Moles MCQS 5070

1 What are the relative formula masses of one mole of solid magnesium and one mole of gaseous chlorine?

	magnesium	chlorine
A	12	17
B	24	35.5
C	24	71
D	48	71

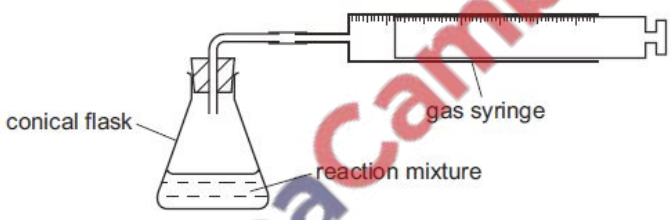
2 Complete combustion of a hydrocarbon produces only carbon dioxide, CO_2, and water, H_2O.

$$C_5H_{12}(l) + 8O_2(g) \rightarrow 5CO_2(g) + 6H_2O(g)$$

When 0.1 mol of the hydrocarbon C_5H_{12} is completely combusted, which volume of carbon dioxide, measured at room temperature and pressure, is produced?

A $0.5\,dm^3$ **B** $2.4\,dm^3$ **C** $5.0\,dm^3$ **D** $12\,dm^3$

3 Calcium carbonate reacts with dilute hydrochloric acid to produce carbon dioxide. The carbon dioxide is collected using the apparatus shown.



The reaction is done four times. For each reaction, 25 g of calcium carbonate and an excess of hydrochloric acid are used.

Which reaction mixture fills the gas syringe with carbon dioxide in the shortest time?

A lumps of calcium carbonate with 1 mol / dm^3 hydrochloric acid

B lumps of calcium carbonate with 2 mol / dm^3 hydrochloric acid

C powdered calcium carbonate with 1 mol / dm^3 hydrochloric acid

D powdered calcium carbonate with 2 mol / dm^3 hydrochloric acid

4 A compound contains 40.0% carbon, 6.7% hydrogen and 53.3% oxygen by mass.

The relative molecular mass of the compound is between 55 and 65.

What is the molecular formula of the compound?

A CH_2O **B** C_2H_4O **C** $C_2H_4O_2$ **D** $C_2H_6O_2$

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5 Which fertilizer contains the highest percentage of nitrogen by mass?

A ammonium nitrate, NH_4NO_3; formula mass is 80

B ammonium phosphate, $(NH_4)_3PO_4$; formula mass is 149

C ammonium sulfate, $(NH_4)_2SO_4$; formula mass is 132

D potassium nitrate, KNO_3; formula mass is 101

6 Iron can be extracted from the ore haematite, Fe_2O_3.

What is the maximum mass of iron that could be produced from 500 kg of haematite?
[A_r: O, 16; Fe, 56]

A 160 kg **B** 240 kg **C** 350 kg **D** 420 kg

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7 When 1 volume of gas R reacts with exactly 5 volumes of oxygen, it forms carbon dioxide and water only.

What is R?

A butane, C_4H_{10}

B ethane, C_2H_6

C methane, CH_4

D propane, C_3H_8

8 Two characteristics of a gas, G, are given.

- G reduces copper(II) oxide to a pink-brown solid.
- 1.4 g of G has a volume of 1.2 dm^3 at room temperature and pressure.

What is G?

A carbon monoxide, CO

B hydrogen, H_2

C nitrogen, N_2

D nitrogen monoxide, NO

9 The relative formula masses of four compounds are given9

A student has a 1.0 g sample of each compound.

Which sample contains the highest number of moles of oxygen atoms?

	compound	relative formula mass
A	Al_2O_3	102
B	CuO	80
C	H_2SO_4	98
D	HNO_3	63

10 What are the percentages by mass of nitrogen in ammonium nitrate, NH_4NO_3, and in calcium nitrate, $Ca(NO_3)_2$?

	% nitrogen in NH_4NO_3	% nitrogen in $Ca(NO_3)_2$
A	18	14
B	18	17
C	35	9
D	35	17

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11 The relative molecular mass of a compound is 166.

What is a possible molecular formula of this compound?

A $C_4H_3O_2$ **B** $C_6H_4O_4$ **C** $C_6H_8O_2$ **D** $C_8H_6O_4$

12 A mass of 63 g of potassium manganate(VII), $KMnO_4$, is needed for the complete oxidation of 23 g of ethanol, C_2H_5OH, under acidic conditions.

How many moles of ethanol can be completely oxidised by one mole of potassium manganate(VII) under these conditions?

