Limiting Reactant Worksheet

1. Given the following reaction: (First, balance the reaction)

$$\_\_\_\ Al_2(SO_3)_3 + \_\_\_\ NaOH \longrightarrow \_\_\_\ Na_2SO_3 + \_\_\_\ Al(OH)_3$$

(a) Suppose 10 g of $Al_2(SO_3)_3$ reacts with 10 g of NaOH. Determine the limiting reactant.

(b) Determine the number of grams of $Al(OH)_3$ produced.

(c) Determine the number of moles of excess reactant left over in the reaction.

2. Given the following reaction:

$$CH_4 + 2\ H_2O \longrightarrow 4\ H_2 + CO_2$$

How many liters of hydrogen can be produced from the reaction between 80 g of methane and 16.3 g of water? Determine the limiting reactant first.

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Answers

1. Given the following reaction: (First, balance the reaction)

$$\_\_\_\ Al_2(SO_3)_3 + \underline{\ 6\ } NaOH \longrightarrow \underline{\ 3\ } Na_2SO_3 + \underline{\ 2\ } Al(OH)_3$$

(a) Suppose 10 g of $Al_2(SO_3)_3$ reacts with 10 g of NaOH. Determine the limiting reactant.

$$10\ g\ Al_2(SO_3)_3 \times \frac{1\ mol\ Al_2(SO_3)_3}{294.15\ g\ Al_2(SO_3)_3} \times \frac{3\ mol\ Na_2SO_3}{1\ mol\ Al_2(SO_3)_3} \times \frac{126\ g\ Na_2SO_3}{1\ mol\ Na_2SO_3} = 12.9\ g\ Na_2SO_3$$

$$10\ g\ NaOH \times \frac{1\ mol\ NaOH}{40\ g\ NaOH} \times \frac{3\ mol\ Na_2SO_3}{6\ mol\ NaOH} \times \frac{126\ g\ Na_2SO_3}{1\ mol\ Na_2SO_3} = 15.8\ g\ Na_2SO_3$$

$Al_2(SO_3)_3$ produces less amount of Na_2SO_3 than NaOH does. $Al_2(SO_3)_3$ is the limiting reagent.

(b) Determine the number of grams of $Al(OH)_3$ produced.

$$10\ g\ Al_2(SO_3)_3 \times \frac{1\ mol\ Al_2(SO_3)_3}{294.15\ g\ Al_2(SO_3)_3} \times \frac{2\ mol\ Al(OH)_3}{1\ mol\ Al_2(SO_3)_3} \times \frac{78\ g\ Al(OH)_3}{1\ mol\ Al(OH)_3} = 5.3\ g\ Al(OH)_3$$

(c) Determine the number of moles of excess reactant left over in the reaction.

$$10\ g\ Al_2(SO_3)_3 \times \frac{1\ mol\ Al_2(SO_3)_3}{294.15\ g\ Al_2(SO_3)_3} \times \frac{6\ mol\ NaOH}{1\ mol\ Al_2(SO_3)_3} \times \frac{40\ g\ NaOH}{1\ mol\ NaOH} = 8.16\ g\ of\ NaOH\ used$$

10 g NaOH − 8.16 g NaOH = 1.894 g of NaOH left

2. Given the following reaction:

$$CH_4 + 2\ H_2O \longrightarrow 4\ H_2 + CO_2$$

How many liters of hydrogen can be produced from the reaction between 80 g of methane and 16.3 g of water? Determine the limiting reactant first.

$$80\ g\ CH_4 \times \frac{1\ mol\ CH_4}{16\ g\ CH_4} \times \frac{2\ mol\ H_2O}{1\ mol\ CH_4} \times \frac{18\ g\ H_2O}{1\ mol\ H_2O} = 180\ g\ H_2O$$

$$16.3\ g\ H_2O \times \frac{1\ mol\ H_2O}{18\ g\ H_2O} \times \frac{1\ mol\ CH_4}{2\ mol\ H_2O} \times \frac{16\ g\ CH_4}{1\ mol\ CH_4} = 72.5\ g\ CH_4$$

H_2O is the limiting reactant.

$$16.3\ g\ H_2O \times \frac{1\ mol\ H_2O}{18\ g\ H_2O} \times \frac{4\ mol\ H_2}{2\ mol\ H_2O} \times \frac{22.4\ L\ H_2}{1\ mol\ H_2} = 40.5\ L\ H_2$$