SERVE-LEAD-EXCEL

GREENDALE SECONDARY SCHOOL
Preliminary Examination 2024

STUDENT NAME

CLASS 4 | TEACHING GROUP | REG. NO

SCIENCE (CHEMISTRY)
Paper 3 Multiple Choice

5105/03
5107/03
Papers 3 and 4: 1 hour 15 minutes

Additional Materials: Multiple Choice Answer Sheet

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.
Do not use staples, paper clips, glue or correction fluid.
Write your name, class, teaching group and register number in the spaces provided above and on the Multiple Choice Answer Sheet provided.

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

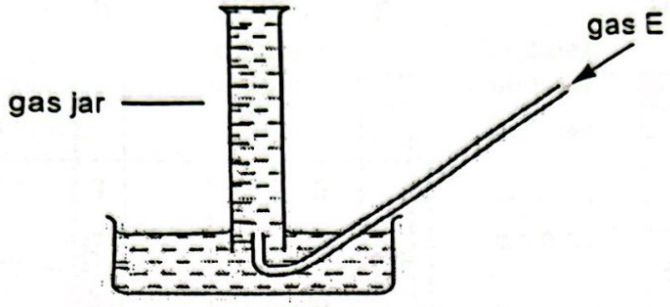
Answers to Paper 3 and Paper 4 must be handed in separately.
Each correct answer will score one mark. A mark will not be deducted for a wrong answer.
You are advised to spend no more than **30 minutes** on **Paper 3**.
You may proceed to answer Paper 4 as soon as you have completed Paper 3.
Any rough working should be done in this booklet.
A copy of the Periodic Table is printed on page 8.
The use of an approved scientific calculator is expected, where appropriate

This document consists of 8 printed pages.

[Turn over

Scanned with CamScanner

1 The diagram shows a method of collecting gases.



Which conclusion(s) about gas E must be correct?

1 Gas E is insoluble in water.
2 Gas E is less dense than air.
3 Gas E is soluble in water.

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

2 Some statements about atoms are listed.

1 Atoms are electrically neutral.
2 The mass of an atom is almost entirely due to its nucleus.
3 The nucleus and the electrons repel each other.
4 The nucleus is negatively charged.

Which statements are correct?

