Register No.	Class

Name _____

Bendemeer Secondary School Bendemeer Secondary School Bendemeer Secondary School Bendemeer Secondary School Bendemeer Secondary School Bendemeer Secondary School

BENDEMEER SECONDARY SCHOOL
2019 PRELIMINARY EXAMINATION
SECONDARY 4 EXPRESS / 5 NORMAL (ACADEMIC)
SCIENCE (CHEMISTRY, BIOLOGY) PAPER 1
5078/01

DATE : **30 Aug 2019**
DURATION : **1 hour**

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.
Write your name, class and register number on the work you hand in.
Do not use paper clips, glue or correction fluid.

There are **forty** 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 2B pencil on the OTAS sheet.

Read the instructions on the OTAS sheet very carefully.

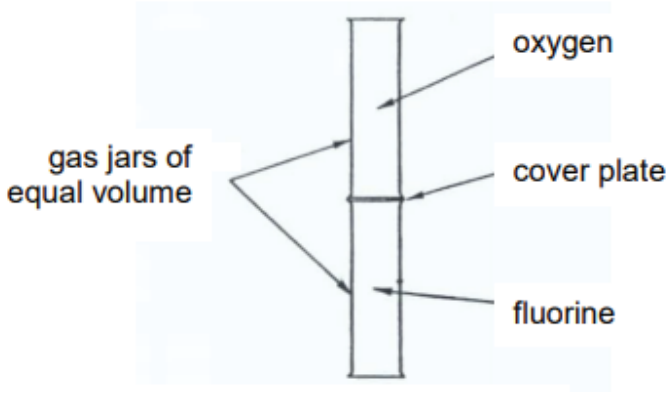
Each correct answer will score one mark. A mark will not be deducted for a wrong answer.
Any rough working should be done on the question paper.
A copy of the Periodic Table is printed on page 18.
The use of an approved scientific calculator is expected, where appropriate.

40

This document consists of **18** printed pages.

[Turn over

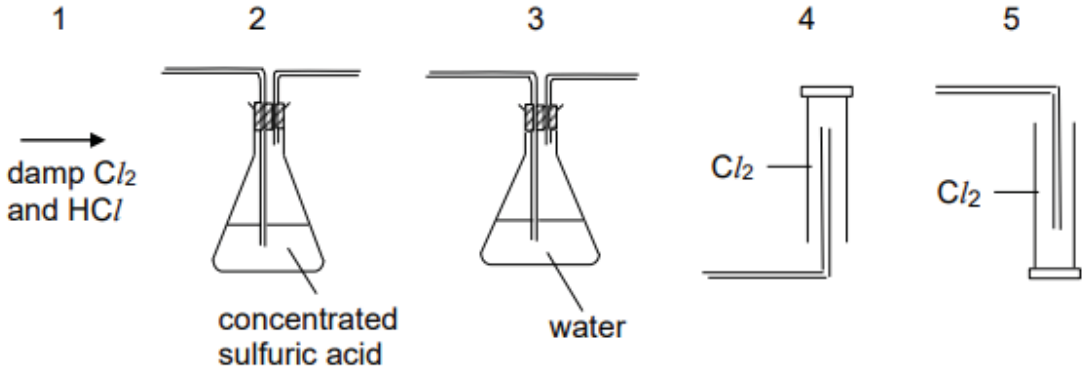
1 The cover-plates were removed from the gas jars in the apparatus shown below. It was seen that after several days, the colour of the gas was the same in both jars.



What is the best explanation for this?

A Both gases contain equal numbers of molecules.
B Both gases have equal densities.
C Oxygen and fluorine molecules are moving rapidly in all directions.
D Oxygen and fluorine molecules diffuse at the same rate.

2 Hydrogen chloride is very soluble in water whereas chlorine is only slightly soluble in water. In what order should the pieces of apparatus shown be joined together in order to collect pure, dry chlorine from a sample of damp chlorine containing a small amount of hydrogen chloride?



A 1, 2, 3, 4
B 1, 2, 3, 5
C 1, 3, 2, 4
D 1, 3, 2, 5

3 The boiling points of various gases found in the air are shown below.

gas	boiling point / °C
argon	–186
carbon dioxide	–78
nitrogen	–198
oxygen	–183

If the air is cooled, the first substance to condense is water.
If the temperature is lowered further, what is the next substance to condense?

A argon
B carbon dioxide
C nitrogen
D oxygen

4 The following reaction can be used to prepare lead(II) iodide.

$$Pb(NO_3)_2(aq) + 2KI(aq) \rightarrow 2KNO_3(aq) + PbI_2(s)$$

Which method is used to separate lead(II) iodide from the above mixture?

