



1 a Give the electron structure of the Group 1 elements sodium and potassium.

sodium **2,8,1** potassium **2,8,8,1**

b Explain why sodium and potassium are both in Group 1 of the Periodic Table.

they both have one electron in their outer shell

c Explain why sodium and potassium have similar properties.

they both have one electron / the same number of electrons in their outer shell

d Write word and balanced equations for the reaction of potassium with water.

word equation **sodium + water → sodium hydroxide + hydrogen**

balanced equation **2Na + 2H₂O → 2NaOH + H₂**

e Describe what you see when potassium reacts with water.

**potassium melts
moves on surface of water
bubbles of gas / fizzing
burns with lilac / purple flame**

f Explain why potassium is more reactive than sodium.

**K loses outer shell electron more easily
because it is further from nucleus
therefore weaker attraction between nucleus and outer electron**

g Explain why Group 1 elements are called the alkali metals.

they all react with water to form metal hydroxides which are alkalis



1 Give the formula of the following ions.

aluminium Al^{3+} nitrate NO_3^- zinc(II) Zn^{2+}

2 Give the formula of the following ionic compounds.

calcium oxide CaO sodium bromide NaBr
aluminium sulfate $\text{Al}_2(\text{SO}_4)_3$ magnesium hydroxide $\text{Mg}(\text{OH})_2$

3 Water is a molecular substance with the molecular formula H_2O .

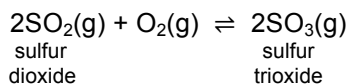
- a What type of bonds are there in water molecules? **covalent**
- b Water boils at 100°C . Explain why water has a low boiling point.
**weak forces between molecules
that only need a small amount of energy to overcome**
- c Explain why pure water does not conduct electricity.
**no charged particles that can move
so cannot carry charge through the substance**
- d Explain what the molecular formula H_2O means.
**2 H atoms and 1 O atom
in each molecule**

4 Sodium oxide is an ionic substance with the formula Na_2O .

- a What type of bonds are there in sodium oxide? **ionic**
- b Sodium oxide melts at 1132°C . Explain why sodium oxide has a high melting point.
**strong attraction between positive and negative ions
that takes a lot of energy to overcome**
- c Explain why sodium oxide conducts electricity when molten but not as a solid.
**when molten, ions can move to carry charge through the substance
but ions cannot move as solid**
- d Explain what the formula Na_2O means.
ratio of sodium ions : oxide ions = 2:1



Sulfur dioxide reacts with oxygen to form sulphur trioxide in a reaction that reaches a dynamic equilibrium in a closed system. The forward reaction is exothermic.



- 1 What happens to the equilibrium yield of sulphur trioxide (SO_3) if the temperature is increased? Explain your answer.

**equilibrium position moves left
in endothermic direction
to lower the temperature
less SO_3 formed**

- 2 What happens to the equilibrium yield of sulphur trioxide (SO_3) if the pressure is increased? Explain your answer.

**equilibrium position moves right
to side with fewer gas molecules
to lower the pressure
more SO_3 formed**

- 3 What happens to the equilibrium yield of sulphur trioxide (SO_3) if more oxygen (O_2) is added? Explain your answer.

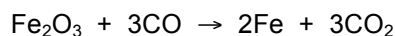
**equilibrium position moves right
to remove the added O_2
more SO_3 formed**

- 4 What happens to the equilibrium yield of sulphur trioxide (SO_3) if a catalyst is used? Explain your answer.

**catalyst speeds up both reactions by the same amount
equilibrium position does not move
no change to amount of SO_3 formed**



1 What mass of iron is formed when 240 g of iron(III) oxide reacts with carbon monoxide?

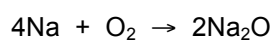


$$\text{moles Fe}_2\text{O}_3 = \frac{\text{mass}}{M_r} = \frac{240}{160} = 1.5 \text{ moles}$$

$$\text{moles Fe} = 2 \times 1.5 = 3.0 \text{ moles}$$

$$\text{mass Fe} = M_r \times \text{moles} = 56 \times 3.0 = 168 \text{ g}$$

2 What mass of oxygen reacts with 9.2 g of sodium?



$$\text{moles Na} = \frac{\text{mass}}{M_r} = \frac{9.2}{23} = 0.4 \text{ moles}$$

$$\text{moles O}_2 = \frac{0.4}{4} = 0.1 \text{ moles}$$

$$\text{mass O}_2 = M_r \times \text{moles} = 32 \times 0.1 = 3.2 \text{ g}$$

3 How many moles in each of the following?

a 12 mg of magnesium

$$\text{moles Mg} = \frac{\text{mass}}{M_r} = \frac{0.012}{24} = 0.0005 \text{ moles}$$

b 8.0 kg of oxygen

$$\text{moles O}_2 = \frac{\text{mass}}{M_r} = \frac{8000}{32} = 250 \text{ moles}$$

4 What is the mass of each of the following?

a 0.100 moles of calcium hydroxide

$$\text{mass Ca(OH)}_2 = M_r \times \text{moles} = 74 \times 0.100 = 7.4 \text{ g}$$

b 0.025 moles of aluminium sulfate

$$\text{mass Al}_2(\text{SO}_4)_3 = M_r \times \text{moles} = 342 \times 0.025 = 8.55 \text{ g}$$