A 1 and 2 B 1 and 4
C 2 and 4 D 2, 3 and 4

3 Which pair of atoms contains the same number of neutrons?

A $^{59}_{27}Co$ and $^{59}_{28}Ni$

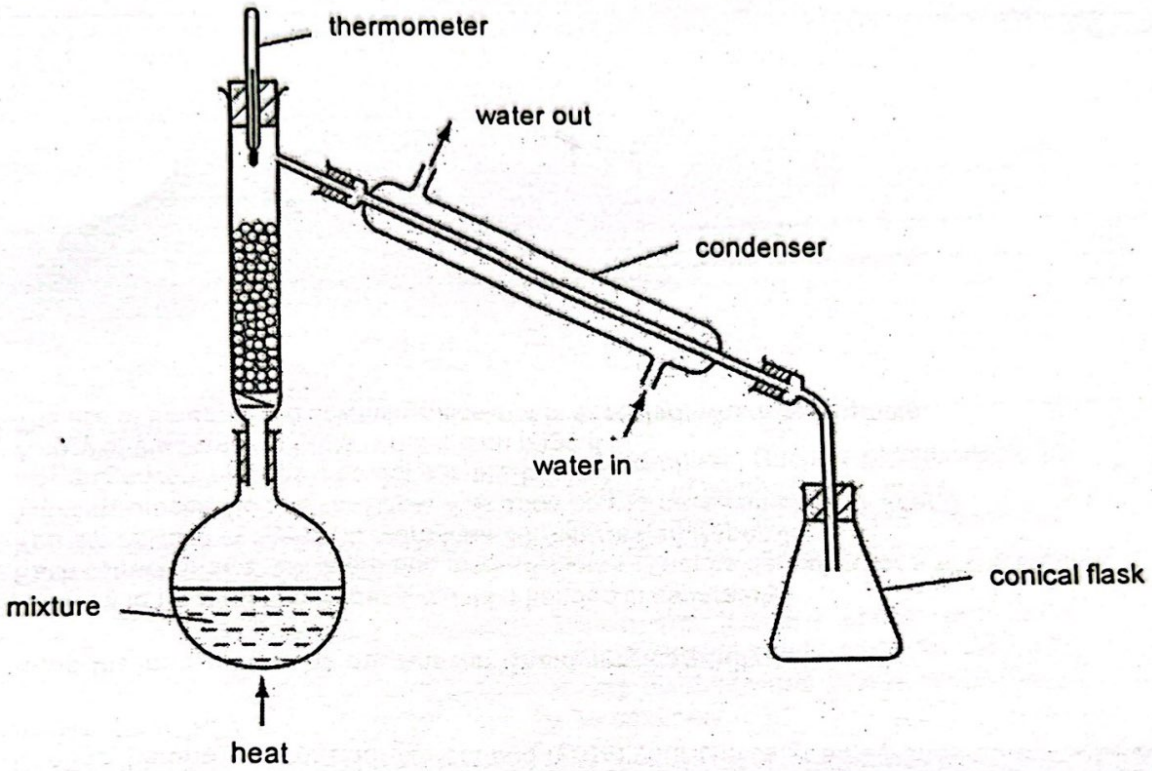
B $^{64}_{29}Cu$ and $^{65}_{29}Cu$

C $^{64}_{29}Cu$ and $^{65}_{30}Zn$

D $^{65}_{29}Cu$ and $^{65}_{30}Zn$

Scanned with CamScanner

4 A student tries to separate a mixture of ethanol and water by fractional distillation using the apparatus shown.



Which error has the student made?

A The condenser is at the wrong angle.

B The thermometer is in the wrong position.

C The top of the conical flask should be open.

D The water enters the condenser in the wrong place.

5 Which process changes an oxygen atom, O, into an oxide ion, O^{2-}?

A electron gain

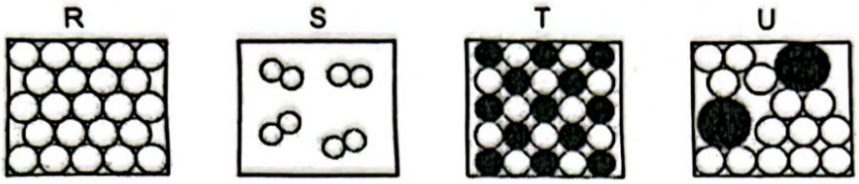
B electron loss

C proton gain

D proton loss

Scanned with CamScanner

6 The diagrams show the arrangement of particles in four substances.



Which row correctly describes these four substances?

	R	S	T	U
A	compound	compound	element	element
B	element	compound	mixture	mixture
C	element	element	compound	mixture
D	mixture	mixture	compound	compound

7 Which row shows the general properties of an ionic compound?

	melting point	soluble in water	conducts electricity in solid state	conducts electricity in liquid state
A	high	no	no	yes
B	high	yes	no	yes
C	low	no	no	no
D	low	yes	yes	yes

8 Aluminium and oxygen react together to form aluminium oxide.

$$xAl(s) + yO_2(g) \rightarrow zAl_2O_3(s)$$

What values for x, y and z balance the equation?

	x	y	z
A	2	1	2
B	2	2	2
C	4	2	2
D	4	3	2

Scanned with CamScanner

9 Flowers of a hydrangea bush are blue when grown in acidic soil and pink when the soil is alkaline.

Which substance is added to the soil of a hydrangea with blue flowers so that it produces pink flowers?

A calcium hydroxide
B calcium sulfate
C copper(II) hydroxide
D copper(II) sulfate

10 The relative atomic mass, A_r, of hydrogen is defined by comparing the average mass of one hydrogen atom with the mass of another atom, X.

What is X?

A ^{1}H B ^{2}H C ^{12}C D ^{13}C

11 What is the similarity between elements placed in the same group in the Periodic Table?

A the number of completely filled electron shells
B the number of electrons in the shell closest to the nucleus
C the number of electrons in the shell furthest from the nucleus
D the number of protons in the nucleus

12 Solder is an alloy of lead and tin. It is used for joining pieces of metals together.

Which statement about solder is correct?

A It contains lead and tin chemically combined together.
B It has a fixed melting point.
C It is a compound.
D Layers of lead atoms cannot slide over one another easily.

13 Iron can be extracted from its ore using carbon.

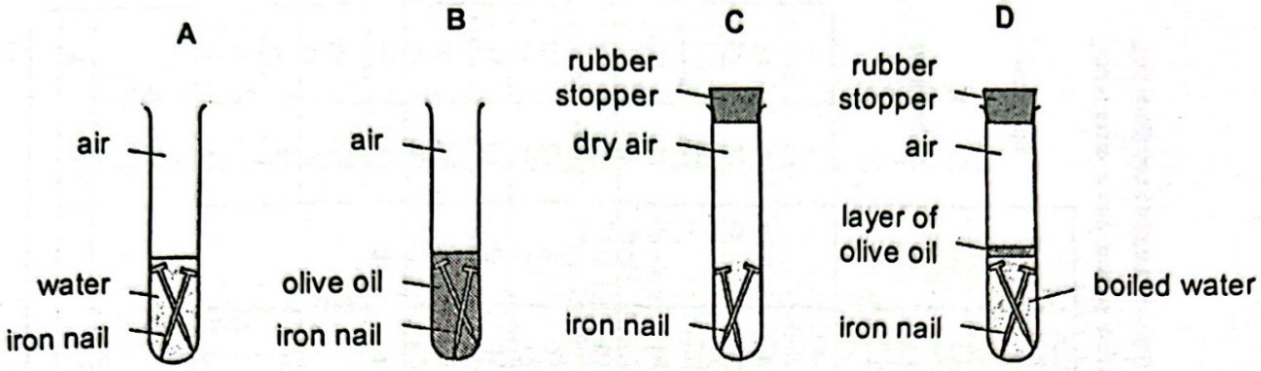
Aluminium cannot be extracted from its ore using carbon.