A crystallization
B distillation
C filtration
D sublimation

5 Hexasulfur was prepared by M.R. Engel in 1891 by reacting concentrated hydrochloric acid with thiosulfate, $HS_2O_3^-$. It is orange-red and forms a rhombohedral crystal. It has a formula of S_6.

What can you deduce from the information given above?

A Hexasulfur contains only one element.
B Hexasulfur is a compound which contains 6 atoms.
C Hexasulfur is a compound which contains 6 elements.
D Hexasulfur is a mixture which contains 6 elements.

6 Three elements, X, Y and Z, have consecutive, increasing proton numbers. If element X is in Group IV, what will be the symbol for the ion of element Z in its compounds?

A Z^{2-} **B** Z^- **C** Z^+ **D** Z^{2+}

7 Element X has 7 protons. Element Y has 8 more protons than X.

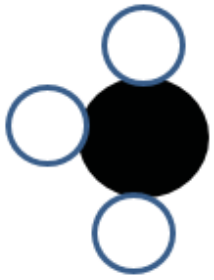
Which statement about element Y is not correct?

A Y has more electron shells than X.
B Y has the same number of valence electrons as X.
C Y is in the same group of the Periodic Table as X.
D Y is in the same period of the Periodic Table as X.

8 Which statement about both chlorine atoms and chloride ions is correct?

A They are chemically identical.
B They are isotopes of chlorine.
C They have the same number of protons.
D They have the same physical properties.

9 The following diagram shows the structure of one molecule of a substance.



What are the possible electronic configurations for the elements in the above substance?

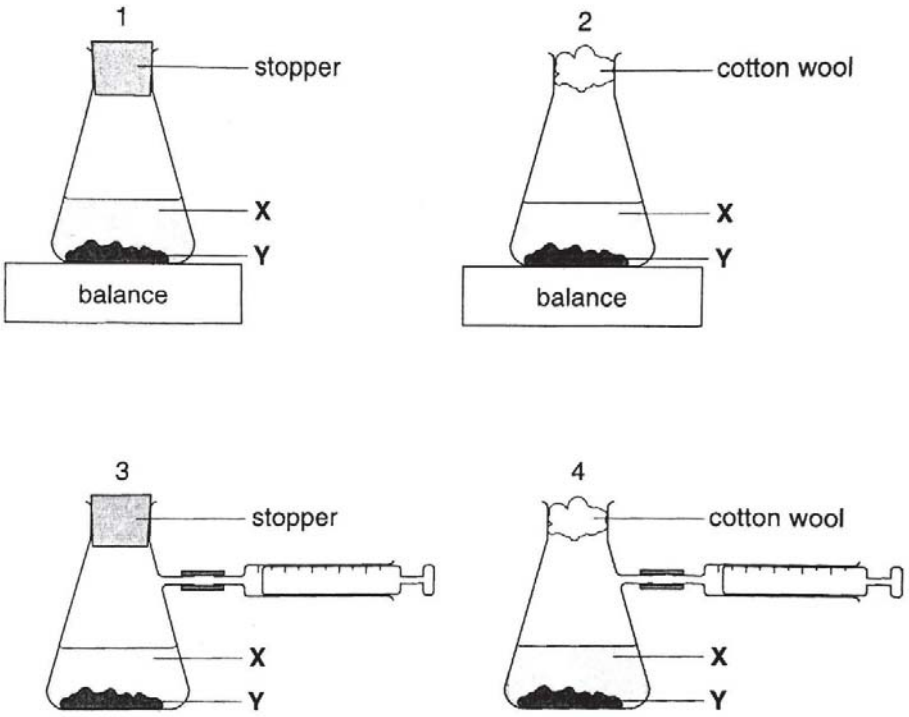
A	1	2.3
B	2.6	2.5
C	2.7	2.3
D	2.8.7	2.5

10 A student thinks that element Q is a metal because it has a high melting point and a high boiling point. What other properties could element Q have to show that it is a metal?

1 Q conducts electricity when solid.
2 Q forms an acidic oxide, QO_2.
3 Q is malleable.

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

11 Liquid X reacts with solid Y to form a gas.
Which two diagrams show suitable methods for investigating the speed of reaction?



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

12 The table gives information about the reactivity of three metals P, Q and R.

metal	reaction with air	reaction with steam	reaction with dilute hydrochloric acid
P	burns with sparks	forms an oxide	forms hydrogen
Q	slowly forms an oxide	no reaction	no reaction
R	slowly forms an oxide	no reaction	forms hydrogen

What is the order of reactivity of P, Q and R?

	most reactive	→	least reactive
A	P	Q	R
B	P	R	Q
C	Q	R	P
D	R	Q	P

13 A steel works and a chemical works are built near to a city. The limestone buildings in the city begin to crumble.

Which gas is most likely to cause this damage?

