Name : _____ Date : _____

Limiting Reactant Worksheet

1. Balance the following reaction:

$$\_\_ NaCl + \_\_ Ba_3(PO_4)_2 \longrightarrow \_\_ Na_3PO_4 + \_\_ BaCl_2$$

   a. Suppose 100 grams of sodium chloride reacts with 200 g of barium phosphate. What is the limiting reactant?

   b. How many grams of excess reactant are left?

2. Acrylonitrile (C_3H_3N) is the starting material for the production of a kind of synthetic fiber acrylic. It can be made from propylene (C_3H_6) by reacting with nitric oxide (NO) as follows:

$$4\ C_3H_6\ (g) + 6\ NO\ (g) \longrightarrow 4\ C_3H_3N\ (s) + 6\ H_2O\ (l) + N_2\ (g)$$

   What mass of C_3H_3N can be made when 21.6 g of propylene react with 21.6 g of nitric oxide?

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Limiting Reactant Worksheet

Answers

1 Balance the following reaction:

$$\underline{6}\ NaCl + \underline{\ \ }\ Ba_3(PO_4)_2 \longrightarrow \underline{2}\ Na_3PO_4 + \underline{3}\ BaCl_2$$

a Suppose 100 grams of sodium chloride reacts with 200 g of barium phosphate. What is the limiting reactant?

$$100\ g\ NaCl \times \frac{1\ mol\ NaCl}{58.443\ g\ NaCl} \times \frac{3\ mol\ BaCl_2}{6\ mol\ NaCl} \times \frac{208.236\ g\ BaCl_2}{1\ mol\ BaCl_2} = 178.1\ g\ BaCl_2$$

$$200\ g\ Ba_3(PO_4)_2 \times \frac{1\ mol\ Ba_3(PO_4)_2}{601.938\ g\ Ba_3(PO_4)_2} \times \frac{3\ mol\ BaCl_2}{1\ mol\ Ba_3(PO_4)_2} \times \frac{208.236\ g\ BaCl_2}{1\ mol\ BaCl_2} = 207.5\ g\ BaCl_2$$

NaCl is the limiting reactant.

b How many grams of excess reactant are left?

$$100\ g\ NaCl \times \frac{1\ mol\ NaCl}{58.443\ g\ NaCl} \times \frac{1\ mol\ Ba_3(PO_4)_2}{6\ mol\ NaCl} \times \frac{601.938\ g\ Ba_3(PO_4)_2}{1\ mol\ Ba_3(PO_4)_2} = 171.7\ g\ Ba_3(PO_4)_2\ used$$

$$200\ g\ Ba_3(PO_4)_2 - 171.7\ g\ Ba_3(PO_4)_2 = 28.3\ g\ Ba_3(PO_4)_2\ remain$$

2 Acrylonitrile (C_3H_3N) is the starting material for the production of a kind of synthetic fiber acrylic. It can be made from propylene (C_3H_6) by reacting with nitric oxide (NO) as follows:

$$4\ C_3H_6\ (g) + 6\ NO\ (g) \longrightarrow 4\ C_3H_3N\ (s) + 6\ H_2O\ (l) + N_2\ (g)$$

What mass of C_3H_3N can be made when 21.6 g of propylene react with 21.6 g of nitric oxide?

$$21.6\ g\ C_3H_6 \times \frac{1\ mol\ C_3H_6}{42.09\ g\ C_3H_6} \times \frac{4\ mol\ C_3H_3N}{4\ mol\ C_3H_6} \times \frac{53.07\ g\ C_3H_3N}{1\ mol\ C_3H_3N} = 27.2\ g\ C_3H_3N$$

$$21.6\ g\ NO \times \frac{1\ mol\ NO}{30.01\ g\ NO} \times \frac{4\ mol\ C_3H_3N}{6\ mol\ NO} \times \frac{53.07\ g\ C_3H_3N}{1\ mol\ C_3H_3N} = 25.5\ g\ C_3H_3N$$

The answer is the one with the smallest amount of the product. Hence, 25.5 g of C_3H_3N is produced.