Which statement explains why iron can be extracted using carbon?

A Aluminium is more reactive than carbon.
B Iron is less reactive than aluminium.
C Iron is less reactive than carbon.
D Iron is denser than aluminium.

Scanned with CamScanner

14 In which test-tube does the iron nails rust the most after a few days?



15 Which volume of gas contains approximately 15 cm^3 of oxygen?

A 15 cm^3 B 30 cm^3

C 75 cm^3 D 100 cm^3

16 A metal statue in a city begins to be worn away.

Which gas could have caused this damage?

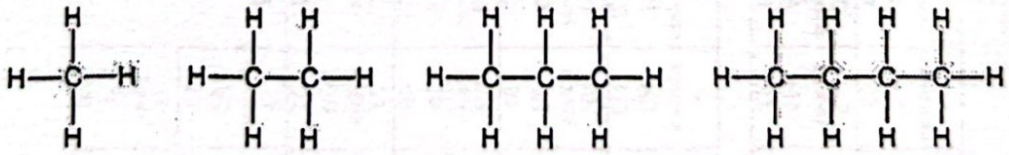
A carbon monoxide

B methane

C sulfur dioxide

D unburnt hydrocarbon

17 The diagram shows the first four members of a homologous series.



What is the difference in molecular formula between one member and the next in the series?

A CH B CH_2 C CH_3 D CH_4

Scanned with CamScanner

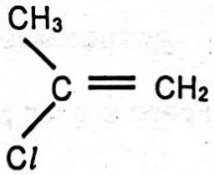
18 Which row describes a polyunsaturated molecule?

	number of double bonds	type of double bonds
A	several	carbon to carbon
B	several	carbon to hydrogen
C	one	carbon to carbon
D	one	carbon to hydrogen

19 Which is the main source of biofuel?

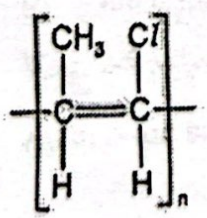
A crude oil
B natural gas
C plastic
D sugarcane

20 The structure of a monomer is shown.

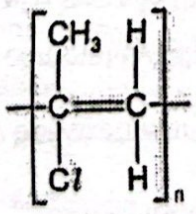


What is the structure of the polymer formed by this monomer?

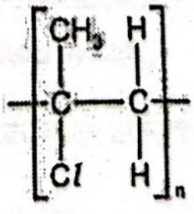
A



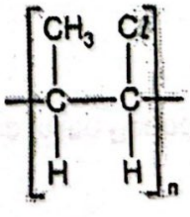
B



C



D



END OF PAPER

Scanned with CamScanner

The Periodic Table of Elements

Group 1	Group 2											Group 13	Group 14	Group 15	Group 16	Group 17	Group 18
							1 H hydrogen 1										2 He helium 4
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	3	4	5	6	7	8	9	10	11	12	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 oganesson –

Key: proton (atomic) number; atomic symbol; name; relative atomic mass

lanthanoids	57 La lanthanum 139	58 Ce cerium 140	59 Pr praseodymium 141	60 Nd neodymium 144	61 Pm promethium –	62 Sm samarium 150	63 Eu europium 152	64 Gd gadolinium 157	65 Tb terbium 159	66 Dy dysprosium 163	67 Ho holmium 165	68 Er erbium 167	69 Tm thulium 169	70 Yb ytterbium 173	71 Lu lutetium 175
actinoids	89 Ac actinium –	90 Th thorium 232	91 Pa protactinium 231	92 U uranium 238	93 Np neptunium –	94 Pu plutonium –	95 Am americium –	96 Cm curium –	97 Bk berkelium –	98 Cf californium –	99 Es einsteinium –	100 Fm fermium –	101 Md mendelevium –	102 No nobelium –	103 Lr lawrencium –

The volume of one mole of any gas is 24 dm^3 at room temperature and pressure (r.t.p.).

