

[Science] Chemistry O Level Exam Paper
Preliminary Examination Set [V]
Secondary Four Express & Five Normal



CANDIDATE NAME:

CLASS:

INDEX NUMBER:

Science(Chemistry)

5076/01

Paper 1 Multiple Choice

5078/01

2024

30 min

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.

Do not use staples, paper clips, glue or correction fluid/tape.

Write your name, class and index number on the Answer Sheet in the spaces provided.

There are **forty** questions on this paper. Answer **all** questions. For each question, there are four possible answers **A, B, C** or **D**.

Choose the **one** you consider correct and record your choice in **soft pencil** on the separate Answer Sheet.

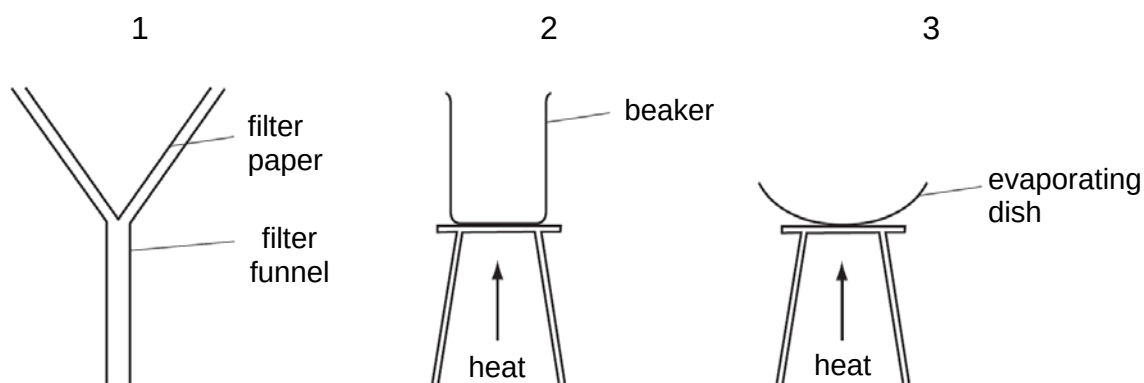
Read the instructions on the Answer Sheet very carefully.

Each correct answer will score one mark. A mark will not be deducted for a wrong answer.

Any rough working should be done in this booklet.

The use of an approved scientific calculator is expected, where appropriate.

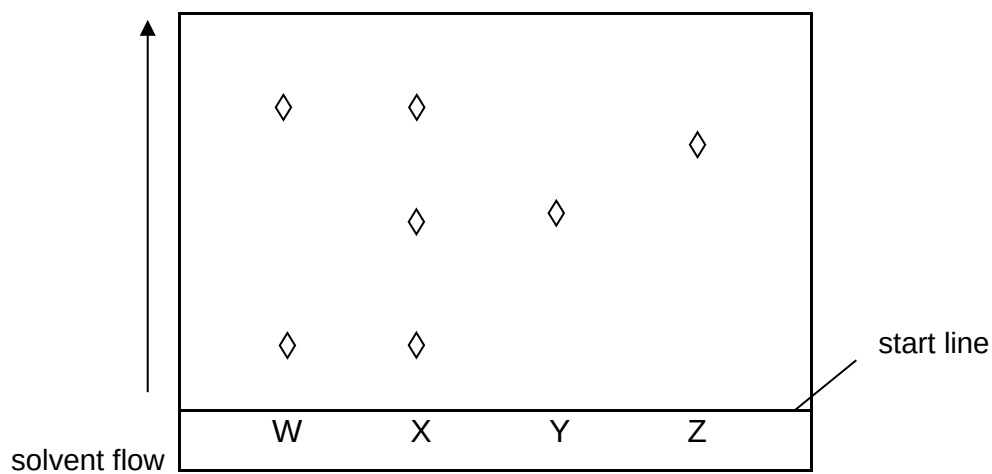
1 The diagrams show three sets of apparatus.



Which apparatus would be used to obtain separate dry samples of sand and salt from a mixture of sand and seawater?

- A** 1 only **B** 3 only **C** 1 and 3 **D** 2 and 3

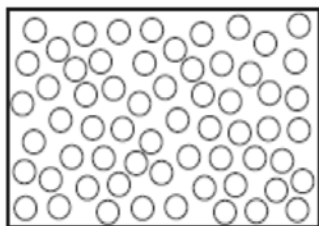
2 The chromatogram shows the dyes present in four food colourings, W, X, Y and Z.



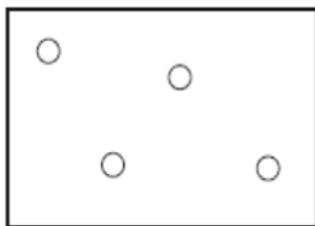
How many different dyes are used to make the food colourings W, X, Y and Z?

