Problems of Stoichiometry of chemical reactions

1) In a receptacle we have 32 g of hydrochloric acid that react with an excess of sodium hydroxide according the following equation:

$HCl + NaOH \rightarrow NaCl + H_2O$

Calculate:

a) Mass of water obtained.

b) How many moles of sodium chloride are obtained?

2) In a receptacle we have 40 g of sulfuric acid that react with an excess of sodium hydroxide according the following equation:

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

Find out:

a) Mass of water obtained.

b) How many moles of sodium sulfate are obtained?

3) In a receptacle we have 460 g of phosphoric acid that react with an excess of aluminium according the following equation:

$2H_3PO_4 + 2Al \rightarrow 2AlPO_4 + 3H_2$

Determine:

a) Mass of aluminium phosphate formed.

b) How many moles of hydrogen are obtained?

4) In a flask we have 2.6 mol of ethene that react with an excess of oxygen according the following equation:

$C_2H_4 + O_2 \rightarrow CO_2 + H_2O$ (not balanced)

Find out:

a) Mass of water obtained.

b) How many moles of carbon dioxide are formed?

5) In a flask we have 3.4 mol of sulfuric acid that react with an excess of aluminium according the following equation:

$H_2SO_4 + Al \rightarrow Al_2(SO_4)_3 + H_2$ (not balanced)

Find out:

a) The volume obtained of hydrogen gas at a temperature of 18 °C and a pressure of 1 atm.

b) Mass of aluminium sulfate formed.

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6) In a flask we have 7.6 mol of sodium hydroxide that react with a solution 1.3 mol/L in sulfuric acid according the following equation:

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

Determine:

a) Volume needed of sulfuric acid solution.

b) Mass of sodium sulfate formed.

7) We want obtain 94.05 g of ammonia. For that, we react nitrogen gas at a temperature of 0 °C and a pressure of 1 atm with an excess of hydrogen according the following equation:

$N_2 + 3H_2 \rightarrow 2NH_3$

Determine:

a) Volume required of nitrogen gas at a temperature of 0 °C and a pressure of 1 atm.

b) How many moles of ammonia are obtained?

8) In a balloon flask we have 162.7 L of hydrogen gas at a temperature of 0 °C and a pressure of 1 atm that react with an excess of nitrogen according the following equation:

$3H_2 + N_2 \rightarrow 2NH_3$

Determine:

a) The volume obtained of ammonia gas at a temperature of 0 °C and a pressure of 1 atm.

b) Mass of ammonia formed.

9) In a flask we have 136 L of ammonia gas at a temperature of 0 °C and a pressure of 1 atm that react with a solution 2.3 mol/L in hydrochloric acid according the following equation:

$HCl + NH_3 \rightarrow NH_4Cl$

Find out:

a) Volume needed of hydrochloric acid solution.

b) Mass of ammonium chloride formed.

10) In a flask we have 3236 mL of solution 1.3 mol/L in nitric acid that react with an excess of potassium hydroxide according the following equation:

$HNO_3 + KOH \rightarrow KNO_3 + H_2O$

Determine:

a) Mass of water formed.

b) How many moles of potassium nitrate are obtained?

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11) In a flask we have 303.3 mL of solution 2.8 mol/L in hydrochloric acid that react with an excess of aluminium according the following equation:

$HCl + Al \rightarrow AlCl_3 + H_2$ (not balanced)

Find out:

a) The volume obtained of hydrogen gas at a temperature of 0 °C and a pressure of 1 atm.

b) Mass of aluminium chloride formed.

12) In a balloon flask we have 427.4 mL of solution 1.3 mol/L in potassium hydroxide that react with a solution 2.3 mol/L in nitric acid according the following equation:

$HNO_3 + KOH \rightarrow KNO_3 + H_2O$

Find out:

a) Volume needed of nitric acid solution.

b) Mass of water obtained.

13) In a receptacle we have 51 g of hydrochloric acid that react with an excess of zinc according the following equation:

$HCl + Zn \rightarrow ZnCl_2 + H_2$ (not balanced)

Determine:

a) Mass of zinc chloride obtained.

b) How many moles of hydrogen are obtained?

14) In a receptacle we have 12 g of hydrochloric acid that react with an excess of zinc according the following equation:

$HCl + Zn \rightarrow ZnCl_2 + H_2$ (not balanced)

Find out:

a) The volume obtained of hydrogen gas at a temperature of 0 °C and a pressure of 1 atm.

b) Mass of zinc chloride formed.

15) 71 g of $Pb_3(PO_4)_4$ react with FeI_2. Calculate:

a) The balanced chemical equation.

b) Mass and moles required of FeI_2.

c) Mass and moles of $Fe_3(PO_4)_2$ obtained.

16) 73 g of H_2S react with CaI_2. Calculate:

a) The balanced chemical equation.

b) Mass and moles required of CaI_2.

c) Mass and moles of CaS obtained.

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17) 28 g of $Fe_2(SO_4)_3$ react with H_2CO_3. Determine:

a) The balanced chemical equation.

b) Mass and moles required of H_2CO_3.

c) Mass and moles of H_2SO_4 obtained.

Answers:

1) **a)** 15.78 g, **b)** 0.8767 mol.

2) **a)** 14.69 g, **b)** 0.4082 mol.

3) **a)** 572.7 g, **b)** 7.041 mol.

4) **a)** 93.6 g, **b)** 5.2 mol.

5) **a)** 81.23 L, **b)** 387.6 g.

6) **a)** 2923 mL, **b)** 539.6 g.

7) **a)** 62 L, **b)** 5.532 mol.

8) **a)** 108.5 L, **b)** 82.27 g.

9) **a)** 2638 mL, **b)** 324.6 g.

10) **a)** 75.71 g, **b)** 4.206 mol.

11) **a)** 9.518 L, **b)** 37.79 g.

12) **a)** 241.5 mL, **b)** 10 g.

13) **a)** 95.27 g, **b)** 0.6986 mol.

14) **a)** 3.684 L, **b)** 22.42 g.

15) **a)** $Pb_3(PO_4)_4 + 6FeI_2 \rightarrow 3PbI_4 + 2Fe_3(PO_4)_2$

b) 131.68 g, 0.4253 mol, **c)** 50.67 g, 0.1418 mol.

16) **a)** $H_2S + CaI_2 \rightarrow 2HI + CaS$

b) 631.02 g, 2.147 mol, **c)** 154.8 g, 2.147 mol.

17) **a)** $Fe_2(SO_4)_3 + 3H_2CO_3 \rightarrow Fe_2(CO_3)_3 + 3H_2SO_4$

b) 13.03 g, 0.2102 mol, **c)** 20.6 g, 0.2102 mol.