The Avogadro constant, $L = 6.02 \times 10^{23}\ mol^{-1}$

Scanned with CamScanner

GREENDALE SECONDARY SCHOOL
Preliminary Examination 2024

SERVE-LEAD-EXCEL

STUDENT NAME

CLASS 4 | TEACHING GROUP | REG. NO

SCIENCE
Paper 4 Chemistry

5105/04
5107/04
Papers 3 and 4: 1 hour 15 minutes

Students answer on the Question Paper.
No Additional Materials are Required.

READ THESE INSTRUCTIONS FIRST

Write your name, class, teaching group and register number in the spaces provided above.
Write in dark blue or black pen.
You may use an HB pencil for any diagrams or graphs.
Do not use staples, paper clips, glue or correction fluid.

Section A
Answer **all** questions.
Write your answers in the spaces provided.

Section B
Answer **one** question.
Write your answers in the spaces provided.

The use of an approved scientific calculator is expected, where appropriate.
In calculations, you should show all the steps in your working, giving your answer at each stage.
You are advised to spend no longer than 30 minutes on Paper 3.
You may proceed to answer Paper 4 as soon as you have completed Paper 3.
A copy of the Periodic Table is printed on page 12.

At the end of the examination hand in your answers to Paper 3 and Paper 4 separately.
The number of marks is given in brackets [ ] at the end of each question or part question.

Scanned with CamScanner

Section A

Answer all questions.

1 Table 1.1 shows information about five elements J, K, L, M and N.

The letters do **not** represent the chemical symbols of the elements.

Table 1.1

element	melting point / °C	boiling point / °C	electrical conductivity	nature of oxide
J	–7	58	poor	acidic
K	98	890	good	basic
L	119	444	poor	acidic
M	–112	–118	poor	no oxide
N	1083	2582	good	basic

Use the letters J, K, L, M and N to answer the following questions.

(a) Which is a liquid at 25 °C?

.....[1]

(b) Which is a Group 1 element?

.....[1]

(c) Which is a noble gas?

.....[1]

[Total: 3]

Scanned with CamScanner

2 Carbon dioxide, CO_2, is a gas found in air. It is the primary greenhouse gas produced by human activities.

(a) What is meant by a *greenhouse gas*?

.....

.....[1]

(b) Draw a 'dot-and-cross' diagram to show one molecule of carbon dioxide, CO_2. Show only the outer shell electrons.

[2]

(c) Carbon dioxide exists as a gas at room temperature and pressure.

With reference to the bonding, explain why carbon dioxide has a low boiling point.

.....

.....

..... [2]

[Total: 5]

Scanned with CamScanner

3 A student wants to investigate how different metals will react with cold water and steam. Table 3.1 shows some observations made when three known metals are treated separately with cold water and steam.

Table 3.1

metal	observations with cold water	observations with steam
calcium	reacts readily with many gas bubbles seen	reacts explosively
magnesium	slow reaction with few gas bubbles seen	reacts vigorously with a bright glow
iron	no observable change	reacts very slowly

(a) Suggest what the student will observe when zinc is treated with steam.

.....[1]

(b) Calcium metal reacts with excess cold water in the equation below.

$$Ca + 2H_2O \rightarrow Ca(OH)_2 + H_2$$

The student wanted to collect the gas and measure the volume of hydrogen gas collected at fixed time intervals. Hydrogen gas is less dense than air.

From the apparatus available in the science laboratory, the student first chose an apparatus to collect and measure the volume of gas produced. However, the student found that the apparatus was **unable** to collect the gas. There was **no gas** collected and found in the apparatus. Fig. 3.1 shows three apparatus available in the science laboratory.

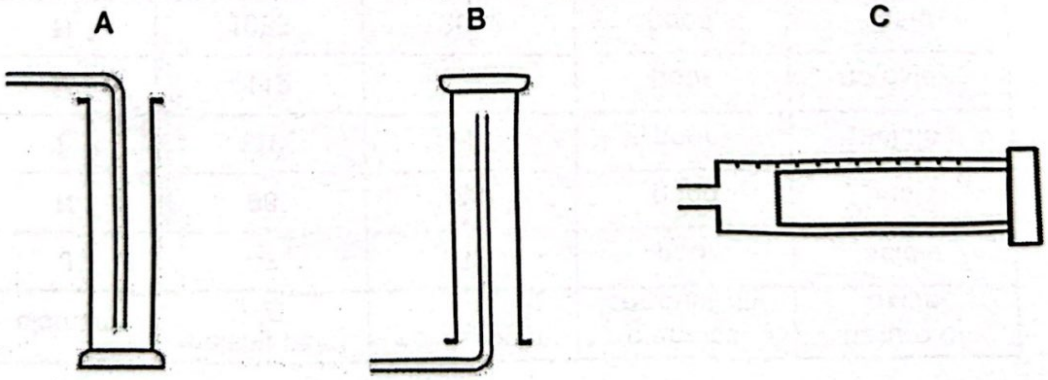


Fig. 3.1

(i) From Fig. 3.1, choose the **letter** for the piece of apparatus the student most likely first chose.

apparatus ..... [1]

Scanned with CamScanner

(ii) The student chose another apparatus and was able to collect and measure the volume of gas produced.

