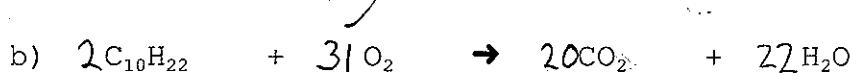
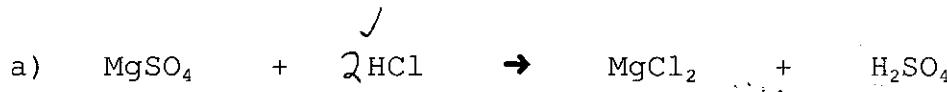


/95 = %

Name: \_\_\_\_\_

SCH 4C  
Stoichiometry Unit Test

1. Balance the following equations



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2. Perform each unit conversion. Be sure to use complete and extended units:

- a) convert 80.4 g of  $\text{CO}_2$  to number of molecules of  $\text{CO}_2$

$$80.4 \text{ g } \text{CO}_2 \times \frac{1 \text{ mol } \text{CO}_2}{44.0 \text{ g } \text{CO}_2} \times \frac{6.022 \times 10^{23} \text{ molec } \text{CO}_2}{1 \text{ mol } \text{CO}_2} = 1.10 \times 10^{24} \text{ molec } \text{CO}_2$$

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- b) convert  $3.65 \times 10^{23}$  Cl atoms to the equivalent mass of  $\text{HSiCl}_3$

$$3.65 \times 10^{23} \text{ Cl atoms} \times \frac{1 \text{ mole } \text{HSiCl}_3}{3 \text{ atoms Cl}} \times \frac{1 \text{ mole } \text{HSiCl}_3}{6.022 \times 10^{23} \text{ molec } \text{HSiCl}_3} \times \frac{135.45 \text{ g } \text{HSiCl}_3}{1 \text{ mole } \text{HSiCl}_3} \\ = 27.4 \text{ g } \text{HSiCl}_3$$

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3. What mass of potassium phosphate is required to form 54.0 g of strontium phosphate?



? g

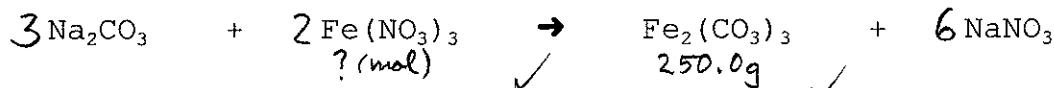
54.0 g

$$54.0 \text{ g } \text{Sr}_3(\text{PO}_4)_2 \times \frac{1 \text{ mol } \text{Sr}_3(\text{PO}_4)_2}{452.80 \text{ g } \text{Sr}_3(\text{PO}_4)_2} \times \frac{2 \text{ mol } \text{K}_3\text{PO}_4}{1 \text{ mol } \text{Sr}_3(\text{PO}_4)_2} \times \frac{212.27 \text{ g } \text{K}_3\text{PO}_4}{1 \text{ mol } \text{K}_3\text{PO}_4} \\ = 50.7 \text{ g } \text{K}_3\text{PO}_4$$

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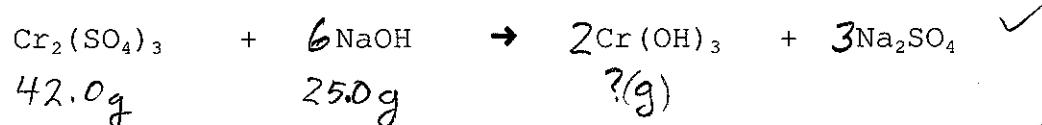
4. What amount of iron (III) nitrate is required to form 250.0 g of iron(III) carbonate ✓



$$250.0 \text{ g Fe}_2(\text{CO}_3)_3 \times \frac{1 \text{ mol Fe}_2(\text{CO}_3)_3}{291.73 \text{ g Fe}_2(\text{CO}_3)_3} \times \frac{2 \text{ mol Fe}(\text{NO}_3)_3}{1 \text{ mol Fe}_2(\text{CO}_3)_3} = 12.71 \text{ mol Fe}(\text{NO}_3)_3$$

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5. What is the maximum possible mass of chromium(III) hydroxide that can form from 42.0 g of chromium(VI) sulphate and 25.0 g of sodium hydroxide



