

06/05/24

Balance the following chemical reaction: $\text{C}_8\text{H}_{18}(\text{l}) + \text{O}_2(\text{g}) \rightarrow \text{CO}_2(\text{g}) + \text{H}_2\text{O}(\text{l})$



If you have 1.75 kg of C_8H_{18} , how many kg of oxygen gas do you need to react with all of the C_8H_{18} ? And how much CO_2 will form if that reaction occurs?

$$\underbrace{1.75 \text{ kg C}_8\text{H}_{18} \times \frac{1000 \text{ g}}{1 \text{ kg}} \times \frac{1 \text{ mole C}_8\text{H}_{18}}{114.2 \text{ g}}}_{15.3 \text{ mol C}_8\text{H}_{18}} \times \frac{12.5 \text{ mol O}_2}{1 \text{ mol C}_8\text{H}_{18}} \times \frac{32 \text{ g O}_2}{1 \text{ mol O}_2} \times \frac{1 \text{ kg}}{1000 \text{ g}} = 6.13 \text{ kg O}_2$$

$$15.3 \text{ mol C}_8\text{H}_{18} \times \frac{8 \text{ mol CO}_2}{1 \text{ mol C}_8\text{H}_{18}} \times \frac{44 \text{ g CO}_2}{1 \text{ mol}} = 5394 \text{ g or } 5.39 \text{ kg CO}_2$$

If you react 1.25 kg of C_8H_{18} with 575 grams of O_2 , how much water will be formed?

$$1250 \text{ g C}_8\text{H}_{18} \times \frac{1 \text{ mol}}{114 \text{ g}} = 10.96 \text{ mol}$$

$$575 \text{ g O}_2 \times \frac{1 \text{ mol}}{32 \text{ g}} = 17.97 \text{ mol} \leftarrow \text{limiting reactant}$$

$$17.97 \text{ mol O}_2 \times \frac{9 \text{ mol H}_2\text{O}}{12.5 \text{ mol O}_2} = 12.94 \text{ mol H}_2\text{O} \times \frac{18.02 \text{ g}}{1 \text{ mol}} = 233 \text{ g H}_2\text{O}$$

How much sodium nitrate do you need to make 750 mL of a 0.28 M sodium nitrate solution?

$$0.75 \text{ L} \times \frac{0.28 \text{ mol}}{\text{L}} = 0.21 \text{ mol NaNO}_3 \text{ needed}$$

$$0.21 \text{ mol NaNO}_3 \times \frac{85 \text{ g}}{1 \text{ mol}} = 17.9 \text{ g NaNO}_3$$

If you combine 352 grams of $\text{C}_6\text{H}_{12}\text{O}_6$ with enough water to make 1.50 L of solution, what is the molarity of this solution?

$$352 \text{ g sugar} \times \frac{1 \text{ mol}}{180.16 \text{ g}} = 1.95 \text{ mol}$$

$$\frac{1.95 \text{ mol}}{1.5 \text{ L}} \rightarrow 1.3 \text{ M sugar}$$

If you combine 79.5 grams of sodium oxalate with enough water to make 2.5 L of solution, what will be the concentration of the **sodium ion** in this solution?

$$79.5 \text{ g Na}_2\text{C}_2\text{O}_4 \times \frac{1 \text{ mol Na}_2\text{C}_2\text{O}_4}{134 \text{ g}} \times \frac{2 \text{ mol Na}^+}{1 \text{ mol Na}_2\text{C}_2\text{O}_4} = 1.19 \text{ mol Na}^+$$

$$\frac{1.19 \text{ mol}}{2.5 \text{ L}} \rightarrow [\text{Na}^+] = 0.475 \text{ M}$$