A carbon dioxide
B carbon monoxide
C nitrogen
D sulfur dioxide

14 Limestone, $CaCO_3$, decomposes when heated as shown in the equation.

$$CaCO_3 \rightarrow CaO + CO_2$$

What is the mass of limestone needed to produce 84 kg of calcium oxide?

A 150 kg
B 280 kg
C 840 kg
D 1000 kg

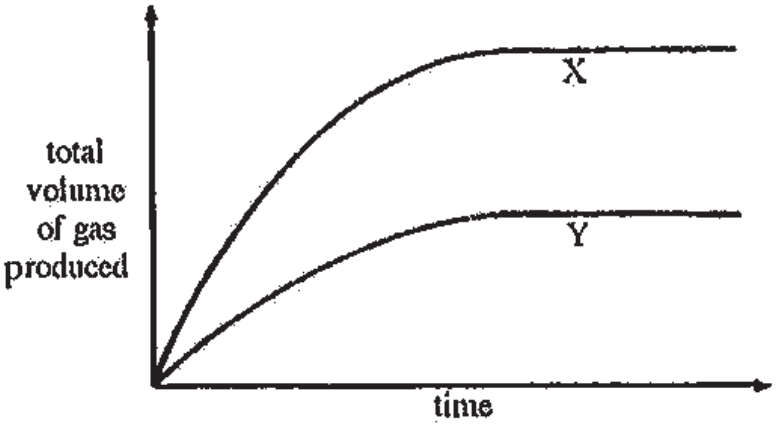
15 The reaction between bromine and iodide ions is shown in the equation.

$$Br_2 + 2I^- \rightarrow I_2 + 2Br^-$$

What happens during this reaction?

A Bromine molecules are the oxidising agent.
B Bromine molecules are oxidised to bromide ions.
C Iodide ions are reduced to iodine molecules.
D Iodide ions gain electrons.

16 The curve X below represents the results of the reaction between 1.0 g of granulated zinc and an excess of acid at 30 °C.

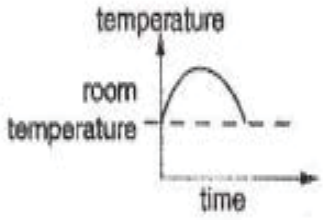


Which of the following changes will produce curve Y?

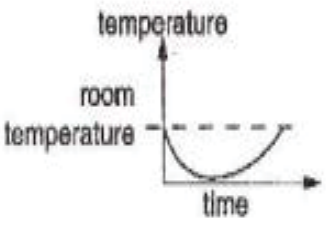
A 0.5 g of granulated zinc at 30 °C
B 0.5 g of powdered zinc at 50 °C
C 1.0 g of granuated zinc at 30 °C
D 1.0 g of powdered zinc at 50 °C

17 Dissolving ammonium nitrate in water is endothermic. Which graph shows how the temperature alters as the ammonium nitrate is added to the water and the solution is left to stand?

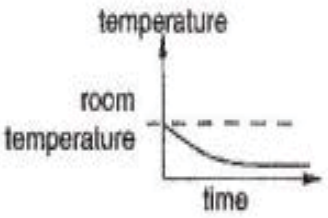
A



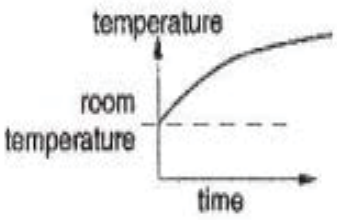
B



C



D



18 Lead(II) sulfate is insoluble in water. What should be added to sulfuric acid to prepare lead(II) sulfate?

A lead(II) carbonate
B lead(II) chloride
C lead(II) nitrate
D lead(II) oxide

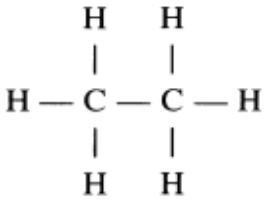
19 Which statement about the homologous series of alcohols is not true?

A Alcohols can be oxidized to acids.
B All alcohols can be made by the fermentation of sugars and carbohydrates.
C Complete combustion of alcohols produces carbon dioxide and water only.
D The relative molecular mass of each member differs from the next member by 14.

20 A hydrocarbon Y with a relative molecular mass of 28 quickly decolourises aqueous bromine in bright sunlight.

What is Y likely to be?