From Fig. 3.1, state the **letter** for the piece of apparatus used and **name** the apparatus.

apparatus ..... name of apparatus ..... [1]

Fig. 3.2 shows the graph for the experiment.

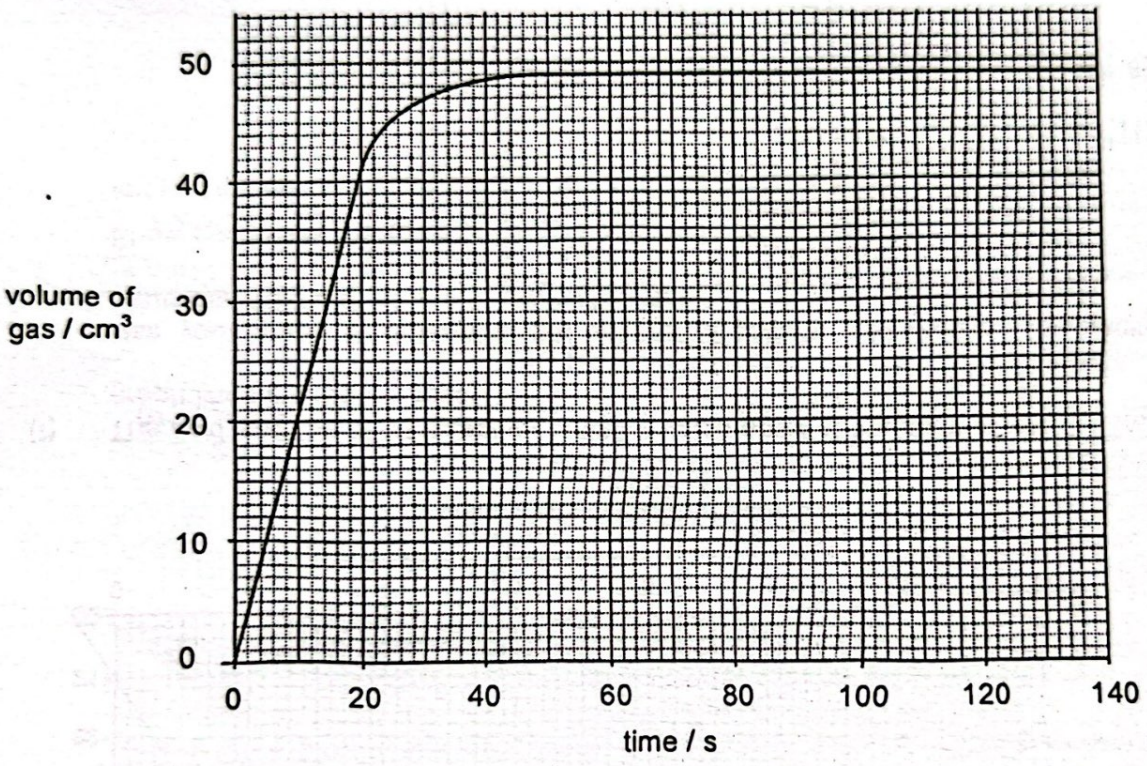


Fig. 3.2

(iii) What is the maximum volume of gas collected?

..... [1]

(iv) Calculate the number of moles of $Ca(OH)_2$ present in 18.5 g of pure calcium hydroxide.
[relative atomic masses A_r: Ca, 40; O, 16; H, 1]

amount of $Ca(OH)_2$ = ... mol [2]

[Total: 6]

Scanned with CamScanner

4 An experiment is carried out to investigate the reaction between potassium hydroxide and sulfuric acid. The reaction is known as neutralisation.

Exactly 10.0 cm^3 of potassium hydroxide solution is measured and transferred to a conical flask.

A 2.00 cm^3 portion of dilute sulfuric acid is added into the conical flask. The mixture is stirred and the highest temperature reached is measured and recorded.

Six further 2.00 cm^3 portions of dilute sulfuric acid are added. Each time the mixture is stirred and the temperature is measured and recorded.

The results for this experiment are shown in Table 4.1.

Table 4.1

volume of acid added / cm^3	0.00	2.00	4.00	6.00	8.00	10.00	12.00	14.00
temperature of the mixture / °C	21.0	24.2	27.4	30.7	32.9	31.2	29.4	27.6

(a) Write an ionic equation, including state symbols, to show what is meant by the term *neutralisation*.

.....[2]

(b) Name the salt produced.

name ..... [1]

(c) What is the apparatus used to add **exactly** 2.00 cm^3 portions of dilute sulfuric acid into the conical flask?