- A** 2 **B** 3 **C** 4 **D** 7

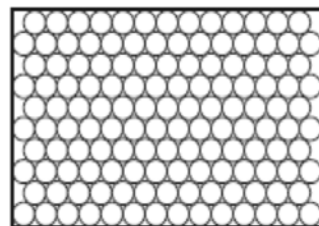
- 3 The diagrams show the arrangement of particles in three different physical states of substance S.



state 1



state 2



state 3

Which statement about the physical states of substance S is correct?

- A State 1 changes to state 3 by freezing.
 - B The substance in state 2 has a fixed volume.
 - C Particles in state 1 vibrate about fixed positions.
 - D The forces between the particles in state 2 are strong.
- 4 An ion of element Y has 18 electrons and nucleon number of 31.

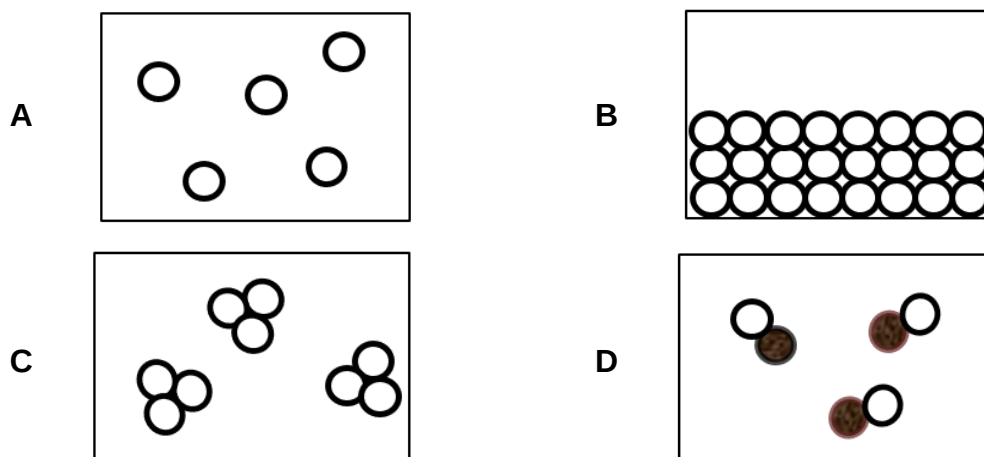
What is the charge on the ion if element Y has 16 neutrons?

- A 2+
 - B 2-
 - C 3+
 - D 3-
- 5 Element Q has an electronic structure of 2, 8, 1.
Element R has an electronic structure of 2, 6.

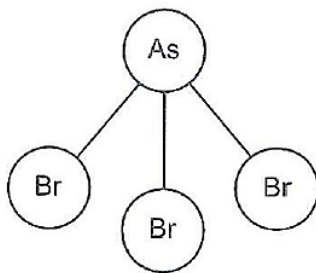
What would be the formula of the compound formed between Q and R?

- A QR
- B Q₂R
- C QR₂
- D Q₂R₂

- 6 Which diagram represents molecules of an element?



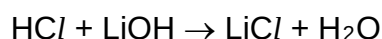
- 7 A molecule of arsenic bromide, AsBr_3 , has the structure shown.



Which properties could be correct for arsenic bromide?

	melting point / °C	electrical conductivity at room temperature
A	31	conducts
B	39	does not conduct
C	650	conducts
D	755	does not conduct

- 8 Hydrochloric acid reacts with lithium hydroxide as shown below.



What is the volume of hydrochloric acid of concentration 2.0 mol/dm^3 needed to fully react with 25.0 cm^3 of lithium hydroxide of concentration 1.0 mol/dm^3 ?

- A 12.5 cm^3 B 25.0 cm^3 C 50.0 cm^3 D 100.0 cm^3

- 9 Which ionic equation represents the neutralisation of aqueous sodium hydroxide with dilute sulfuric acid?

- A $\text{H}^+ (\text{aq}) + \text{OH}^- (\text{aq}) \rightarrow \text{H}_2\text{O} (\text{l})$
B $2\text{Na}^+ (\text{aq}) + \text{SO}_4^{2-} (\text{aq}) \rightarrow \text{Na}_2\text{SO}_4 (\text{aq})$
C $\text{NaOH} (\text{aq}) + \text{H}^+ (\text{aq}) \rightarrow \text{Na}^+ (\text{aq}) + \text{H}_2\text{O} (\text{l})$
D $2\text{Na}^+ (\text{aq}) + \text{H}_2\text{SO}_4 (\text{aq}) \rightarrow \text{Na}_2\text{SO}_4 (\text{aq}) + 2\text{H}^+ (\text{aq})$

- 10 Red cabbage juice is an example of a natural indicator which turns purple in water. When an acid is added, the indicator turns red and when an alkali is added, it turns yellow.

A student added two solutions, vinegar and aqueous ammonia, to two separate test tubes containing cabbage juice.

What will be the colours of the two solutions?

	vinegar	aqueous ammonia
A	red	purple
B	red	yellow
C	yellow	red
D	yellow	purple

- 11 The oxide of element X was added separately to hydrochloric acid and aqueous sodium hydroxide.