A



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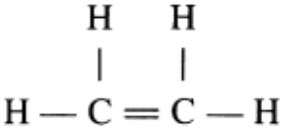

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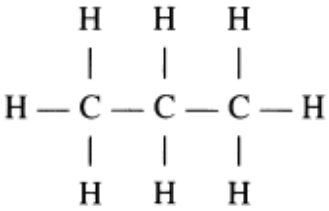

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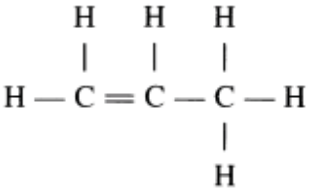


Group																	
I	II											III	IV	V	VI	VII	0
							1 H hydrogen 1										2 He helium 4
3 Li lithium 7	4 Be beryllium 9											5 B boron 11	6 C carbon 12	7 N nitrogen 14	8 O oxygen 16	9 F fluorine 19	10 Ne neon 20
11 Na sodium 23	12 Mg magnesium 24											13 Al aluminium 27	14 Si silicon 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 –		114 Fl flerovium –		116 Lv livermorium –		

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.).

Name		Register No.	Class

BENDEMEER SECONDARY SCHOOL
2019 PRELIMINARY EXAMINATION
SECONDARY 4 EXPRESS / 5 NORMAL (ACADEMIC)
SCIENCE (CHEMISTRY) PAPER 3
5076/03, 5078/03

DATE : 29 August 2019
DURATION : 1 hour 15 minutes

READ THESE INSTRUCTIONS FIRST

Write your name, class and register number on the work you hand in.
You may use a 2B pencil for any diagrams, graphs, tables or rough working.
Write in dark blue or black pen.
Do not use paper clips, glue or correction fluid.

The use of an approved scientific calculator is expected, where appropriate.
You may lose marks if you do not show your working or if you do not use appropriate units.

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

Section B
Answer any **two** questions.
Write your answers in the spaces provided on the question paper.

A copy of the Data Sheet is printed on page 14.
A copy of the Periodic Table is printed on page 15.

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.

65

Section A (45 marks)

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

1 From the list below, choose the most suitable answer.
Each substance can be used only once or not at all.

carbon dioxide	chlorine	potassium chloride
carbon monoxide	nitrogen	argon
sodium oxide	brass	water

Which substance

(a) can conduct electricity in the aqueous and molten states;

…… [1]

(b) is the most abundant in air;

…….. [1]

(c) produces a black solid when added to potassium iodide;

…….. [1]

(d) is a monoatomic element;

……... [1]

(e) does not contain a fixed percentage composition of its constituents?

……... [1]

2 The group numbers of the elements A, B, C and D are given in Table 2.1.

Table 2.1

element	group number	period number
A	I	2
B	IV	3
C	VI	3
D	VIII	4

Using the information given, answer the following questions.

(a) Using the electronic structure, explain why element C is a non-metal.

……... [1]

(b) Identify element B.

……... [1]

(c) Which element conducts electricity at room temperature in both solid and liquid states?

……... [1]

(d) Showing all electrons, draw a 'dot and cross' diagram to show the bonding in the compound formed between A and C.

[2]

(e) Does the compound formed in **(d)** have a high or low melting point?
Explain your answer.

……...

……...

…….. [2]

3 Small pieces of five metals are added to aqueous solutions of the five metal nitrates. The results are recorded in Table 3.1.

✓ indicates reaction takes place
X indicates no reaction takes place

Table 3.1

solution	metal				
	copper, Cu	magnesium, Mg	nickel, Ni	silver, Ag	tin, Sn
$Cu(NO_3)_2$	X	✓	✓	X	✓
$Mg(NO_3)_2$	X	X	X	X	X
$Ni(NO_3)_2$	X	✓	X	X	X
$AgNO_3$	✓	✓	✓	X	✓
$Sn(NO_3)_2$	X	✓	✓	X	X

(a) Place the five metals in order of reactivity.

Most reactive: ……..

……..

..……

Least reactive: …….. [2]

(b) Give two observations to be made when magnesium is added to aqueous copper(II) nitrate.

……...

……... [2]

(c) When a metal M is added to iron(II) nitrate, a colourless solution is obtained and the oxidation state of M changes from 0 to +2.

(i) Suggest what metal M might be.

……..... [1]

(ii) Write a balanced equation for the reaction between M and iron(II) nitrate. Use the letter M in your equation.

……... [1]

(iii) Explain, in terms of oxidation states, why this reaction is considered to be a redox reaction.

……...