A 0.37 **B** 0.80 **C** 1.00 **D** 1.25

13 The compounds shown can be used as nitrogenous fertilisers.

Which compound has the lowest percentage by mass of nitrogen?

A $(NH_2)_2CO$ [M_r: 60]

B $(NH_4)_2SO_4$ [M_r: 132]

C $(NH_4)_3PO_4$ [M_r: 149]

D NH_4NO_3 [M_r: 80]

14 The compound magnesium nitrate has the formula $Mg(NO_3)_2$.

What is the relative formula mass of magnesium nitrate?

A 86 **B** 134 **C** 148 **D** 172

15 In athletics, banned drugs such as nandrolone have been taken illegally to improve performance. Nandrolone has the molecular formula $C_{18}H_{26}O_2$.

What is the relative molecular mass, M_r, of nandrolone?

(Relative atomic mass: H = 1; C = 12; O = 16)

A 46 **B** 150 **C** 274 **D** 306

16 The equation shows the thermal decomposition of magnesium carbonate (M_r = 84).

$$MgCO_3 \rightarrow MgO + CO_2$$

Which mass of magnesium oxide is formed when 21.0 g of magnesium carbonate are completely decomposed?

A 1.9 g **B** 4.0 g **C** 10.0 g **D** 40.0 g

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17 The relative atomic mass of chlorine is 35.5.

What is the mass of 2 moles of chlorine gas?

A 17.75g B 35.5g C 71g D 142g

18 The empirical formula of a liquid compound is C_2H_4O.

To find the empirical formula, it is necessary to know

A the density of the compound.

B the percentage composition by mass of the compound.

C the relative molecular mass of the compound.

D the volume occupied by 1 mole of the compound.

19 25.0g of hydrated copper(II) sulfate crystals are heated to produce anhydrous copper(II) sulfate and water vapour.

$$CuSO_4.5H_2O(s) \rightarrow CuSO_4(s) + 5H_2O(g)$$

What is the mass of anhydrous copper(II) sulfate formed?
[M_r: $CuSO_4$, 160; H_2O, 18]

A 9.0g B 16.0g C 22.5g D 25.0g

20 One mole of an organic compound, Q, is completely burnt in oxygen and produces exactly three moles of water.

Which compound is Q?

A butane, C_4H_{10}

B ethanol, C_2H_5OH

C propane, C_3H_8

D propanol, C_3H_7OH

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21 Which sample contains the most atoms

A 0.5 moles of water

B 1.0 moles of carbon dioxide

C 1.0 moles of methane

D 2.0 moles of hydrogen chloride

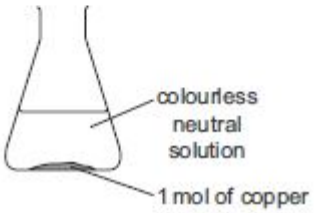
22 In an experiment, 1 mol of powdered copper and 1 mol of powdered zinc are placed in a flask.

Dilute acid, containing 1 mol of acid, is added to the flask.

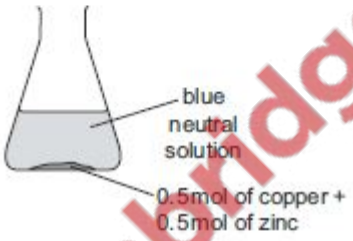
The flask is left until all the reactions, if any, are complete.

Which diagram shows the result of the experiment?