The word equation for the reactions are shown.

X oxide + hydrochloric acid $\rightarrow$ salt + water

X oxide + sodium hydroxide $\rightarrow$ salt + water

Which row describes element X and its oxide?

	X	X oxide
A	metal	amphoteric
B	metal	basic
C	non-metal	acidic
D	non-metal	neutral

- 12** Substance **Y** decolourises acidified potassium manganate(VII) solution, KMnO_4 .

Which statement correctly describes the reaction above?

- A** Substance **Y** is an oxidising agent and acidified KMnO_4 has been oxidised.
- B** Substance **Y** is an oxidising agent and acidified KMnO_4 has been reduced.
- C** Substance **Y** is a reducing agent and acidified KMnO_4 has been oxidised.
- D** Substance **Y** is a reducing agent and acidified KMnO_4 has been reduced.

- 13** In the Periodic Table, there is a trend from metallic to non-metallic elements across a period.

What causes the trend?

- A** an increase in number of electrons
- B** an increase in number of electron shells
- C** an increase in number of neutrons
- D** an increase in number of valence electrons

- 14** Fluorine is a halogen.

The table shows some of the properties of other halogens.

element	M_r	number of valence electrons	melting point/ $^{\circ}\text{C}$	boiling point/ $^{\circ}\text{C}$	colour of vapour
chlorine	71	7	-101	-35	yellow-green
bromine	160	7	-7	59	red-brown
iodine	254	7	114	184	violet

Which statement about fluorine is likely to be correct?

- A** The M_r of fluorine is 19.
- B** The boiling point of fluorine is -188°C .
- C** The melting point of fluorine is 212°C .
- D** At room temperature and pressure, fluorine is a black solid.

- 15** The table below shows the reaction of four metals, W, X, Y and Z, with water and steam.

metal	reaction with water	reaction with steam
W	catches fire	explodes
X	no change	no change
Y	no change	slow effervescence
Z	slow effervescence	rapid effervescence

What is the order of reactivity of the metals from most reactive to least reactive?

- A** $X \rightarrow Y \rightarrow Z \rightarrow W$
B $W \rightarrow Y \rightarrow Z \rightarrow X$
C $X \rightarrow Z \rightarrow Y \rightarrow W$
D $W \rightarrow Z \rightarrow Y \rightarrow X$
- 16** Four different solids, W, X, Y and Z are dissolved in equal volumes of water at 20 °C by a student.

The following is recorded by the student.

solid which dissolves	type of energy change
W	endothermic
X	exothermic
Y	endothermic
Z	exothermic

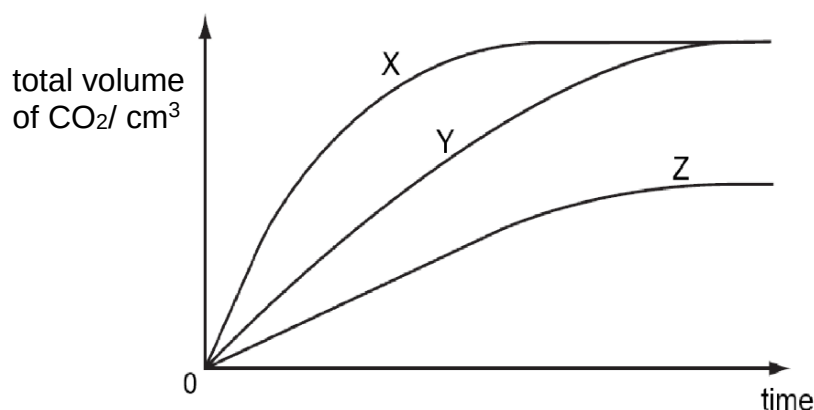
Which row of the table describes the correct temperature recorded?

	solid which dissolves	temperature recorded / °C
A	W	30
B	X	12
C	Y	21
D	Z	40

- 17** In experiment 1, an excess of finely powdered marble is added to 20 cm³ of dilute hydrochloric acid.

In experiment 2, an excess of large marble chips is added to 20 cm³ of dilute hydrochloric acid of the same concentration.

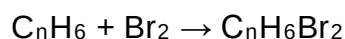
The total volume of carbon dioxide given off are determined at regular time intervals and plotted in the following graph.



Which part of curves is obtained in the two experiments?

	experiment 1	experiment 2
A	X	Z
B	X	Y
C	Y	Z
D	Y	X

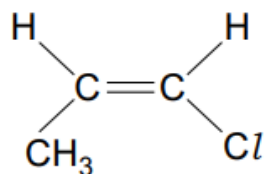
- 18** The reaction between a hydrocarbon, C_nH₆ and bromine can be represented by the equation below.