……... [2]

4 (a) Ammonium phosphate, $(NH_4)_3PO_4$, can be prepared by adding 25.0 cm^3 of 0.5 mol/dm^3 of aqueous ammonium hydroxide, NH_4OH, to 33.5 cm^3 of dilute phosphoric acid, H_3PO_4.

$$3\ NH_4OH\ (aq) + H_3PO_4\ (aq) \longrightarrow (NH_4)_3PO_4\ (aq) + 3\ H_2O\ (l)$$

(i) Calculate the number of moles of ammonium hydroxide used.

number of moles = ……. [1]

(ii) Calculate the number of moles of phosphoric acid required.

number of moles = ……. [1]

(iii) Calculate the concentration of the phosphoric acid used.

concentration of phosphoric acid = ……. mol/dm^3 [2]

(b) (i) Ammonium phosphate is used as a fertiliser in soils. However it is not advisable to add the fertiliser to acidic soils that has been treated with calcium hydroxide.

Explain why with the help of a balanced equation.

……...

…….. [2]

(ii) Write an ionic equation, including state symbols, for the reaction between ammonium hydroxide and phosphoric acid.

…….. [1]

5 Cold packs are used to reduce swelling, inflammation and pain by removing the heat. A list of chemicals from a science laboratory is shown below:

ammonium chloride	dilute hydrochloric acid	water
anhydrous sodium carbonate	sodium hydroxide	

(a) From the list of chemicals provided above, select a pair of chemicals that can be used for making a cold pack in a science laboratory.

…….. [1]

(b) Explain your answer in **(a)** and state the type of energy change.

……..

…….. [1]

6 P, Q, R and S are samples of water taken from different places thought to be polluted. Tables 6.1 and 6.2 show the observations made when each sample of water is tested.

Table 6.1

tests for sulfate ions	observations			
	sample P	sample Q	sample R	sample S
add a few drops of dilute hydrochloric acid, then add several drops of aqueous barium chloride	white ppt formed	no visible reaction	white ppt formed	no visible reaction

Table 6.2

tests for chloride ions	observations			
	sample P	sample Q	sample R	sample S
add a few drops of dilute nitric acid, then add several drops of aqueous silver nitrate	no visible reaction	white ppt formed	white ppt formed	no visible reaction

Use the results of the tests to help you answer the following questions.

(a) Which water sample is polluted with both sulfate and chloride ions?

…….. [1]

(b) One of the samples is known to contain only ammonium sulfate.

(i) Which sample is it?

…….. [1]

(ii) Give a reason for your answer.

……...

……... [1]

(c) Which sample appears to be the least polluted?

…….. [1]

7 A series of experiments were carried out to compare the rates of the reaction of hydrochloric acid with marble (calcium carbonate) under different conditions. In each experiment, excess marble was reacted with 25 cm^3 of acid. The conditions for each experiment were shown in Table 7.1.

Table 7.1

experiment	marble	acid concentration (mol/dm^3)
A	large chips	0.1
B	large chips	0.2
C	small chips	0.1
D	small chips	0.2
E	powder	0.2

The gas given off was collected and its total volume was measured every 15 seconds for 6 minutes. The results obtained were plotted as shown in Fig. 7.2.

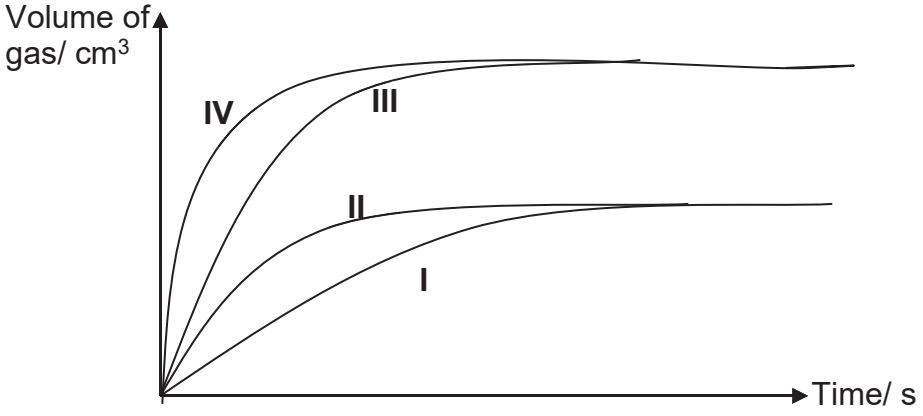


Fig. 7.2

(a) Write an equation for the reaction which occurred.

…….. [1]

(b) For each of the experiments A to D, state which of the curves I to IV corresponds to the results obtained in Fig. 7.2.

Experiment A: curve ……

Experiment B: curve ……

Experiment C: curve ……

Experiment D: curve …… [2]

(c) Sketch the result obtained for experiment E in Fig. 7.2 and label it with "V." [1]

(d) State one condition which must be kept constant during the experiments.