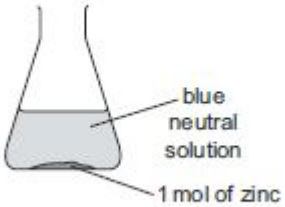
A



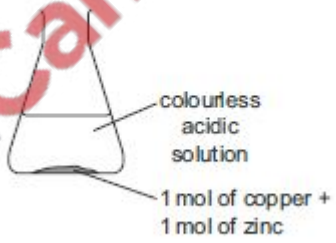
B



C



D



23 Magnesium reacts with dilute sulfuric acid.

$$Mg(s) + H_2SO_4(aq) \rightarrow MgSO_4(aq) + H_2(g)$$

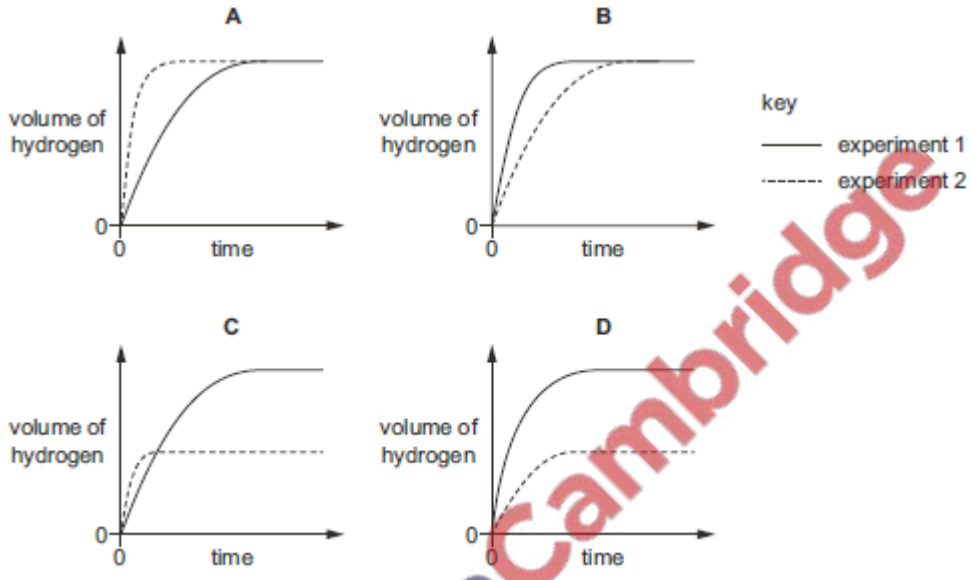
Two experiments were carried out.

experiment 1 24.0 g of magnesium was reacted with 100 cm^3 of 1.0 mol / dm^3 sulfuric acid.

experiment 2 24.0 g of magnesium was reacted with 50 cm^3 of 2.0 mol / dm^3 sulfuric acid.

In each experiment the volume of hydrogen was measured at various times. The results were plotted on a graph.

Which graph is correct?



24 A compound contains 70% by mass of iron and 30% by mass of oxygen.

What is its empirical formula?

[A_r: O, 16; Fe, 56]

A FeO **B** Fe_2O_3 **C** Fe_3O_2 **D** Fe_3O_4

25 The formula for hydrated copper(II) nitrate is $Cu(NO_3)_2.xH_2O$. It contains 36.5% water of crystallisation by mass.

What is the value of x?

[A_r: H, 1; N, 14; O, 16; Cu, 64]

A 4 **B** 5 **C** 6 **D** 7

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26 At the start of a reaction, a 1.00 dm^3 solution contains 0.300 mol of ethanol.

After 100 seconds the concentration of the ethanol has decreased to 0.296 mol/dm^3.

What is the rate of reaction over the first 100 seconds?

A 2.96×10^{-3} $mol/dm^3/s$

B 3.00×10^{-5} $mol/dm^3/s$

C 4.00×10^{-5} $mol/dm^3/s$

D 8.00×10^{-5} $mol/dm^3/s$

27 50.0 cm^3 of 0.10 mol/dm^3 silver nitrate, $AgNO_3$, is added to 150.0 cm^3 of 0.05 mol/dm^3 sodium chloride, NaCl, in a beaker.

As well as solid silver chloride, what is present in the beaker after reaction?

A aqueous silver nitrate and aqueous sodium nitrate

B aqueous sodium chloride and aqueous sodium nitrate

C aqueous sodium chloride only

D aqueous sodium nitrate only

28 Nitrogen monoxide and oxygen react to form nitrogen dioxide.

$$2NO(g) + O_2(g) \rightarrow 2NO_2(g)$$

What is the maximum volume of nitrogen dioxide that could be obtained when 1 dm^3 of nitrogen monoxide reacts with 2 dm^3 of oxygen?

A 1 dm^3 **B** 2 dm^3 **C** 3 dm^3 **D** 4 dm^3

29 What is the definition of relative atomic mass, A_r?

A $\left(\frac{\text{average mass of naturally occurring atoms of an element}}{\text{mass of one atom of } ^{12}C}\right) \times 12$

B $\left(\frac{\text{average mass of naturally occurring atoms of an element}}{\text{mass of one atom of } ^{12}C \times 12}\right)$

C $\left(\frac{\text{average mass of naturally occurring atoms of an element}}{\text{mass of one atom of } ^{12}C}\right)$

D $\left(\frac{\text{mass of one atom of } ^{12}C}{\text{average mass of naturally occurring atoms of an element}}\right)$

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30 A compound containing only the elements carbon and hydrogen has 80.0% by mass of carbon.

What is its empirical formula?

A C_3H **B** CH_3 **C** CH_4 **D** C_2H_6

31 In an experiment, 1 cm^3 of a gaseous hydrocarbon, **Z**, requires 4 cm^3 of oxygen for complete combustion to give 3 cm^3 of carbon dioxide. All gas volumes are measured at r.t.p.

