KEY

Percentage Yield

Name - _____

1.) The roasting of siderite ore, $FeCO_3$, produces iron (III) oxide in the reaction below.

$$4\ FeCO_3 + O_2 \rightarrow 2\ Fe_2O_3 + 4\ CO_2$$

A $35.0\ g$ sample of siderite ore produces $22.5\ g$ of Fe_2O_3. What is the percentage yield of the reaction?

Answer - $35.0\ g\ FeCO_3 \times \frac{1\ mol\ FeCO_3}{115.86\ g\ FeCO_3} \times \frac{2\ mol\ Fe_2O_3}{4\ mol\ FeCO_3} \times \frac{159.7\ g\ Fe_2O_3}{1\ mol\ Fe_2O_3} = 24.1\ g\ Fe_2O_3$

$$percent\ yield = \frac{mass\ of\ product\ obtained}{mass\ of\ product\ expected} \times 100\% \quad percent\ yield = \frac{22.5}{24.1} \times 100\% = 93.4\%$$

2.) The reaction $SiO_2 + 4\ HF \rightarrow SiF_4 + 2\ H_2O$ produces $2.50\ g$ of H_2O when $12.20\ g$ of SiO_2 is treated with an excess of HF.

a.) What mass of SiF_4 is formed?

Answer - $2.50\ g\ H_2O \times \frac{1\ mol\ H_2O}{18.02\ g\ H_2O} \times \frac{1\ mol\ SiF_4}{2\ mol\ H_2O} \times \frac{104.09\ g\ SiF_4}{1\ mol\ SiF_4} = 7.22\ g\ SiF_4$

b.) What mass of SiO_2 is left unreacted?

Answer - $2.50\ g\ H_2O \times \frac{1\ mol\ H_2O}{18.02\ g\ H_2O} \times \frac{1\ mol\ SiO_2}{2\ mol\ H_2O} \times \frac{60.09\ g\ SiO_2}{1\ mol\ SiO_2} = 4.17\ g\ SiO_2$

$$12.20 - 4.17 = 8.03\ g\ SiO_2\ excess$$

c.) What is the percentage yield of SiF_4?

Answer - $12.20\ g\ SiO_2 \times \frac{1\ mol\ SiO_2}{60.09\ g\ SiO_2} \times \frac{1\ mol\ SiF_4}{1\ mol\ SiO_2} \times \frac{104.09\ g\ SiF_4}{1\ mol\ SiF_4} = 21.1\ g\ SiF_4$

$$percent\ yield = \frac{mass\ of\ product\ obtained}{mass\ of\ product\ expected} \times 100\% \quad percent\ yield = \frac{7.22}{21.1} \times 100\% = 34.2\%$$

KEY

3.) When $5.00\ kg$ of malachite ore containing 4.30% of malachite, $Cu_2(OH)_2CO_3$, is heated, the product is copper (II) oxide. $Cu_2(OH)_2CO_3 \rightarrow CO_2 + 2\ CuO + H_2O$

If the reaction has an 84.0% yield, how many grams of CuO are produced?

Answer - $215\ g\ Cu_2(OH)_2CO_3 \times \frac{1\ mol\ Cu_2(OH)_2CO_3}{221.13\ g\ Cu_2(OH)_2CO_3} \times \frac{2\ mol\ CuO}{1\ mol\ Cu_2(OH)_2CO_3} \times \frac{79.55\ g\ CuO}{1\ mol\ CuO} = 154.69\ g\ CuO$

$$percent\ yield = \frac{mass\ of\ product\ obtained}{mass\ of\ product\ expected} \times 100\% \quad 84.0\% = \frac{mass\ of\ product\ obtained}{154.69} \times 100\%$$

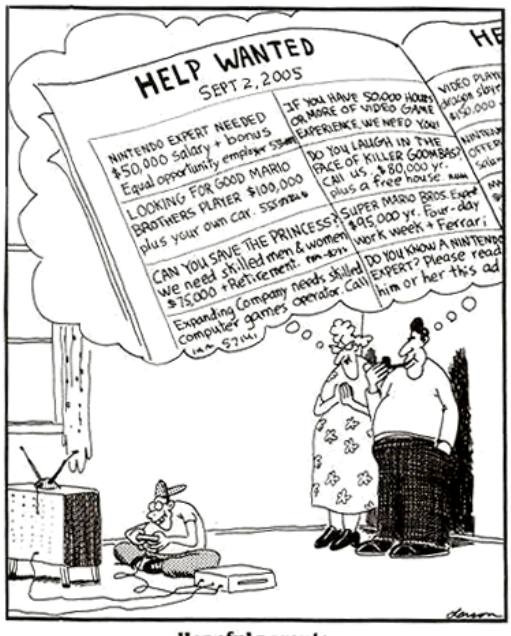
$$mass\ of\ product\ obtained = 130.\ g$$

4.) A mine produces a silver ore named argentite, Ag_2S. The ore is smelted according to the overall reaction $Ag_2S + C + 2\ O_2 \rightarrow 2\ Ag + CO_2 + SO_2$

A sample of pure Ag_2S has a mass of $152.6\ g$. When smelted, the sample produces $117.4\ g$ of pure silver. What is the percentage yield of the smelting process?

Answer - $152.6\ g\ Ag_2S \times \frac{1\ mol\ Ag_2S}{247.8\ g\ Ag_2S} \times \frac{2\ mol\ Ag}{1\ mol\ Ag_2S} \times \frac{107.87\ g\ Ag}{1\ mol\ Ag} = 132.856\ g\ Ag$

$$percent\ yield = \frac{mass\ of\ product\ obtained}{mass\ of\ product\ expected} \times 100\% \quad percent\ yield = \frac{117.4}{132.856} \times 100\% = 88.37\%$$



Hopeful parents

Answers - 1.) 93.4% 2a.) 7.22 g SiF_4 b.) 8.03 g SiO_2 c.) 34.3% 3.) 130. g CuO 4.) 88.37%