.....[1]

(d) The particles in the mixture move faster as the volume of acid added increases from 0.00 cm^3 to 8.00 cm^3.

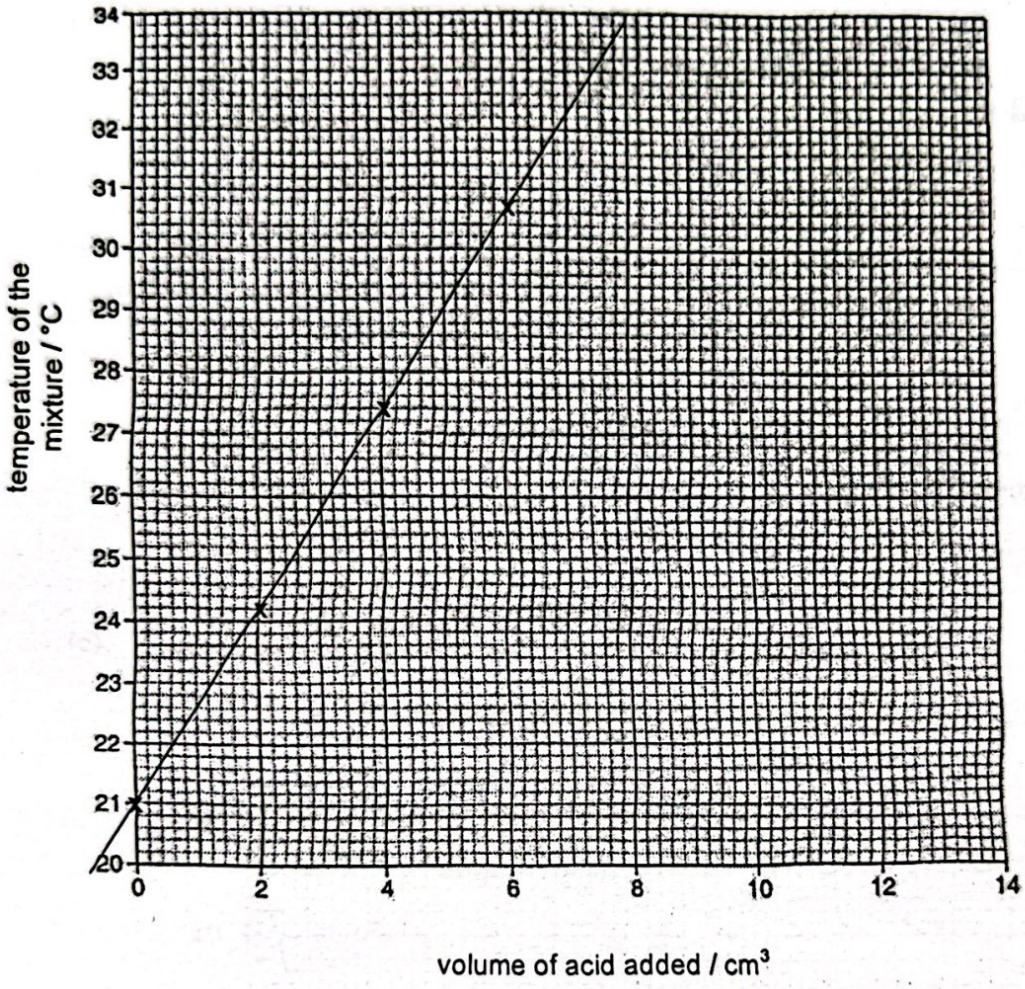
Use the data from Table 4.1 to suggest why the particles move faster.

.....[1]

(e) **(i)** Four points have been plotted on the grid and a best-fit line has been drawn. On the grid, plot the remaining four points. Mark each point with a cross (x). [1]

(ii) Draw a best-fit line for these four points. Extend this line to intersect (cross) the line already drawn. [1]

Scanned with CamScanner



(f) The acid and the alkali exactly neutralise each other at the point where the two graph lines intersect (cross).

Use your graph to determine the volume of sulfuric acid required to exactly neutralise 10.0 cm^3 of potassium hydroxide.

Show clearly **on the graph** how you obtained your answer.

volume = ... cm^3 [1]

[Total: 8]

Scanned with CamScanner

Section B

Answer **one** question from this section.

5 Fig. 5.1 shows some elements in the Periodic Table.

Group	1	2	13	14	15	16	17	18
Period 2	Ll						F	
Period 3	Na						Cl	
Period 4	K						Br	

Fig. 5.1

(a) Put a tick (✓) in **one** box for each row to show whether the following statements about the trends of these elements in Fig. 5.1 are true or false.

	true	false
Potassium has a lower melting point than sodium.		
Melting point decreases from fluorine to bromine.		
As the number of electron shells of halogens increases, the colour of the elements become darker.		
Metallic character increases across Period 3 from left to right.		

