

1. a

2. d

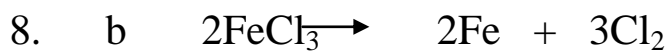
3. a

4. c

5. a

6. a

7. a (Cu is reduced eg: gains 2 electrons  $\text{Cu}^{2+}$  and becomes Cu(s),  $\text{H}_2$  each atom loses an electron)

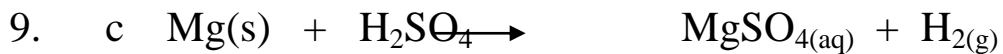


$$3.85 \text{ g} = 0.024 \text{ moles}$$

$$\text{Ratio FeCl}_3 : \text{Cl}_2 = 3 : 2$$

$$n(\text{Cl}_2) = \frac{3}{2} \times 0.024$$

$$= 0.036$$



10. c

Short answer:

$$\begin{aligned} 11. \quad 5000 \text{ g of ore} &= 0.9 \times 5000 \text{ g of magnetite} \\ &= 4500 \text{ g} \end{aligned}$$

$$4500 \text{ g Fe}_3\text{O}_4 = \frac{4500}{231.55} = 19.434 \text{ moles}$$

$$19.434 \text{ moles Fe}_3\text{O}_4 \text{ gives } 3 \times 19.434 \text{ moles Fe} = 3256 \text{ g}$$



a)  $2.5 \text{ g Cu} = 0.0393 \text{ moles}$

$$\begin{aligned} \text{mass of copper nitrate} &= 0.0393 \times (63.55 + (2 \times 14.01) + (6 \\ &\times 16)) \\ &= 7.378 \text{ g} \end{aligned}$$

b) If 0.0393 mole Cu reacts then  $\frac{0.0393}{3} \times 2$  moles NO form  
 $= 0.0262 \text{ mol}$

$$\begin{aligned} \text{mass} &= n \times M_r \\ &= 0.786 \text{ g} \end{aligned}$$

c) Cu is oxidised to  $\text{Cu}^{2+}$ , so something else must be reduced. Nitrogen is reduced by gaining 3 electrons to go from  $\text{NO}_3^-$  to NO.

13. a) The general trend is for increasing ionisation energy as the atomic radius decreases and the outer electron is held more tightly by the increasing nuclear charge. More energy is needed to remove tightly held electrons.

b) The general trend is for decreasing ionisation energy as the outer electron is shielded from the nucleus by one extra complete electron shell as you descend the group and so it is held less tightly.

14. a)  $\text{Al} > \text{Fe} > \text{Cu}$

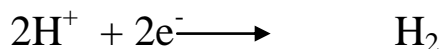
Al must be most reactive as the energy required is so high that only electricity will achieve extraction.

Fe is extracted by chemical means.

Cu can be extracted by less extreme chemical means.

b) The conditions for extraction of Cu were to be found in early kilns and fires. The conditions necessary for Al were not available until electricity was available in mass production.

c) Aluminium metal is more expensive than iron as aluminium is more expensive to extract from the mineral. Aluminium is extracted by electrolysis, which requires large amounts of electricity, and this is very costly. Iron is extracted by heating in a furnace, which does not require as much power. The equipment required for the aluminium extraction is also more complicated and expensive.



16. a) Determine moles of each:

$$n(\text{C}) = 85.7/12 = 7.14$$

$$n(\text{H}) = 14.3/1.008 = 14.2$$

$$\text{Ratio} = 1:2$$

$$\text{Empirical formula} = \text{CH}_2$$

b) Empirical formula mass = 14

$$\text{Molecular mass} = 84$$

$$\frac{\text{Molecular formula mass}}{\text{Empirical formula mass}} = \frac{\text{molecular formula}}{\text{empirical formula}}$$

$$\frac{84}{14} = \frac{\text{molecular formula}}{\text{CH}_2}$$

$$6 \times \text{CH}_2 = \text{molecular formula}$$