……... [1]

8 A chemical process is carried out by oil companies to produce high grade petrol (an eight carbon hydrocarbon). The process is carried out by using aluminium oxide catalyst.

(a) **(i)** A typical reaction for this process is:

$C_{16}H_{34} \rightarrow C_8H_{18} + 2C_4H_8$

Name this chemical process.

…….. [1]

(ii) Describe a simple chemical test to distinguish between the two products shown in the equation.

……

……

…… [2]

(b) Table 8.1 shows some of the products obtained by using this process for 100 g of different fractions under the same conditions.

Table 8.1

fraction	products obtained / g per 100 g of 'fraction' used			
	hydrogen	methane	ethene	petrol
ethane	10	5	75	0
paraffin	1	15	30	23
diesel	0	6	20	17

(i) Which fraction is the best source for petrol?

…….. [1]

(ii) Another typical reaction for this process in order to produce ethene is shown below. Complete the equation.

$C_{18}H_{38} \rightarrow 6C_2H_4 +$ _____ [1]

(c) Ethene undergoes polymerisation to form poly(ethene) which is a non-biodegradable polymer.

(i) Explain the meaning of the term "non-biodegradable".

……...

……... [1]

(ii) In the space below, draw 2 repeat units of poly(ethene).

[1]

Section B

Answer **any two** questions in this section.
Write your answer in the spaces provided.

9 A colourless gas X with an empirical formula CH_2 produces a neutral organic liquid W of molecular mass 46 upon hydration (addition of steam).

X reacts with (i) hydrogen to give a gas Y of molecular mass 30 and
(ii) bromine to give a liquid Z of molecular mass 188.

(a) Give the names and molecular formulae of compounds W, X, Y and Z.

W: ……..

X: ……...

Y: ……...

Z: …… [4]

(b) Write a balanced equation for the hydration of X and briefly describe how this reaction could be carried out in the laboratory.

……...

……... [2]

(c) Describe, with a balanced equation, one reaction of W other than combustion.

……...

……...

……...

[2]

(d) 0.42 g of W is vaporized by heating to 100°C at room temperature and pressure. Calculate the volume occupied by the vapour under these conditions.

volume of W = …….. dm^3 [2]

10 Thermal decomposition of compounds breaks them down into smaller substances when sufficient heat is applied.

(a) Air bags are used to protect passengers in a car during an accident. When the crash sensor detects an impact, it causes a mixture of chemicals to be heated to a high temperature. Reactions take place which produce nitrogen gas. The nitrogen fills the air bag. This is shown in Fig. 10.1.

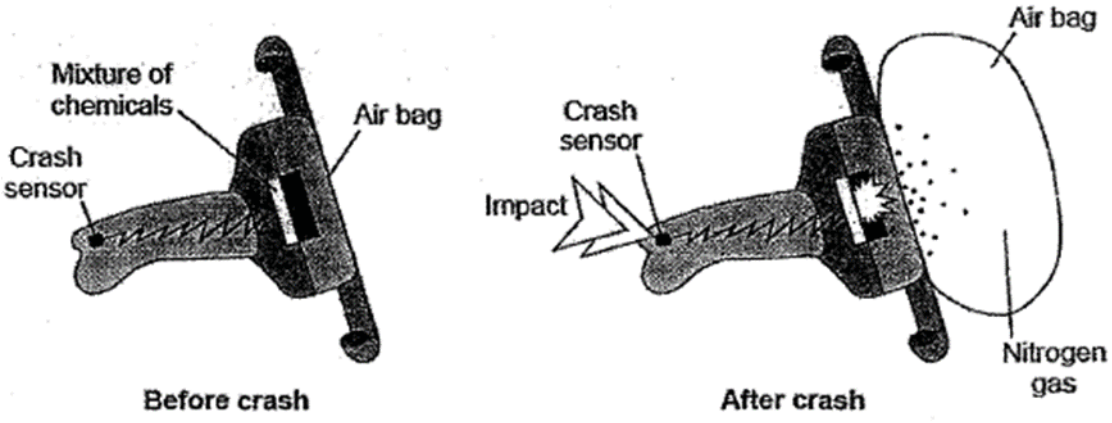


Fig. 10.1

The mixture of chemicals contains solid sodium azide, NaN_3 which decomposes to form sodium and nitrogen as follows:

…… NaN_3 (…….) → ……Na (…….) + …..N_2 (…….)

(i) Balance the chemical equation and complete the state symbols in the chemical equation above. [2]

(ii) Draw the electronic structure of nitrogen gas. Show outer electrons only.