[2]

(b) Sodium is placed into water.

(i) Describe the change you would observe when Universal Indicator is added into the reaction mixture.

.....

..... [1]

(ii) Hydrogen gas is produced when sodium reacts with water.

Describe a test to confirm that hydrogen gas is produced.

test.....

observation.....[2]

Scanned with CamScanner

(c) Iodine is an element found in group 17 and period 5 of the Periodic Table. 6

Iodine, I_2, is produced by passing chlorine gas, Cl_2, through sodium iodide, NaI, solution. The other product formed is sodium chloride.

Fig. 5.2 shows how this can be demonstrated in the laboratory.

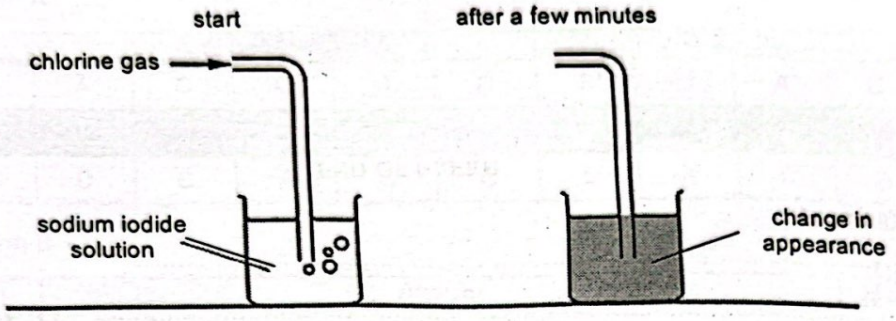


Fig. 5.2

(i) The electronic configuration of some Group 17 elements are shown in Table 5.1.

Table 5.1

elements	electronic configuration
F	2.7
Cl	2.8.7
Br	2.8.18.7

State the number of electron shells and number of valence electrons an atom of iodine has.

number of electron shells: .....

number of valence electrons: .....[1]

(ii) Write a balanced chemical equation for the reaction between chlorine gas and sodium iodide solution.

..... [1]

(iii) Explain why this reaction takes place.

.....

..... [1]

[Total: 8]

Scanned with CamScanner

6 (a) Alkanes and alkenes belong to two different homologous series.

(i) Write the general formula for each series.

alkanes .....

alkenes .....
[1]

(ii) Describe a method you could use and the observations you would expect to make to distinguish between two gases, ethane and ethene.

method

.....

.....

observations

.....

.....

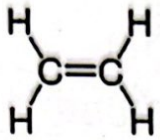
.....

.....

.....[3]

Scanned with CamScanner

(b) The structure of ethene is shown.



(i) Ethene is used to make the polymer poly(ethene).

Draw the full structural formula of two repeating units of poly(ethene).

Show all the bonds in your answer.

[1]

(ii) Name the type of reaction that takes place when the polymer poly(ethene) is formed.

..... [1]

(iii) State a use of poly(ethene).

..... [1]

(iv) Describe **one** pollution problem caused by the disposal of poly(ethene).

.....

.....[1]

[Total: 8]

END OF PAPER

Scanned with CamScanner

The Periodic Table of Elements

Group 1	Group 2											Group 13	Group 14	Group 15	Group 16	Group 17	Group 18
							1 H hydrogen 1										2 He helium 4
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	3	4	5	6	7	8	9	10	11	12	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 darmstadium –	111 Rg roentgenium –	112 Cn copernicium –	113 Nh nihonium –	114 Fl flerovium –	115 Mc moscovium –	116 Lv livermorium –	117 Ts tennessine –	118 Og oganesson –

Key: proton (atomic) number; atomic symbol; name; relative atomic mass

lanthanoids	57 La lanthanum 139	58 Ce cerium 140	59 Pr praseodymium 141	60 Nd neodymium 144	61 Pm promethium –	62 Sm samarium 150	63 Eu europium 152	64 Gd gadolinium 157	65 Tb terbium 159	66 Dy dysprosium 163	67 Ho holmium 165	68 Er erbium 167	69 Tm thulium 169	70 Yb ytterbium 173	71 Lu lutetium 175
actinoids	89 Ac actinium –	90 Th thorium 232	91 Pa protactinium 231	92 U uranium 238	93 Np neptunium –	94 Pu plutonium –	95 Am americium –	96 Cm curium –	97 Bk berkelium –	98 Cf californium –	99 Es einsteinium –	100 Fm fermium –	101 Md mendelevium –	102 No nobelium –	103 Lr lawrencium –

The volume of one mole of any gas is 24 dm^3 at room temperature and pressure (r.t.p.).

