STOICHIOMETRY Worksheet

1. Hydrogen is generated by passing pot steam over iron, which oxidizes to form Fe_3O_4, in the following equation.

$$3\ Fe\ (s) + 4\ H_2O\ (l) \rightarrow 4\ H_2\ (g) + Fe_3O_4\ (s)$$

a. If 625 g of Fe_3O_4 is produced in the reaction, how many moles of hydrogen are produced simultaneously?

b. How many moles of iron would be needed to generate 27 g of H_2?

2. Calculate the mass of silver bromide produced from 22.5 g of silver nitrate in the following reaction:

$$2\ AgNO_3\ (aq) + MgBr_2\ (aq) \rightarrow 2\ AgBr\ (s) + Mg(NO_3)_2\ (aq)$$

3. What mass of acetylene, C_2H_2, can be produced from the reaction of 90 g of calcium carbide, CaC_2, with water in the following reaction?

$$CaC_2\ (s) + 2\ H_2O\ (l) \rightarrow C_2H_2\ (g) + Ca(OH)_2\ (s)$$

4. Chlorine gas can be produced in the laboratory by adding concentrated hydrochloric acid to manganese (IV) oxide in the following reaction:

$$MnO_2\ (s) + 4\ HCl\ (aq) \rightarrow MnCl_2\ (aq) + 2\ H_2O\ (l) + Cl_2\ (g)$$

a. Calculate the mass of MnO_2 needed to produce 25 g of Cl_2.

b. What mass of $MnCl_2$ is produced when 0.091 g of Cl_2 is generated?

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Answers

1. Hydrogen is generated by passing pot steam over iron, which oxidizes to form Fe_3O_4, in the following equation.

$$3\ Fe\ (s) + 4\ H_2O\ (l) \rightarrow 4\ H_2\ (g) + Fe_3O_4\ (s)$$

a. If 625 g of Fe_3O_4 is produced in the reaction, how many moles of hydrogen are produced simultaneously?

625 g Fe_3O_4 x (1 mol Fe_3O_4/232 g Fe_3O_4) x (4 mol H2/1 mol Fe_3O_4) = 10.8 mol H_2

b. How many moles of iron would be needed to generate 27 g of H_2?

27 g H_2 x (1 mol H_2/2 g H_2) x (3 mol Fe/4 mol H_2) = 10.1 mol Fe

2. Calculate the mass of silver bromide produced from 22.5 g of silver nitrate in the following reaction:

$$2\ AgNO_3\ (aq) + MgBr_2\ (aq) \rightarrow 2\ AgBr\ (s) + Mg(NO_3)_2\ (aq)$$

22 g $AgNO_3$ x (1 mol $AgNO_3$/170 g $AgNO_3$) x (2 mol AgBr/2 mol $AgNO_3$) x (188 g AgBr/1 mol AgBr) = 24.3 g

3. What mass of acetylene, C_2H_2, can be produced from the reaction of 90 g of calcium carbide, CaC_2, with water in the following reaction?

$$CaC_2\ (s) + 2\ H_2O\ (l) \rightarrow C_2H_2\ (g) + Ca(OH)_2\ (s)$$

90 g CaC_2 x (1 mol CaC_2/64 g CaC_2) x (1 mol C_2H_2/1 mol CaC_2) x (26 g C_2H_2/1 mol C_2H_2) = 36.6 g C_2H_2

4. Chlorine gas can be produced in the laboratory by adding concentrated hydrochloric acid to manganese (IV) oxide in the following reaction:

$$MnO_2\ (s) + 4\ HCl\ (aq) \rightarrow MnCl_2\ (aq) + 2\ H_2O\ (l) + Cl_2\ (g)$$

a. Calculate the mass of MnO_2 needed to produce 25 g of Cl_2.

25 g Cl_2 x (1 mol Cl_2/71 g Cl_2) x (1 mol MnO_2/ 1 mol Cl_2) x (87 g MnO_2/ 1 mol MnO_2) = 30.6 g MnO_2

b. What mass of $MnCl_2$ is produced when 0.091 g of Cl_2 is generated?

0.091 g Cl_2 x (1 mol Cl_2/71 g Cl_2) x (1 mol $MnCl_2$/1 mol Cl_2) x 125.84 g $MnCl_2$/1 mol $MnCl_2$) = 0.161 g $MnCl_2$