[2]

(iii) An air bag consists of 130 g of sodium azide. When the sodium azide decomposed, 60 dm^3 of nitrogen was obtained at room temperature and pressure.

Show, using calculations, if the thermal decomposition of sodium azide has been efficient in producing nitrogen to fill up the air bag.

[3]

(b) A student used the apparatus in Fig. 10.2 to investigate what happens when liquid paraffin is heated to a high temperature.

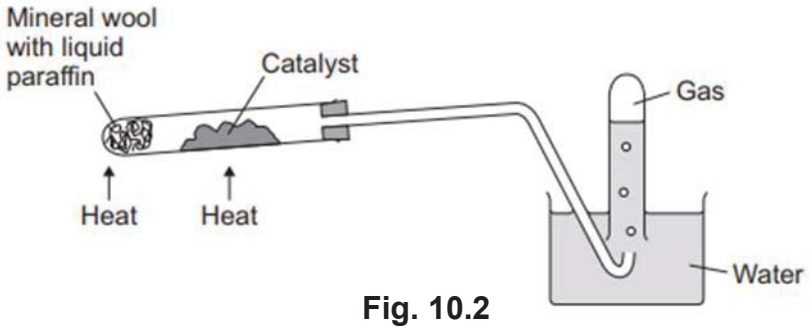


Fig. 10.2

Liquid paraffin contains alkanes. The most abundant alkane has a chemical formula of $C_{20}H_{42}$.

Name the reaction shown in Fig. 10.2. Describe, with the aid of a chemical equation, what happens to the alkane molecules in the reaction.

……..

……..

……..

……..

…….. [3]

11 Bromine, chlorine and iodine belong to the same group of elements.

(a) **(i)** What is the name given to this group of elements?

……. [1]

(ii) A student was asked to perform the following experiments to show the trend in the reactivity of the above three elements.

Experiment 1: bromine solution + aqueous potassium iodide

Experiment 2: chlorine solution + aqueous potassium bromide

Experiment 3: iodine solution + aqueous potassium chloride

Describe, with balanced equations, what you will observe in the three experiments.

……

……

……

……

……. [3]

(iii) Using your answer in **(a)(ii)**, arrange the elements in order of increasing reactivity and explain how reactivity changes when going down the group.

……

……. [2]

(b) **(i)** State the reagents used to prepare magnesium chloride.

……. [1]

(ii) Describe how dry crystals of magnesium chloride is produced in the laboratory.

……..

……..

……..

……...

[3]

……

END OF PAPER

Data Sheet

Colours of Some Common Metal Hydroxides

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

The Periodic Table of Elements

Group																	
I	II											III	IV	V	VI	VII	0
							1 H hydrogen 1										2 He helium 4
3 Li lithium 7	4 Be beryllium 9		**Key** proton (atomic) number atomic symbol name relative atomic mass									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 –		114 Fl flerovium –		116 Lv livermorium –		

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 –

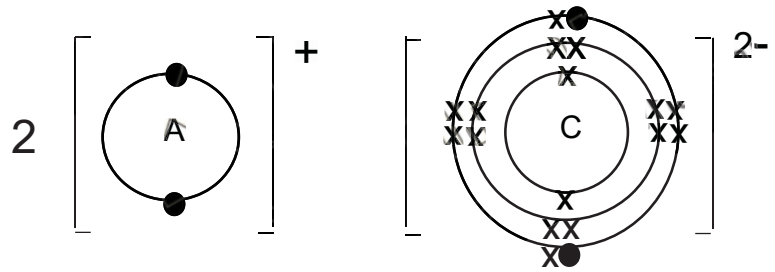
The volume of one mole of any gas is 24 dm^3 at room temperature and pressure (r.t.p.).

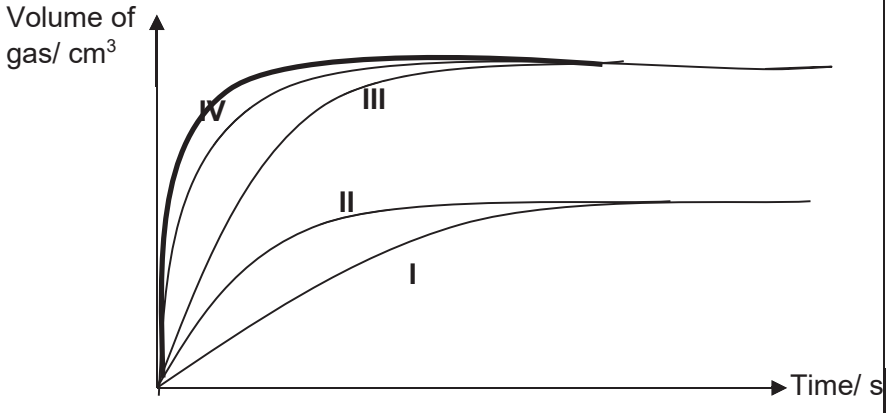
Bendemeer Secondary School
2019 Preliminary Exam
Science (Chemistry)
Answer Scheme