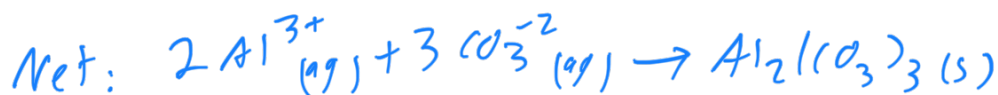
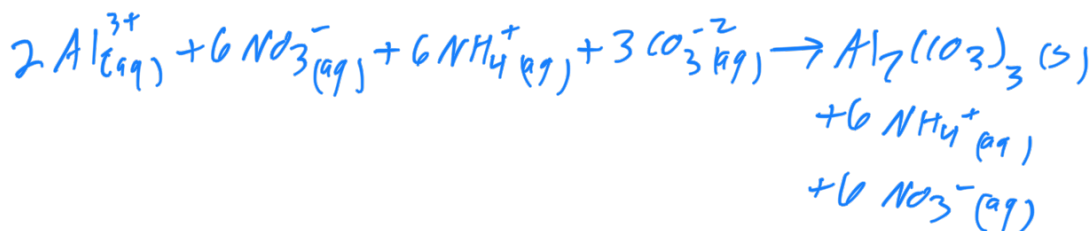
If you have 500 mL of a 0.45 M solution of magnesium nitrate, how do you make 250 mL of a 0.18 M magnesium nitrate solution?

$$0.25 \text{ L} \times \frac{0.18 \text{ mol}}{\text{L}} = 0.045 \text{ mol Mg(NO}_3)_2 \text{ needed}$$

Take 100 mL 0.45 M solution and add water to set total volume $\rightarrow$ 250 mL

You combine 350 mL of 0.25 M aluminum nitrate with 425 mL of 0.15 M ammonium carbonate.

a) Write the balanced total and net ionic equations for what happens



b) How many grams of precipitate form?

$$0.35\text{L} \times \frac{0.25\text{ mol Al}^{3+}}{\text{L}} = 0.0875\text{ mol Al}^{3+}$$

$$0.425\text{L} \times \frac{0.15\text{ mol CO}_3^{2-}}{\text{L}} = 0.06375\text{ mol CO}_3^{2-}$$

To react w/ all Al^{3+} requires $0.0875\text{ mol Al}^{3+} \times \frac{3\text{ mol CO}_3^{2-}}{2\text{ mol Al}^{3+}} = 0.13\text{ mol CO}_3^{2-}$
 Not enough CO_3^{2-} so CO_3^{2-} is limiting

$$0.06375\text{ mol CO}_3^{2-} \times \frac{1\text{ mol Al}_2(\text{CO}_3)_3}{3\text{ mol CO}_3^{2-}} \times \frac{234\text{ g Al}_2(\text{CO}_3)_3}{1\text{ mol}} = 4.97\text{ g Al}_2(\text{CO}_3)_3$$

c) What is the concentration of each ionic species in solution after the mixing occurs?

$$[\text{CO}_3^{2-}] = 0 \quad V_{\text{total}} = 0.775\text{L}$$

$$\text{moles NO}_3^{-} = 0.35\text{L} \times \frac{0.25\text{ mol Al(NO}_3)_3}{\text{L}} \times \frac{3\text{ mol NO}_3^{-}}{1\text{ mol Al(NO}_3)_3} = 0.2625$$

$$[\text{NO}_3^{-}] = \frac{0.2625\text{ mol}}{0.775\text{L}} = 0.339\text{M}$$

$$0.425\text{L (NH}_4)_2\text{CO}_3 \times \frac{0.15\text{ mol}}{\text{L}} \times \frac{2\text{ mol NH}_4^{+}}{1\text{ mol (NH}_4)_2\text{CO}_3} = 0.1275 \quad [\text{NH}_4^{+}] = \frac{0.1275\text{ mol}}{0.775\text{L}} = 0.165\text{M}$$

$$0.06375\text{ mol CO}_3^{2-} \times \frac{2\text{ mol Al}^{3+}}{3\text{ mol CO}_3^{2-}} = 0.0425\text{ mol Al}^{3+} \text{ in precip}$$

$$0.0875\text{ mol Al}^{3+} - 0.0425\text{ mol Al}^{3+} = 0.045\text{ mol Al}^{3+} \text{ in sol'n}$$

$$[\text{Al}^{3+}] = \frac{0.045\text{ mol}}{0.775\text{L}} = 0.058\text{M}$$