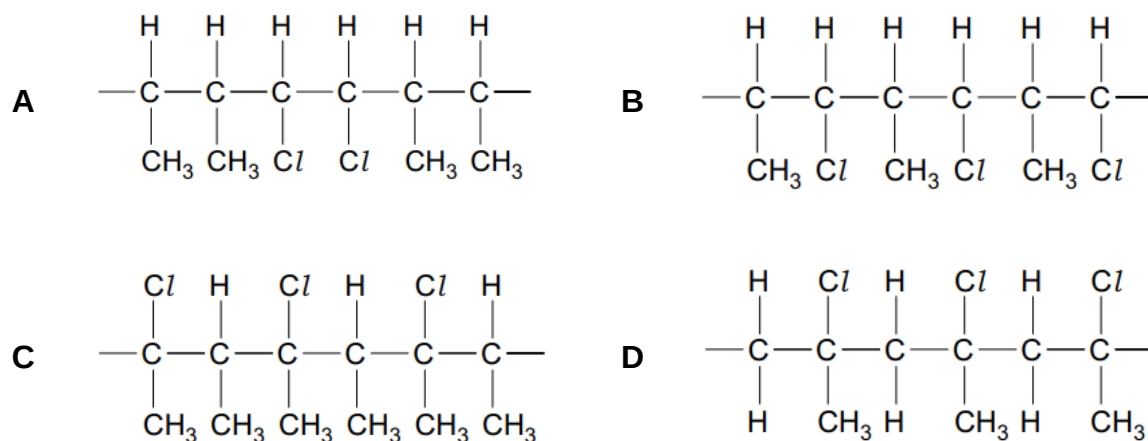
Which statement is correct for this reaction?

- A** This is an addition reaction.
- B** UV light is needed for reaction to occur.
- C** Nickel is used as a catalyst in the reaction.
- D** The molecular formula of the hydrocarbon is C₂H₆.

- 19 The structure below shows a monomer.



Which structure shows a part of the polymer chain formed from **three** molecules of the monomer?



- 20 Carbon dioxide and methane are 'greenhouse gases' which contribute to global warming.

Which process does **not** increase global warming?

- A** burning fossil fuels
- B** decay of organic waste
- C** farming cattle for beef
- D** growing crops such as sugar cane

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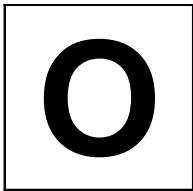
Data Sheet

Colours of Some Common Metal Hydroxides

aluminium hydroxide	white
calcium hydroxide	white
copper(II) hydroxide	light blue
iron (II) hydroxide	green
iron(III) hydroxide	red-brown
zinc hydroxide	white

The Periodic Table of Elements

Group																									
1	2																13	14	15	16	17	18			
		1 H hydrogen 1																							
		Key proton (atomic) number atomic symbol name relative atomic mass																							
3 Li lithium 7	4 Be beryllium 9																		5 B boron 11	6 C carbon 12	7 N nitrogen 14	8 O oxygen 16	9 F fluorine 19	10 Ne neon 20	
11 Na sodium 23	12 Mg magnesium 24																		13 Al aluminium 27	14 Si silicon 28	15 P phosphorus 31	16 S sulfur 32	17 Cl chlorine 35.5	18 Ar argon 40	
19 K potassium 39	20 Ca calcium 40	21 Sc scandium 45	22 Ti titanium 48	23 V vanadium 51	24 Cr chromium 52	25 Mn manganese 55	26 Fe iron 56	27 Co cobalt 59	28 Ni nickel 59	29 Cu copper 64	30 Zn zinc 65	31 Ga gallium 70	32 Ge germanium 73	33 As arsenic 75	34 Se selenium 79	35 Br bromine 80	36 Kr krypton 84								
37 Rb rubidium 85	38 Sr strontium 88	39 Y yttrium 89	40 Zr zirconium 91	41 Nb niobium 93	42 Mo molybdenum 96	43 Tc technetium –	44 Ru ruthenium 101	45 Rh rhodium 103	46 Pd palladium 106	47 Ag silver 108	48 Cd cadmium 112	49 In indium 115	50 Sn tin 119	51 Sb antimony 122	52 Te tellurium 128	53 I iodine 127	54 Xe xenon 131								
55 Cs caesium 133	56 Ba barium 137	57 – 71 lanthanoids		72 Hf hafnium 178	73 Ta tantalum 181	74 W tungsten 184	75 Re rhenium 186	76 Os osmium 190	77 Ir iridium 192	78 Pt platinum 195	79 Au gold 197	80 Hg mercury 201	81 Tl thallium 204	82 Pb lead 207	83 Bi bismuth 209	84 Po polonium –	85 At astatine –	86 Rn radon –							
87 Fr francium	88 Ra radium	89 – 103 actinoids		104 Rf Rutherfordium	105 Db dubnium	106 Sg seaborgium	107 Bh bohrium	108 Hs hassium	109 Mt meitnerium	110 Ds darmstadtium	111 Rg roentgenium	112 Cn copernicium	113 Nh nihonium	114 Fl flerovium	115 Mc moscovium	116 Lv livermorium	117 Ts tennessine	118 Og oganeson							



[Science] Chemistry O Level Exam
Paper Preliminary Examination Set [V]
Secondary Four Express & Five Normal



CANDIDATE NAME:

CLASS:

INDEX NUMBER:

Science(Chemistry)

Paper 2 Theory

5076/03

2024

5078/03

1 hour 15 minutes

READ THESE INSTRUCTIONS FIRST

Write your name, class and index number on all the work you hand in.
Write in dark blue or black pen on both sides of the paper.
You may use a HB pencil for any diagrams or graphs.
Do not use staples, paper clips, glue or correction fluid/tape.