Consider  $\text{Cr}_2(\text{SO}_4)_3$

$$42.0 \text{ g Cr}_2(\text{SO}_4)_3 \times \frac{1 \text{ mol Cr}_2(\text{SO}_4)_3}{392.21 \text{ g Cr}_2(\text{SO}_4)_3} \times \frac{2 \text{ mol Cr}(\text{OH})_3}{1 \text{ mol Cr}_2(\text{SO}_4)_3} \times \frac{103.03 \text{ g Cr}(\text{OH})_3}{1 \text{ mol Cr}(\text{OH})_3}$$

$$= 22.1 \text{ g Cr}(\text{OH})_3$$

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Consider NaOH

$$25.0 \text{ g NaOH} \times \frac{1 \text{ mol NaOH}}{40.00 \text{ g NaOH}} \times \frac{2 \text{ mol Cr}(\text{OH})_3}{6 \text{ mol NaOH}} \times \frac{103.03 \text{ g Cr}(\text{OH})_3}{1 \text{ mol Cr}(\text{OH})_3}$$

$$= 21.5 \text{ g Cr}(\text{OH})_3$$

∴ 21.5 g  $\text{Cr}(\text{OH})_3$  is the maximum possible mass of  $\text{Cr}(\text{OH})_3$ . / NaOH is the limiting reagent

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6. Determine the concentration of each of the following solutions:

a) 750 mL of a solution that contains 0.015 mol of HCl

$$n = 0.015 \text{ mol HCl}$$

$$C = \frac{n}{V} \quad \checkmark$$

$$C = ? \text{ (M)}$$

$$C = \frac{0.015 \text{ mol HCl}}{0.750 \text{ L}} \quad \checkmark$$

$$V = 750 \text{ mL} \rightarrow 0.750 \text{ L} \quad \checkmark$$

$$C = 0.02 \text{ M HCl} \quad \checkmark$$

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b) 650 mL of a solution that contains 0.045 g of HCl

$$n = 0.045 \text{ g HCl} \times \frac{1 \text{ mol HCl}}{36.46 \text{ g HCl}} = 0.00123 \text{ mol HCl} \quad \checkmark$$

$$C = ? \text{ (M)}$$

$$V = 650 \text{ mL} \rightarrow 0.650 \text{ L} \quad \checkmark$$

$$C = \frac{n}{V} \quad \checkmark$$

$$\rightarrow C = 0.00190 \text{ M HCl} \quad \checkmark$$

$$C = \frac{0.00123 \text{ mol HCl}}{0.650 \text{ L}} \quad \checkmark$$

c) 5.0 L of a solution of sulphuric acid made through the dilution of 55 mL of 12.0 M H<sub>2</sub>SO<sub>4</sub>

$$C_s = 12.0 \text{ M}$$

$$C_D = \frac{C_s V_s}{V_D} \quad \checkmark$$

$$V_s = 55 \text{ mL} \rightarrow 0.055 \text{ L} \quad \checkmark$$

$$C_D = ?$$

$$C_D = \frac{12.0 \text{ M} \times 0.055 \text{ L}}{5.0 \text{ L}}$$

$$V_D = 5.0 \text{ L}$$

$$C_D = 0.132 \text{ M} \quad \checkmark$$

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7. Determine the mass of  $\text{Na}_2\text{CO}_3$  required to make 2.0 L of 0.25 M sodium carbonate solution.

$$n = ?$$

$$n = CV \quad \checkmark$$

$$C = 0.25 \text{ M } \text{Na}_2\text{CO}_3$$

$$n = \frac{0.25 \text{ mol } \text{Na}_2\text{CO}_3}{1 \text{ L}} \times 2.0 \text{ L}$$

$$V = 2.0 \text{ L} \quad \checkmark$$

$$n = 0.50 \text{ mol } \text{Na}_2\text{CO}_3 \quad \checkmark$$

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$$0.50 \text{ mol } \text{Na}_2\text{CO}_3 \times \frac{105.99 \text{ g } \text{Na}_2\text{CO}_3}{1 \text{ mol } \text{Na}_2\text{CO}_3} = 53.0 \text{ g } \text{Na}_2\text{CO}_3 \quad \checkmark$$

8. Determine the concentration of solution that would result if 85.0 g of  $\text{NaHCO}_3$  is dissolved in 1.5 L of water. What will this concentration become if 8.0 L of water is added?

