IGCSE · Cambridge (CIE) · Chemistry

15 mins 15 questions

Multiple Choice Questions

# Formulae & Relative Masses

Formulae / Empirical Formulae & Formulae of Ionic Compounds / Writing Equations / Ar & Mr

| | |
|---|---|
| Easy (5 questions) | /5 |
| Medium (5 questions) | /5 |
| Hard (5 questions) | /5 |
| **Total Marks** | **/15** |

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# Easy Questions

**1** A molecule contains carbon, hydrogen and oxygen. For every carbon atom there are twice as many hydrogen atoms but the same number of oxygen atoms.

What is the formula of the molecule?

**A.** $C_2H_6O$

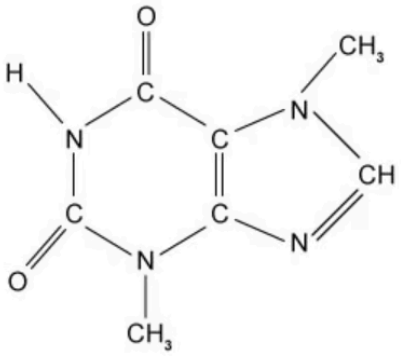
**B.** $C_2H_4O_2$

**C.** $C_4H_8O_2$

**D.** $C_2H_2O_2$

**(1 mark)**

**2** Theobromine is a stimulant found in chocolate and in tea leaves and is closely related to caffeine, the stimulant found in coffee.




Theobromine

What is the formula of theobromine?

**A.** $C_6H_5N_4O_2$

**B.** $C_7H_8N_4O_2$

**C.** $C_7H_8N_3O_2$

**D.** $C_7H_7N_4O_2$

**(1 mark)**

**3** Hydrogen reacts with elements from Group VII to produce compounds called hydrogen halides. An example is when a molecule of hydrogen reacts with a molecule of fluorine to produce hydrogen fluoride.

What is the correct equation for the reaction?

**A.** $2\ H + 2\ F \rightarrow 2\ HF$

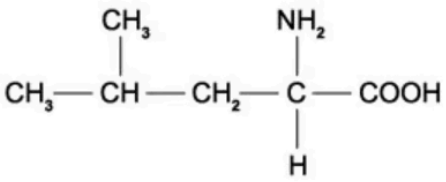
**B.** $H_2 + F_2 \rightarrow H_2F_2$

**C.** $2\ H + 2\ F \rightarrow H_2F_2$

**D.** $H_2 + F_2 \rightarrow 2\ HF$

**(1 mark)**

**4** Leucine is an essential amino acid used in the synthesis of proteins in the body.




Leucine

What is the relative molecular mass of leucine?

**A.** 144 g

**B.** 86 g

**C.** 125 g

**D.** 131 g

**(1 mark)**

**5** When magnesium carbonate is heated, the products are magnesium oxide and carbon dioxide.

$$MgCO_3\ (s) \rightarrow MgO\ (s) + CO_2\ (g)$$

What mass of magnesium oxide is formed when 21 g of magnesium carbonate thermally decomposes?

($A_r$ = Mg = 24, C = 12, O = 16)

**A.** 10

**B.** 11

**C.** 20

**D.** 22

**(1 mark)**

# Medium Questions

**1** What is the balanced equation for the reaction of methane and oxygen?

**A.** $CH_4(g) + 2\ O_2(g) \rightarrow CO_2(g) + H_2O(g)$

**B.** $CH_4(g) + O_2(g) \rightarrow CO_2(g) + 2\ H_2O(g)$

**C.** $2\ CH_4(g) + 4\ O_2(g) \rightarrow 2\ CO_2(g) + H_2O(g)$

**D.** $CH_4(g) + 2\ O_2(g) \rightarrow CO_2(g) + 2\ H_2O(g)$

**(1 mark)**

## 2 Extended Only

A compound contains two atoms of oxygen and one atom of calcium. It also contains hydrogen in sufficient amounts so that the overall charge of the molecule is neutral.

What is the molecular formula for the compound?

**A.** $Ca(OH)_4$

**B.** $Ca(OH)_2$

**C.** $H_4CaO_2$

**D.** $CaO_2H_2$

**(1 mark)**

## 3 Extended Only

Dilute sulfuric acid and barium chloride solution react to produce barium sulfate and hydrochloric acid, as shown in the reaction below:

$$H_2SO_4 + BaCl_2 \rightarrow BaSO_4 + 2\ HCl$$

Which row represents the correct state symbols for the reaction?

| | $H_2SO_4$ | $BaCl_2$ | $BaSO_4$ | HCl |
|---|---|---|---|---|
| **A** | (aq) | (l) | (s) | (aq) |
| **B** | (l) | (aq) | (aq) | (l) |
| **C** | (aq) | (aq) | (s) | (aq) |
| **D** | (l) | (aq) | (l) | (aq) |

**(1 mark)**

**4** 6 g of hydrogen react with 48 g of oxygen to form water. A chemist performs the same reaction using 2 g of hydrogen.