Section A

Answer **all** questions.

Section B

Answer **all** questions. Question 11 has a choice of parts to answer.

Candidates are reminded that **all** quantitative answers should include appropriate units.
The use of an approved scientific calculator is expected, where appropriate.
Candidates are advised to show all their working in a clear and orderly manner, as more marks are awarded for sound use of Physics than for correct answers.

At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [] at the end of each question or part question.

Section A	
Section B	
Total	

Section A

Answer **all** the questions in the spaces provided.

- 1** Choose from the following substances to answer the questions.

ammonia	carbon monoxide	silver sulfate
aluminium oxide	copper	sulfur
calcium hydroxide	methane	sulfur dioxide

Each substance may be used once, more than once or not at all.

Identify a substance which:

- (a)** is produced during incomplete combustion

..... [1]

- (b)** is an acidic gas

..... [1]

- (c)** is amphoteric

..... [1]

- (d)** is an element which forms X^{2-} ion

..... [1]

- (e)** is used to reduce the acidity of soils

..... [1]

- (f)** is a greenhouse gas.

..... [1]

[Total: 6]

2 Helium, neon, argon, krypton, xenon and radon are noble gases in Group 18.

(a) State one use for helium.

.....[1]

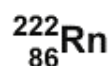
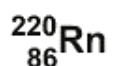
(b) Radon is very unreactive.

Use the electronic structure of radon to explain why.

.....

.....[1]

(c) Two isotopes of radon are shown.



(i) Give one similarity in the atomic structure of these two isotopes.

.....

.....[1]

(ii) Give one difference in the atomic structure of these two isotopes.

.....

.....[1]

(d) A sample of neon has a volume of 21dm^3 at room temperature and pressure.

(i) The temperature of the sample is increased.

The pressure remains constant.

Describe and explain, using kinetic particle theory, what happens to the volume of the sample.

.....

.....

.....[2]

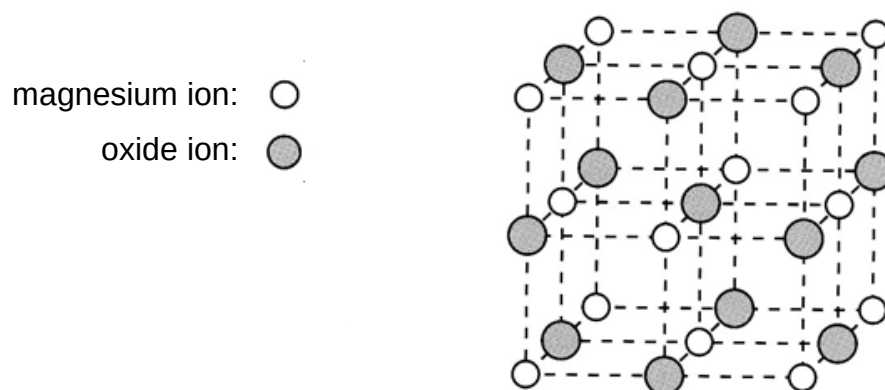
(ii) Calculate the mass of neon in the 21 dm^3 sample.

Give your answer to **three** significant figures.

mass g [2]

[Total: 8]

- 3 The structure of magnesium oxide is shown in the diagram below.



- (a) Explain, with reference to the structure of magnesium oxide, why molten magnesium oxide conducts electricity, but solid magnesium oxide does not.

.....

.....

.....[2]

- (b) Complete the following table which gives information about two ions.

ion	number of protons	number of neutrons	number of electrons	nucleon (mass) number
O^{2-}	8	8		
Mg^{2+}			10	24

[3]

- (c) Draw a 'dot-and-cross' diagram to show the bonding in magnesium oxide. Show only the outer shell electrons.

[2]

[Total: 7]