$$n = 85.0 \text{ g } \text{NaHCO}_3 \times \frac{1 \text{ mol } \text{NaHCO}_3}{84.01 \text{ g } \text{NaHCO}_3} = 1.01 \text{ mol } \text{NaHCO}_3$$

$$c = ?$$

$$V = 1.5 \text{ L} \quad \checkmark$$

$$C = \frac{n}{V} \rightarrow C = \frac{1.01 \text{ mol } \text{NaHCO}_3}{1.5 \text{ L}} \rightarrow C = 0.675 \text{ M } \text{NaHCO}_3$$

$$C_s = 0.675 \text{ M}$$

$$C_d = \frac{C_s V_s}{V_d} \quad \checkmark$$

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$$\checkmark V_s = 1.5 \text{ L} \quad \checkmark$$

$$C_d = ?$$

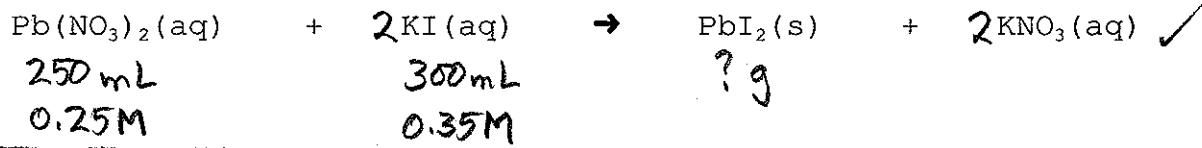
$$C_d = \frac{0.675 \text{ M} \times 1.5 \text{ L}}{9.5 \text{ L}}$$

$$V_d = 1.5 \text{ L} + 8.0 \text{ L} = 9.5 \text{ L}$$

$$C_d = 0.107 \text{ M } \text{NaHCO}_3 \quad \checkmark$$

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9. What is the maximum possible mass of lead(II) iodide precipitate that could form from the reaction of 250 mL of 0.25 M lead(II) nitrate mixed with 300 mL of 0.35 M potassium iodide?



Consider  $\text{Pb}(\text{NO}_3)_2 \quad n = ? \quad n = CV \quad \checkmark$

$C = 0.25\text{M} \quad / \quad n = 0.25\text{mol/L} \times 0.250\text{L}$

$V = 250\text{mL} \rightarrow 0.250\text{L} \quad n = 0.0625\text{ mol Pb}(\text{NO}_3)_3 \quad \checkmark$

$$0.0625 \text{ mol Pb}(\text{NO}_3)_3 \times \frac{1 \text{ mol PbI}_2}{1 \text{ mol Pb}(\text{NO}_3)_3} \times \frac{461.01 \text{ g PbI}_2}{1 \text{ mol PbI}_2} = 28.8 \text{ g PbI}_2 \quad \checkmark$$

Consider  $n = ? \quad n = CV$

$KI \quad C = 0.35\text{M} \quad / \quad n = 0.35\text{mol/L} \times 0.300\text{L}$

$V = 300\text{mL} \rightarrow 0.300\text{L} \quad n = 0.105\text{ mol KI} \quad \checkmark$

$$0.105 \text{ mol KI} \times \frac{1 \text{ mol PbI}_2}{2 \text{ mol KI}} \times \frac{461.01 \text{ g PbI}_2}{1 \text{ mol PbI}_2} = 24.2 \text{ g PbI}_2 \quad \checkmark$$

limiting  
reagent

maximum possible  
mass

BONUS: Determine the concentration of potassium ion in p.p.m. for 250 mL of solution that contains a mass of 0.0015 g of  $\text{K}_2\text{CO}_3$



$$\frac{0.0015 \text{ g K}_2\text{CO}_3}{250 \text{ mL}} \times \frac{1 \text{ mol K}_2\text{CO}_3}{138.21 \text{ g K}_2\text{CO}_3} \times \frac{2 \text{ mol K}^{+}}{1 \text{ mol K}_2\text{CO}_3} \times \frac{39.10 \text{ g K}^{+}}{1 \text{ mol K}^{+}}$$

$$\times \frac{1000 \text{ mg}}{1 \text{ g}} \times \frac{1000 \text{ mL}}{1 \text{ L}} = \frac{3.395 \text{ mg}}{1 \text{ L}} \Rightarrow 3.395 \text{ p.p.m.}$$

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