What mass of oxygen is required to combine with the hydrogen?

**A.** 24 g

**B.** 12 g

**C.** 16 g

**D.** 72 g

**(1 mark)**

## 5 Extended Only

The formula and charge for positive and negative ions are shown.

| cation | anion |
|---|---|
| $Al^{3+}$, $Mg^{2+}$, $Cu^{2+}$, $Fe^{2+}$, $Li^{+}$ | $F^{-}$, $CO_3^{2-}$, $NO_3^{-}$, $S^{2-}$, $SO_4^{2-}$ |

The table shows the name and formula of common ionic compounds formed from the ions. Which row is not correct?

| | **name** | **formula** |
|---|---|---|
| **A** | lithium sulfide | $Li_2S$ |
| **B** | iron(II) fluoride | $Fe_2F_3$ |
| **C** | aluminium sulfate | $Al_2(SO_4)_3$ |
| **D** | magnesium nitrate | $Mg(NO_3)_2$ |

**(1 mark)**

# Hard Questions

**1** Ammonia is manufactured by the reaction of hydrogen and nitrogen in the Haber process, as shown in the equation below:

$$N_2 + 3\ H_2 \rightarrow 2\ NH_3$$

16.8 tonnes of ammonia can be produced from 14 tonnes of nitrogen.

How much nitrogen is needed to produce 51 tonnes of ammonia?

**A.** 42.5

**B.** 34

**C.** 17

**D.** 24.5

**(1 mark)**

**2** The left hand side for the reaction between ammonia and copper(II) oxide is shown. What are the products of the balanced equation?

$$3\ CuO + 2\ NH_3 \rightarrow$$

**A.** $3\ Cu + 2\ N + 3\ H_2O$

**B.** $3\ Cu + 3\ HNO_3$

**C.** $3\ Cu + N_2 + H_2O$

**D.** $3\ Cu + N_2 + 3\ H_2O$

**(1 mark)**

**3** What is the balanced equation for the reaction between aqueous NaOH and $Fe_2(SO_4)_3$?

**A.** $Fe_2(SO_4)_3\,(aq) + 6\ NaOH\,(aq) \rightarrow 2\ Fe(OH)_3\,(s) + 3\ Na_2SO_4\,(aq)$

**B.** $Fe_2(SO_4)_3\,(aq) + 2\ NaOH\,(aq) \rightarrow Fe(OH)_3\,(s) + Na_2SO_4\,(aq)$

**C.** $2\ Fe_2(SO_4)_3\,(aq) + 4\ NaOH\,(aq) \rightarrow Fe(OH)_3\,(s) + Na_2SO_4\,(aq)$

**D.** $3\ Fe_2(SO_4)_3\,(aq) + 6\ NaOH\,(aq) \rightarrow 3\ Fe(OH)_3\,(s) + 2\ Na_2SO_4\,(aq)$

**(1 mark)**

## 4 Extended Only

Magnesium nitrate and sodium carbonate react as shown.

$$Mg(NO_3)_{2(aq)} + Na_2CO_{3(aq)} \rightarrow MgCO_{3(s)} + 2\ NaNO_{3(aq)}$$

Which row describes the spectator ions and the net ionic equation for the reaction?

| | **spectator ions** | **net ionic equation** |
|---|---|---|
| **A** | $Mg^{2+}$ and $CO_3^{2-}$ | $Mg^{2+}(aq) + CO_3^{2-}(aq) \rightarrow MgCO_3(s)$ |
| **B** | $NO_3^-$ and $Na^+$ | $NO_3^-(aq) + Na^+(aq) \rightarrow NaNO_3(aq)$ |
| **C** | $Mg^{2+}$ and $CO_3^{2-}$ | $NO_3^-(aq) + Na^+(aq) \rightarrow NaNO_3(aq)$ |
| **D** | $NO_3^-$ and $Na^+$ | $Mg^{2+}(aq) + CO_3^{2-}(aq) \rightarrow MgCO_3(s)$ |

**(1 mark)**

## 5 Extended Only

Nitric acid and potassium hydroxide react in a neutralisation reaction to produce salt and water, as shown by the equation below:

$$HNO_3(aq) + KOH(aq) \rightarrow KNO_3(aq) + H_2O(l)$$

Which row describes the spectator ions and the net ionic equation for the reaction?

| | spectator ions | net ionic equation |
|---|---|---|
| **A** | $NO_3^-$ and $K^+$ | $NO_3^-(aq) + K^+(aq) \rightarrow KNO_3(aq)$ |
| **B** | $H^+$ and $OH^-$ | $NO_3^-(aq) + K^+(aq) \rightarrow KNO_3(aq)$ |
| **C** | $NO_3^-$ and $K^+$ | $H^+(aq) + OH^-(aq) \rightarrow H_2O(l)$ |
| **D** | $H^+$ and $OH^-$ | $H^+(aq) + OH^-(aq) \rightarrow H_2O(l)$ |

**(1 mark)**