 6.696 \times 10^{-2}\text{ mol } NaHCO_3$$

$$\text{molarity} = \frac{\#\text{ of moles of solute}}{\text{volume of solution}} = \frac{6.696 \times 10^{-3}\text{ mol}}{250.00 \times 10^{-3}\text{ L}}$$

$$= \underline{0.2678\text{ M}}$$

Molar mass of $K_2Cr_2O_7$ = 294.1188 g/mol

$$184.56\text{ mg } K_2Cr_2O_7 \times \frac{1\text{ g}}{10^3\text{ mg}} \times \frac{1\text{ mol}}{294.1188\text{ g}} = 6.2750 \times 10^{-4}\text{ mol}$$

$$\text{molarity} = \frac{\text{moles of solute}}{\text{volume of solution}} = \frac{6.2750 \times 10^{-4}\text{ mol}}{500.00 \times 10^{-3}\text{ L}} = 1.2550 \times 10^{-3}\text{ M}$$

(4) $\frac{0.124 \text{ mol } Ca(NO_3)_2}{100.00 \times 10^{-3} \text{ L of solution}} = 1.24 \text{ M } Ca(NO_3)_2 \text{ solution}$

$Ca(NO_3)_2 (aq) \longrightarrow Ca^{2+}(aq) + 2\,NO_3^-(aq)$

$1.24\text{M} \longrightarrow 1.24\text{M} \quad 2(1.24\text{M}) = 2.48\text{M}$

Ca^{2+} ions = 1.24M NO_3^- ions = 2.48M

Molar mass of NH_4Cl = 53.5387 g/mol

$5.34\text{g } NH_4Cl \times \frac{\text{mol}}{53.5387\text{g}} = 9.9741 \times 10^{-2} \text{ mol } NH_4Cl$

$\frac{9.9741 \times 10^{-2} \text{ mol } NH_4Cl}{450.00 \times 10^{-3} \text{ L solution}} = 0.2216 \text{ M } NH_4Cl$

$NH_4Cl (aq) \longrightarrow NH_4^+(aq) + Cl^-(aq)$

$0.2216\text{M} \longrightarrow 0.2216\text{M} \quad 0.2216\text{M}$

NH_4^+ ions = 0.2216M Cl^- ions = 0.2216M

(5) $\text{Molarity} = \frac{\#\text{ moles of solute}}{\text{Volume of solution}}$

$0.400\text{M} = \frac{\#\text{ moles NaOH}}{250.00 \times 10^{-3} \text{ L}}$

$\#\text{ moles of NaOH} = (0.400\text{M})(250.00 \times 10^{-3}\text{L}) = 0.100 \text{ mol}$

$$0.100\ \text{mol NaOH} \times \frac{39.98789\ \text{g}}{1\ \text{mol}} = 3.99878\ \text{g NaOH}$$

$$= \underline{3.99\ \text{g NaOH} \quad \text{or} \quad 4.00\ \text{g}}$$

(6) $$\text{Molarity} = \frac{\#\ \text{moles KOH}}{\text{volume of solution}}$$

$$0.250\ \text{M} = \frac{\#\ \text{of moles of KOH}}{2.00\ \text{L}}$$

$$\#\ \text{moles KOH} = (0.250\ \text{M})(2.00\ \text{L}) = 0.500\ \text{mol}$$

Molar mass of KOH = 56.0963 g/mol

$$0.500\ \text{mol KOH} \times \frac{56.09639\ \text{g}}{1\ \text{mol}} = 28.0482\ \text{g KOH}$$

a) weigh out 28.0482 g of KOH using the analytical balance. Transfer this solid quantitatively into a 2.00 L volumetric flask. Add a little DI water to dissolve KOH completely. When ~~enough~~ ... up to the ... Mark with DI water. Cap and invert the volumetric flask a few times to mix the contents.

(7)

2.00 M NaOH	0.700 M NaOH 250.00 ML
Stock solution	dilute solution

Since matter is conserved

$$\left.\begin{array}{l}\#\text{ of moles of NaOH} \\ \text{taken from stock solution}\end{array}\right\} = \#\text{ of moles of NaOH in dilute solution}$$

$$\left(\begin{array}{c}\text{molarity} \\ \text{of stock}\end{array}\right) \times \left(\begin{array}{c}\text{volume of} \\ \text{stock}\end{array}\right) = \left(\begin{array}{c}\text{molarity of} \\ \text{dilute sol}^{n}\end{array}\right)\left(\begin{array}{c}\text{volume of} \\ \text{dilute sol}^{n}\end{array}\right)$$

$$(2.00\text{M})\left(\begin{array}{c}\text{volume of} \\ \text{stock sol}^{n}\end{array}\right) = (0.700\text{M})(250.00\text{mL})$$

$$\left.\begin{array}{c}\text{volume of stock} \\ \text{solution}\end{array}\right\} = \frac{(0.700\text{M})(250.00\text{mL})}{(2.00\text{M})}$$

$$= 87.5\text{ mL}$$

∴ Using a burette, carefully transfer 87.5 mL of the stock solution into a 250.00 mL volumetric flask. Add enough DI water to make up to the 250.00 mL mark. Invert the flask a few times to mix the contents.