The Avogadro constant, $L = 6.02 \times 10^{23}\ mol^{-1}$

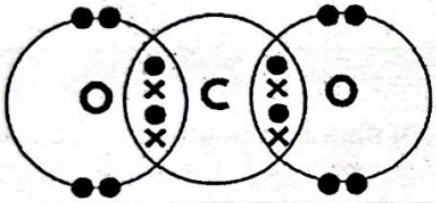
Scanned with CamScanner

NA Science (Chemistry)
Secondary 4
2024 Prelim Answers

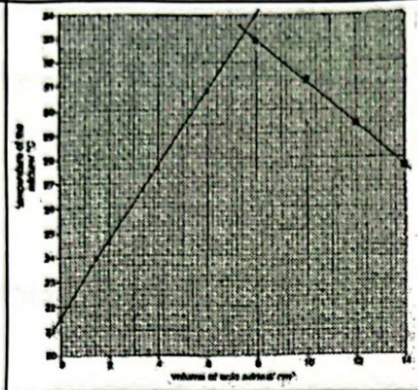
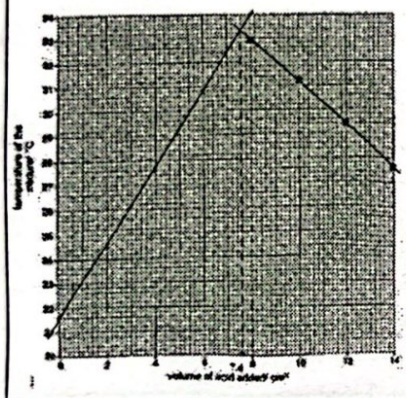
Section A

1	2	3	4	5	6	7	8	9	10
A	A	C	C	A	C	B	D	A	C
11	12	13	14	15	16	17	18	19	20
C	D	C	A	C	C	B	A	D	B

Section B

Qn	Answer	Mark
1(a)	J	[1]
1(b)	K	[1]
1(c)	M	[1]
	TOTAL	[3]
2(a)	Traps heat and lead to global warming	[1]
2(b)		[2]
2(c)	Little energy [1] required to overcome weak intermolecular forces of attraction between the carbon dioxide molecules. [1]	[2]
	TOTAL	[5]
3(a)	Reacts readily	[1]
3(b)(i)	A	[1]
3(b)(ii)	C, gas syringe	[1]
3(b)(iii)	49 cm^3	[1]
3(b)(iv)	Number of moles = 18.5/[40+2(16) + 2(1)] = 0.25/0.250 mol	[1] [1]
	TOTAL	[6]
4(a)	H^+ (aq) + OH^- (aq) → H_2O (l)	[2]
4(b)	Potassium sulfate	[1]
4(c)	Burette	[1]
4(d)	Increase in temperature	[1]

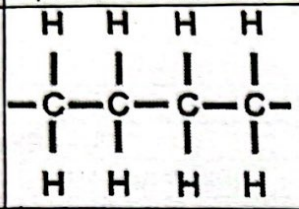
Scanned with CamScanner

Qn	Answer	Mark
4(e)(i)		[1]
4(e)(ii)	Best fit line cutting through all the points	[1]
4(f)	7.6 and dotted line shown on graph 	[1]
	TOTAL	[8]

Section C

Qn	Answer	Mark
5(a)	True, False, True, False	[2]
5(b)(i)	Universal indicator changes from green to violet.	[1]
5(b)(ii)	Place a lighted splint near the gas; Lighted splint is extinguished with a 'pop' sound.	[2]
5(c)(i)	5 AND 7	[1]
5(c)(ii)	$Cl_2 + 2NaI \rightarrow 2NaCl + I_2$	[1]
5(c)(iii)	Chlorine is more reactive than iodine hence chlorine can displace iodine from sodium iodide solution.	[1]
	TOTAL	[8]
6(a)(i)	C_nH_{2n+2} AND C_nH_{2n}	[1]
6(a)(ii)	Bubble both gases into aqueous bromine separately;[1]	[3]

Scanned with CamScanner

	Aqueous bromine changes from reddish brown to colourless with ethene.; Aqueous bromine remains reddish brown with ethane	
6(b)(i)		[1]
6(b)(ii)	Addition (reaction)	[1]
6(b)(iii)	Make plastic bags/plastic toys/plastic bottles	[1]
6(b)(iv)	Any one: • Land pollution – plastics do not decompose. Burying plastic waste in landfills leads to an increasing amount of built-up solid waste. • Air pollution – upon incineration (burning the plastics), poisonous gases are produced. For example, PVC produces corrosive hydrogen chloride gas on combustion. • Water pollution – plastics thrown into the sea endanger marine animals. For example, turtles often mistake plastic bags for food and choke on them. Plastics may clog up rivers and drains which might become breeding grounds for mosquitoes.	[1]
	TOTAL	[8]

Scanned with CamScanner