Worksheet for Basic Stoichiometry

Part 1 and 2 are from Unit 8.

Part 1: Mole ⟷ Mass Conversions

Convert the following number of moles of chemical into its corresponding mass in grams.

1. 0.436 moles of ammonium chloride NH_4Cl

$\frac{1\text{ mole}}{0.436\text{ mole}} = \frac{53.46g}{x} = $ **23.3 g**

2. 2.360 moles of lead (II) oxide $Pb^{+2}O^{-2} = PbO$

$\frac{1\text{ mole}}{2.360\text{ mole}} = \frac{223.2g}{x} = $ **526.8g**

3. 0.031 moles of aluminium iodide $Al^{+3}I^{-1} \rightarrow AlI_3$

$\frac{1\text{ mole}}{0.031\text{ mole}} = \frac{407.68g}{x} = $ **12.6g**

4. 1.077 moles of magnesium phosphate $Mg^{+2}PO_4^{-3} \rightarrow Mg_3(PO_4)_2$

$\frac{1\text{ mole}}{1.077\text{ mole}} = \frac{262.87g}{x} = $ **283.1g**

5. 0.50 moles of calcium nitrate

$Ca^{+2}NO_3^{-1} \rightarrow Ca(NO_3)_2$ $\frac{1\text{ mole}}{0.50\text{ mole}} = \frac{164.1g}{x} = $ **82.1g**

Convert the following masses into their corresponding number of moles.

6. 23.5 g of sodium chloride NaCl

$\frac{58.45g}{23.5g} = \frac{1\text{ mole}}{x} = $ **0.402 moles**

7. 0.778 g of sodium cyanide NaCN

$\frac{49.02g}{0.778g} = \frac{1\text{ mole}}{x} = $ **0.0159 g moles**

8. 0.250 g of water H_2O

$\frac{18g}{0.250g} = \frac{1\text{ mole}}{x} = $ **0.0139 moles**

9. 169.45 g of calcium acetate $Ca(C_2H_3O_2)_2$

$\frac{158.12g}{169.45g} = \frac{1\text{ mole}}{x} = $ **1.072 moles**

10. 79.9 g of potassium permanganate $KMnO_4$

$\frac{149.038g}{79.9g} = \frac{1\text{ mole}}{x}$ **0.536 moles**

Part 2: Moles ⟷ Number of Particles Conversions

Convert the following number of moles into their corresponding number of particles.

11. 0.0455 moles of hydrochloric acid

1 mole = 6.02×10^{23} particles

$\frac{1\text{ mole}}{0.0455\text{ moles}} = \frac{6.02 \times 10^{23}\text{ particles}}{x}$ **2.74×10^{22} particles**

12. 1.2 moles of glucose ($C_6H_{12}O_6$)

$\frac{1\text{ mole}}{1.2\text{ moles}} = \frac{6.02 \times 10^{23}\text{ particles}}{x}$ **7.22×10^{23} particles**

13. 0.32 moles of sodium bicarbonate

$\frac{1\text{ mole}}{0.32\text{ moles}} = \frac{6.02 \times 10^{23}\text{ particles}}{x}$ **1.93×10^{23} particles**

Part 3 and on are from unit 9(this unit).

Part 3: Solve the following stoichiometry grams-grams problems:

1) The combustion of a sample of butane, C_4H_{10} (lighter fluid), produced 2.46 grams of water.

$$2\ C_4H_{10} + 13O_2 \text{ -------> } 8CO_2 + 10H_2O$$

(a) How many moles of water formed?

10 moles

(b) How many moles of butane burned?

2 moles

(c) How many grams of butane burned?

(58.04)2 = 116.08g

(d) How much oxygen was used up in moles?

13 moles

(e) How much oxygen was used up in grams?

32(13) = 416g

2) Using the following equation:

80g 142.07g

$$2\ NaOH + H_2SO_4 \rightarrow 2\ H_2O + Na_2SO_4$$

How many grams of sodium sulfate will be formed if you start with 200 grams of sodium hydroxide and you have an excess of sulfuric acid?

80g / 200g = 142.07g / x

355.18g

3) Using the following equation:

275.8g 219.9g

$$Pb(SO_4)_2 + 4\ LiNO_3 \rightarrow Pb(NO_3)_4 + 2\ Li_2SO_4$$

How many grams of lithium nitrate will be needed to make 250 grams of lithium sulfate, assuming that you have an adequate amount of lead (IV) sulfate to do the reaction?

219.9g / 250g = 275.8g / x

313.55g

4) Using the following equation:

159.86g 111.86g

$$Fe_2O_3 + 3\ H_2 \text{ ------------> } 2\ Fe + 3\ H_2O$$

Calculate how many grams of iron can be made from 16.5 grams of Fe_2O_3 by the following equation.

159.86g / 16.5g = 111.86g / x

11.5g

5) Using the following equation:

507.6g   811.75g

$2\ I_2 + KIO_3 + 6HCl \text{ --------> } 5ICl + KCl + 3H_2O$

Calculate how many grams of iodine are needed to prepare 28.6 grams of ICl by this reaction.

$\frac{811.75g}{28.6g} = \frac{507.6g}{x}$ 17.9g

6) Using the following equation:

425.54g

$5\ KNO_2 + 2\ KMnO_4 + 3\ H_2SO_4 \text{ ------> } 5\ KNO_3 + 2\ MnSO_4 + K_2SO4 + 3\ H_2O$

How many moles and how many grams of $KMnO_4$ are needed to carry out this reaction on 11.4 grams of KNO_2?

$\frac{11.4g}{425.54g} = 0.0268$ moles KNO_2 $\frac{5 mol\ KNO_2}{0.0268\ mol\ KNO_2} = \frac{2 mol\ KMnO_4}{x}$

1.69g $KMnO_4$ 0.0107 moles $KMnO_4$

7) Using the following equation:

68.04g

$4\ NH_3 + 5\ O_2 \text{ -----------> } 4\ NO + 6\ H_2O$

How many moles and how many grams of oxygen (O_2) are needed to react with 56.8 grams of ammonia by this reaction?

$\frac{56.8g}{68.04g} = 0.834$ moles NH_3 $\frac{4 mol\ NH_3}{0.834 mol\ NH_3} = \frac{5 mole\ O_2}{x}$ 1.04 mol O_2

33.28g O_2

8) Using the following equation:

197.904g

$NaIO_3 + 6\ HI \text{ ------------> } 3\ I_2 + NaI + 3\ H_2O$

Calculate the number of moles and the number of grams of iodine (I_2) that can be made this way from 16.4 grams of $NaIO_3$.

$\frac{16.4g}{197.904g} = 0.0829$ moles $NaIO_3$

$\frac{1\ mol\ NaIO_3}{0.0829\ mol\ NaIO_3} = \frac{3\ mol\ I_2}{x}$

0.249 mole I_2

63.1g I_2