



**Stage 3 - Set 5 Answers: Percentage composition and yield**

1. a)  $M(\text{Fe}_2\text{O}_3) = 159.7 \text{ g mol}^{-1}$   
 $\% \text{Fe} : \frac{111.7}{159.7} \times 100$   
 $= 69.9\%$

b)  $\% \text{Heamatite} : \frac{65.0}{69.9} \times 100$   
 $= 92.9\%$

2.  $\text{Zn} + 2\text{H}^+ \rightarrow \text{Zn}^{2+} + \text{H}_2$   
 $m(\text{remaining}) = m(\text{Cu})$   
 $= 0.630 \text{ g}$   
 $m(\text{Zn}) = 2.71 - 0.630$   
 $= 2.08 \text{ g}$   
 $\% \text{Zn} : \frac{2.08}{2.71} \times 100$   
 $= 76.8\%$

3. a)  $n(\text{Br}_2) = \frac{125}{79.9 \times 2}$   
 $= 0.782 \text{ mol}$

$$n(\text{C}_6\text{H}_6) = \frac{60.0}{78.108}$$

$$= 0.768 \text{ mol}$$

1 mol of  $\text{Br}_2$  requires 1 mol of  $\text{C}_6\text{H}_6$   
 0.782 mol of  $\text{Br}_2$  requires 0.782 mol of  $\text{C}_6\text{H}_6$

$n(\text{C}_6\text{H}_6 \text{ required}) > n(\text{C}_6\text{H}_6 \text{ available})$

$\text{C}_6\text{H}_6$  is LR

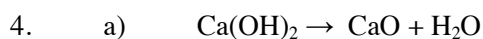
$$n(\text{C}_6\text{H}_5\text{Br}) = n(\text{C}_6\text{H}_6)$$

$$= 0.768 \text{ mol}$$

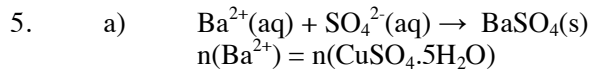
$$m(\text{C}_6\text{H}_5\text{Br}) = 0.768 \times 157$$

$$= 121 \text{ g}$$

b)  $\% \text{yield} : \frac{93.2}{121} \times 100$   
 $= 77.3\%$



b)  $\% \text{CaO} : \frac{4.33}{5.67} \times 100$   
 $= 76.4\%$



b) 
$$n(\text{CuSO}_4 \cdot 5\text{H}_2\text{O}) = \frac{1.11}{249.69}$$

$$= 4.45 \times 10^{-3} \text{ mol}$$

$$= n(\text{BaCl}_2)$$

$$m(\text{BaCl}_2) = (4.45 \times 10^{-3}) \times (137.3 + 70.9)$$

$$= 0.926 \text{ g}$$

c) 
$$n(\text{CuCl}_2 \cdot 2\text{H}_2\text{O}) = n(\text{BaCl}_2 \text{ used})$$

$$= 4.45 \times 10^{-3} \text{ mol}$$

$$m(\text{CuCl}_2 \cdot 2\text{H}_2\text{O}) = (4.45 \times 10^{-3}) \times 170.482$$

$$= 0.758 \text{ g}$$

$$\% \text{ yield} = \frac{0.345}{0.758} \times 100$$

$$= 45.5 \%$$

6. 
$$n(\text{Na}_2\text{S}_2\text{O}_7) = \frac{1}{2} n(\text{S})$$

$$n(\text{S}) = \frac{17500}{32.06}$$

$$= 5.46 \times 10^2 \text{ mol}$$

$$n(\text{Na}_2\text{S}_2\text{O}_7) = \frac{1}{2} (5.46 \times 10^2)$$

$$= 2.73 \times 10^2 \text{ mol}$$

$$m(\text{Na}_2\text{S}_2\text{O}_7) = (2.73 \times 10^2) \times (45.98 + 64.12 + 112)$$

$$= 6.06 \times 10^4 \text{ g}$$

$$\% \text{ yield} = \frac{50000}{60617} \times 100$$

$$= 82.5 \%$$

7. let  $x = m(\text{NaHCO}_3)$   
 $y = m(\text{Na}_2\text{CO}_3)$

$$x + y = 100$$

$$y = 100 - x$$

$$n(\text{Na}_2\text{CO}_3) = \frac{90.7}{106}$$

$$= 0.856 \text{ mol}$$

$$n(\text{Na}_2\text{CO}_3 \text{ total}) = \frac{1}{2} n(\text{NaHCO}_3 \text{ initial}) + n(\text{Na}_2\text{CO}_3 \text{ initial})$$

$$= \left(\frac{1}{2} \times \frac{x}{84.01}\right) + \frac{y}{100}$$

$$0.856 = \frac{x}{168} + \frac{100 - x}{100}$$

$$62x = 1556.352$$

$$x = 25.1 \text{ g}$$

$$y = 74.9 \text{ g}$$

$$\% \text{ Na}_2\text{CO}_3 = \frac{74.9}{100} \times 100$$

$$= 74.9 \%$$