Which formula represents **Z**?

A C_2H_2 **B** C_2H_4 **C** C_3H_4 **D** C_3H_8

32 Compound **P** is the only substance formed when two volumes of ammonia gas react with one volume of carbon dioxide gas (both volumes being measured at r.t.p.).

What is the formula of **P**?

A $NH_2CO_2NH_4$

B $(NH_2)_2CO$

C $NH_4CO_2NH_4$

D $(NH_4)_2CO_3$

33 Two isotopes of chlorine are ^{35}Cl and ^{37}Cl.

Using these isotopes, how many different relative molecular masses are possible for the compound with molecular formula $C_2H_3Cl_3$?

A 2 **B** 3 **C** 4 **D** 5

34 An organic compound has the molecular formula $C_8H_{16}O_4$.

What is the empirical formula of the compound?

A C_2H_4O **B** $C_4H_8O_2$ **C** $C_6H_{12}O_3$ **D** $C_8H_{16}O_4$

35 The equation shown represents the neutralisation of aqueous sodium hydroxide with dilute sulfuric acid.

$$2NaOH(aq) + H_2SO_4(aq) \rightarrow Na_2SO_4(aq) + 2H_2O(l)$$

How much sulfuric acid is required to neutralise 100 cm^3 of 1.0 mol/dm^3 NaOH?

A 50 cm^3 of 2.0 mol/dm^3 sulfuric acid

B 100 cm^3 of 1.0 mol/dm^3 sulfuric acid

C 25 cm^3 of 0.5 mol/dm^3 sulfuric acid

D 50 cm^3 of 1.0 mol/dm^3 sulfuric acid

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36 What is the number of moles of hydrogen atoms in 3.2 g of methane?

A 0.02 **B** 0.2 **C** 0.4 **D** 0.8

37 The formula of the gas ozone is O_3.

What is the volume of 48 g of ozone at r.t.p.?

A 16 dm^3 **B** 24 dm^3 **C** 36 dm^3 **D** 72 dm^3

38 What is the relative molecular mass, M_r, of $CuSO_4.5H_2O$?

A 127 **B** 160 **C** 178 **D** 250

39 1.00 dm^3 of ammonia gas is passed over heated copper(II) oxide.

$$3CuO(s) + 2NH_3(g) \rightarrow 3Cu(s) + N_2(g) + 3H_2O(l)$$

What is the volume of nitrogen formed when measured at the same temperature and pressure as the ammonia?

A 0.25 dm^3 **B** 0.50 dm^3 **C** 1.00 dm^3 **D** 2.00 dm^3

40 Using the Periodic Table for the relative atomic masses, which has the least mass?

A 0.1 moles of silicon dioxide, SiO_2

B 0.5 moles of oxygen, O_2

C 0.5 moles of lithium, Li

D 1.0 moles of ammonia, NH_3

41 The table shows the numbers of atoms present in the formula of some compounds.

Which row is **not** correct?

	numbers of atoms	formula
A	1 × calcium, 1 × carbon, 3 × oxygen	$CaCO_3$
B	1 × carbon, 5 × hydrogen, 1 × oxygen	C_2H_5OH
C	1 × hydrogen, 1 × oxygen, 1 × sodium	NaOH
D	2 × hydrogen, 4 × oxygen, 1 × sulfur	H_2SO_4

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41 Using the Periodic Table for the relative atomic masses, which has the greatest mass?

A 0.1 moles of iodine molecules, I_2

B 0.5 moles of carbon dioxide, CO_2

C 1.0 mole of beryllium oxide, BeO

D 1.0 mole of sodium, Na

42 Ammonia is manufactured from nitrogen and hydrogen by the Haber process.

$$N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g)$$

What is the percentage yield when 60 kg of ammonia is produced from 60 kg of hydrogen?

A 5.9% **B** 17.6% **C** 35.3% **D** 50.0%

43 What is the relative molecular mass, M_r, of $CuSO_4.5H_2O$?

A 127 **B** 160 **C** 178 **D** 250

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Marking KEY

1.C 27.B

2.D 28.A

3.D 29.A

4.C 30.B

5.A 31.C

6.C 32.A

7.D 33.C

8.A 34.A

9.C 35.D

10.C 36.D

11.D 37.B

12.D 38.D

13.B 39.B

14.C 40.C

15.C 41.A

16.C 42.B

17.D 43.D

18.B

19.B

20.B

21.C

22.A

23.C

24.B

25.C

26.C