4 Fig. 4.1 describes the reactions of two colourless solutions, **J** and **K**.

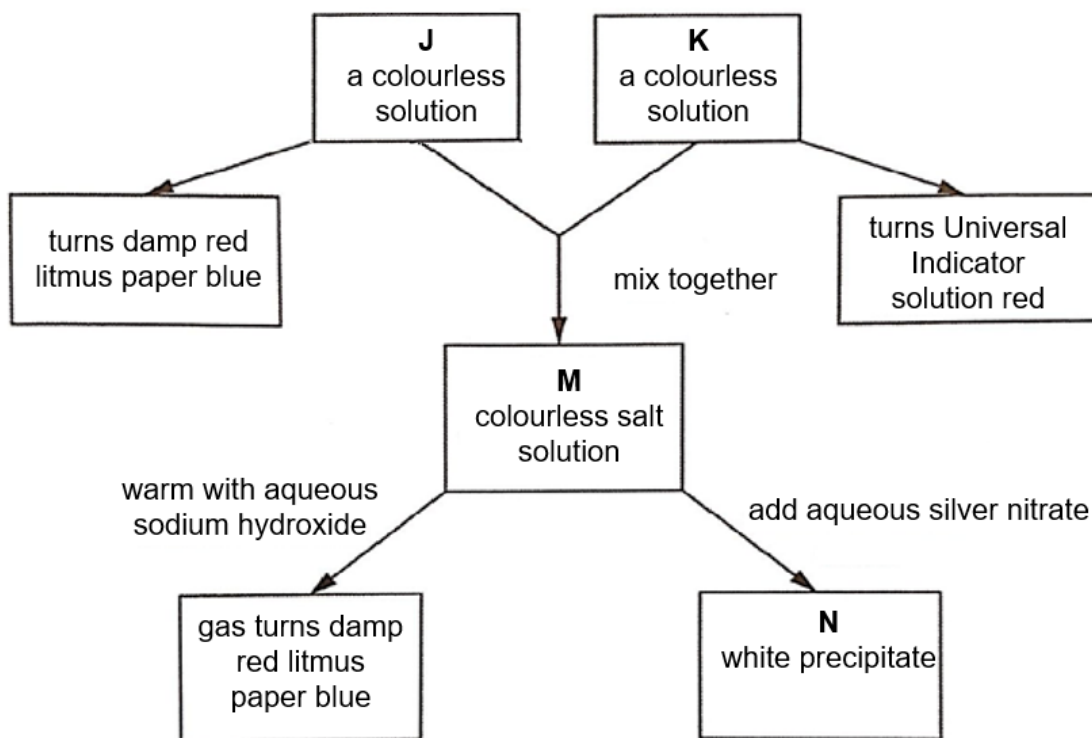


Fig. 4.1

(a) Name substances **J**, **K**, **M** and **N**.

- (i) **J** [1]
- (ii) **K** [1]
- (iii) **M** [1]
- (iv) **N** [1]

(b) Write a balanced chemical equation for the reaction between **M** and sodium hydroxide.

..... [2]

(c) Briefly describe how you can obtain a pure dry sample of **N** that is formed.

.....

.....

..... [2]

[Total: 8]

5 Chlorine is in Group 17 of the Periodic Table.

(a) Name the most reactive element in Group 17.

.....[1]

(b) The electronic structure of chlorine is 2,8,7.
Use this information to explain why chlorine is in Period 3 of the Periodic Table.

.....

.....[1]

(c) Aqueous chlorine is an oxidising agent.

Chlorine gas is bubbled into aqueous potassium iodide.

(i) Write the ionic equation for the reaction between chlorine gas and iodide ions.

.....[1]

(ii) Describe the colour change that happens during the reaction.

.....[1]

(d) Describe the trend in melting point down Group 17.

.....

.....[1]

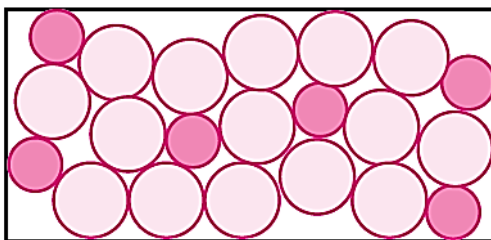
[Total: 5]

- 6 Iron is often used to make an alloy called stainless steel. Stainless steel does not rust easily.

(a) What is meant by the term *alloy*?

.....[1]

(b) The diagram shows the arrangement of atoms in an alloy.



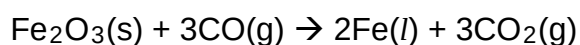
Stainless steel is much harder than pure iron.

Use ideas about the arrangement of atoms in stainless steel to explain why.

.....
.....
.....
.....[2]

(c) Iron is extracted from iron(III) oxide in a blast furnace using carbon monoxide.

The chemical equation for the reaction between iron(III) oxide and carbon monoxide is shown.



State and explain whether carbon monoxide is acting as an oxidising agent or a reducing agent in the reaction.

.....
.....
.....[2]

[Total: 5]

- 7 A Formula One car uses octane as fuel. Octane belongs to a family of organic compounds called alkanes. Alkanes contain only carbon and hydrogen atoms.

Table 7.1 shows the melting points and boiling points of some alkanes.

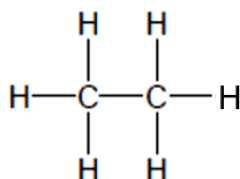
Table 7.1

name of alkane	formula	melting point / °C	boiling point / °C
ethane	C ₂ H ₆	-183	-89
propane	C ₃ H ₈	-188	-42
butane	C ₄ H ₁₀	-138	-1
pentane	C ₅ H ₁₂	-130	36
hexane	C ₆ H ₁₄	-95	69
octane	C ₈ H ₁₈	-57	126

- (a) Name the type of bonding found in octane.

.....[1]

- (b) Ethane is a colourless and odourless gas.
A molecule of ethane has the following structure.



Draw a 'dot-and-cross' diagram to show the bonding in ethane.
Show only the outer shell electrons.

[2]

- (c) From the information in **Table 7.1**, what can you deduce about the relationship between the molecular size of the alkanes and their boiling points?

.....

.....[1]

(d) Heptane is an alkane with seven carbon atoms.

Write the molecular formula of heptane.

.....[1]

(e) Predict the physical state of heptane at room temperature and pressure.

.....[1]

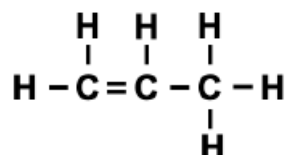
[Total: 6]

8 Petroleum (crude oil) is a mixture of hydrocarbons.

- (a) Petroleum is separated into useful fractions by fractional distillation.
State the physical property used to separate the fractions.

.....[1]

- (b) Naphtha is the fraction that is used to produce propene. The structure of propene is shown.



- (i) A homologous series is a group of compounds with the same general formula.

State one **other** property of compounds in the same homologous series.

.....
..... [1]

- (ii) Propene, along with ethene and butene, forms a homologous series.

State the general formula of this homologous series.

..... [1]

- (iii) Propene reacts with aqueous bromine to form Y.

Draw the full structural formula of a molecule of Y.
Show all the bonds in your answer.

[1]

- (iv) Propene is the raw material used to produce poly(propene), a plastic that is used to make microwavable containers.

Draw the full structural formula of **two** repeating units of poly(propene). Show all the bonds in your answer.

[2]

- (v) State why poly(propene) causes a pollution problem when it is disposed of.

.....
..... [1]

- (c) Carbon dioxide and ethanol are produced by fermenting glucose solution.

- (i) Describe the conditions needed for this reaction to occur optimally.

.....
..... [2]

- (ii) Ethanol obtained from sugarcane plants, known as bioethanol, is a *renewable* alternative to crude oil.
Explain why bioethanol is considered *renewable*.

.....
..... [1]

[Total: 10]

End of Section A

Section B

Answer **one** question from this section.

9 Calcium is a metal in Group 2 of the Periodic Table.

(a) A sample of calcium is added to cold water.
Colourless aqueous calcium hydroxide, $\text{Ca}(\text{OH})_2$, and a colourless gas are formed.

(i) Name the gas formed in the reaction.

..... [1]

(ii) Aqueous calcium hydroxide is an alkali.
State the formula of the ion that causes the solution to be alkaline.

..... [1]

(iii) A pH meter can be used to measure the pH of aqueous calcium hydroxide.
Describe one **other** way in which the pH of aqueous calcium hydroxide is measured.

.....
.....
.....
.....[2]

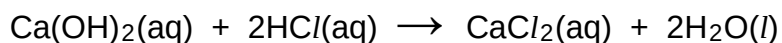
(b) A sample of 250 cm^3 of aqueous calcium hydroxide is added to an excess of hydrochloric acid.

(i) The concentration of the aqueous calcium hydroxide is 0.150 mol / dm^3 .

Calculate the number of moles of calcium hydroxide in the sample.

number of moles = mol [2]

- (ii) The equation for the reaction between aqueous calcium hydroxide and hydrochloric acid is shown.



Deduce the number of moles of hydrochloric acid that react with the calcium hydroxide.

number of moles = mol [1]

- (c) Rubidium also reacts with cold water.

Compare the observations of the reaction of calcium and cold water with the reaction of rubidium and cold water.

In your answer you should include at least one similarity and at least one difference.

.....
.....
.....
.....
.....[3]

[Total: 10]

- 10** Magnesium carbonate reacts with sulfuric acid to form carbon dioxide gas. Four separate experiments were conducted using 5 g of magnesium carbonate and excess sulfuric acid. The conditions of each experiment are shown in Table 10.1.

Table 10.1

experiment	size of MgCO_3	temperature / $^{\circ}\text{C}$	concentration of H_2SO_4 / mol / dm^3
1	lumps	30	1.00
2	powder	30	1.00
3	lumps	40	1.00
4	powder	40	2.00

- (a)** Draw a labelled diagram showing the set-up of apparatus that can be used to collect and measure the volume of gas produced in the experiment.

[2]

- (b)** State two experiments that could be compared to show the effects of temperature on the rate of reaction.

..... and[1]

- (c)** Using the idea of collision between particles, explain how increasing the temperature increases the rate of reaction between magnesium carbonate and sulfuric acid.

.....

.....

.....

.....[2]

- (d) Fig. 10.1 shows a graph of the results for experiment 1.
Draw a curve on Fig. 10.1 to show the results of experiment 2.
Label this curve 'experiment 2'.

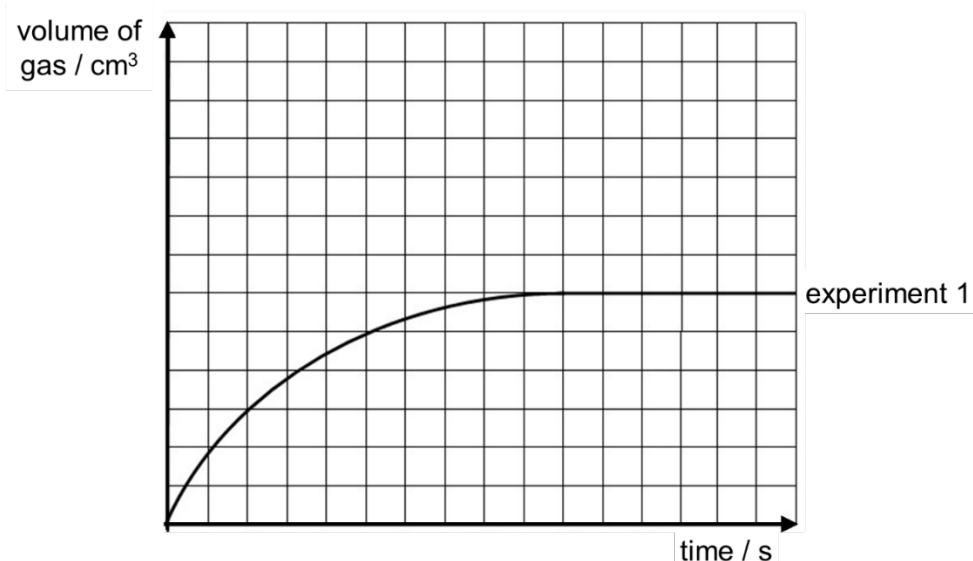


Fig. 10.1

[1]

- (e) Describe how you would determine in the laboratory if the reaction of magnesium carbonate with dilute sulfuric acid is an exothermic or endothermic reaction.
Include all measurements or observations you will make.

.....

.....

.....

.....

.....

.....

.....

..... [4]

End of paper

[Total: 10]

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Data Sheet

Colours of Some Common Metal Hydroxides

aluminium hydroxide	white
calcium hydroxide	white
copper(II) hydroxide	light blue
iron(II) hydroxide	green
iron(III) hydroxide	red-brown
zinc hydroxide	white

The Periodic Table of Elements

Group																		
1	2																17	18
		1 Hhydrogen 1																
		2 Hehelium 4																
		3 Li 7																
		4 Be 9																
		5 B 11																
		6 C 12																
		7 N 14																
		8 O 16																
		9 F 19																
		10 Ne 20																
		11 Na 23																
		12 Mg 24																
		13 Al 27																
		14 Si 28																
		15 P 31																
		16 S 32																
		17 Cl 35.5																
		18 Ar 40																
		19 K 39																
		20 Ca 40																
		21 Sc 45																
		22 Ti 48																
		23 V 51																
		24 Cr 52																
		25 Mn 55																
		26 Fe 56																
		27 Co 59																
		28 Ni 59																
		29 Cu 64																
		30 Zn 65																
		31 Ga 70																
		32 Ge 73																
		33 As 75																
		34 Se 79																
		35 Br 80																
		36 Kr 84																
		37 Rb 85																
		38 Sr 88																
		39 Y 89																
		40 Zr 91																
		41 Nb 93																
		42 Mo 96																
		43 Tc –																
		44 Ru 101																
		45 Rh 103																
		46 Pd 106																
		47 Ag 108																
		48 Cd 112																
		49 In 115																
		50 Sn 119																
		51 Sb 122																
		52 Te 128																
		53 I 127																
		54 Xe 131																
		55 Cs 133																
		56 Ba 137																
		57–71 lanthanoids																
		58 Hf 178																
		59 Ta 181																
		60 W 184																
		61 Re 186																
		62 Os 190																
		63 Ir 192																
		64 Pt 195																
		65 Au 197																
		66 Hg 201																
		67 Tl 204																
		68 Pb 207																
		69 Bi 209																
		70 Po –																
		71 At –																
		72 Rn –																
		73 Fr –																
		74 Ra –																
		75–103 actinoids																
		76 Rf –																
		77 Db –																
		78 Sg –																
		79 Bh –																
		80 Hs –																
		81 Meitnerium –																
		82 Ds –																
		83 Rg –																
		84 Cn –																
		85 Nh –																
		86 Flerovium –																
		87 Mc –																
		88 Lv –																
		89 Ts –																
		90 Og –																
		91 Gh –																
		92 Un –																
		93 Nb –																
		94 Pu –																
		95 Am –																
		96 Cm –																
		97 Bk –																
		98 Cf –																
		99 Es –																
		100 Fm –																
		101 Md –																
		102 No –																
		103 Lr –																
		104 Lawrencium –																
		105 – –																

The volume of one mole of any gas is 24 dm³ at room temperature and pressure (r.t.p.).
The Avogadro constant, $L = 6.02 \times 10^{23} \text{ mol}^{-1}$.