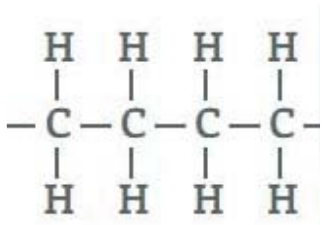
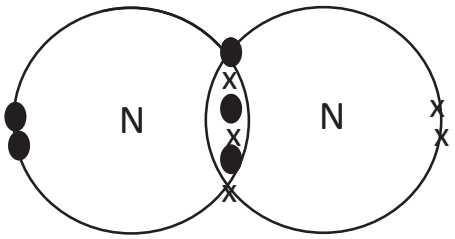
Paper 1

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

Paper 3

Qn	Answer	Mks	Marker's Comments
1	(a) sodium oxide/ potassium chloride (b) nitrogen (c) chlorine (d) argon (e) brass	1 1 1 1 1	
2	(a) Electronic structure of C is 2.8.6. It gains 2 electrons during reactions. Non-metals gain electrons during reactions.	1	
	(b) silicon	1	
	(c) A	1	
	(d)  	2	
	(e) High melting point. It is an **ionic compound** with **giant ionic structure**. A lot of energy is needed to overcome **the strong electrostatic forces of attraction between the oppositely charged ions.**	½ ½ 1	
3	(a) Mg Ni Sn Cu Ag	2 (3 correct 1m)	
	(b) Magnesium dissolves/ Blue solution turns colourless/ pink solid formed.	Any 2	
	(c) (i) Magnesium/ calcium/ zinc	1	

	(ii) $M + Fe(NO_3)_2 \rightarrow Fe + M(NO_3)_2$	1	
	(iii) Oxidation state of M increases from 0 in M to +2 in $M(NO_3)_2$. Hence M is oxidised. Oxidation state of Fe decreases from +2 in $Fe(NO_3)_2$ to 0 in Fe. Hence Fe is reduced. There is both oxidation and reduction taking place at the same time. Hence this is a redox reaction.	1 1	
4	(a) (i) $25/1000 \times 0.5 = 0.0125$	1	
	(ii) $NH_4OH : H_3PO_4$ 3 : 1 (from equation) 0.0125 : **0.00417**	1	
	(iii) Concentration = Mole/vol = 0.00417/ (33.5/1000) = **0.124 mol/dm^3**	1 1	
	(bi) $2(NH_4)_3PO_4 + 3Ca(OH)_2 \rightarrow Ca_3(PO_4)_2 + 6NH_3 + 6H_2O$ Ammonium phosphate will react with calcium hydroxide instead of fertilizing the soil.	1 1	
	(ii) $H^+ (aq) + OH^- (aq) \rightarrow H_2O (l)$	1	
5	(a) Ammonium chloride and water	1	
	(b) **Heat is taken in** from the surroundings when dissolving ammonium chloride in water. It is an **endothermic** process.	½ ½	
6	(a) R	1	
	(b) (i) P	1	
	(ii) P forms white precipitate when barium chloride is added, indicating that sulfate ions are present. P has no visible reaction when silver nitrate is added, indicating the absence of chloride ions.	1	
	(c) S	1	
7	(a) $CaCO_3 + 2HCl \rightarrow CaCl_2 + CO_2 + H_2O$	1	
	(b) Experiment A: curve I Experiment B: curve III Experiment C: curve II Experiment D: curve IV	½ m each	
	(c)  	1	

	(d) Temperature of acid.	1	
8	(a) (i) Cracking	1	
	(ii) Test: Add aqueous bromine Result with C_8H_{18}: No reaction with aqueous bromine Result with C_4H_8: Decolourises aqueous bromine	1 ½ ½	
	(b) (i) paraffin	1	
	(ii) $C_{18}H_{38} \rightarrow 6C_2H_4 + \mathbf{C_6H_{14}}$	1	
	(c) (i) "Non-biodegradable" means that the polymer cannot be broken down into simpler substances by air and bacteria.	1	
	(ii) 	1	
9	(a) W: ethanol, C_2H_5OH X: ethene, C_2H_4 Y: ethane, C_2H_6 Z: dibromoethane, $C_2H_4Br_2$	1 1 1 1	
	(b) $C_2H_4 + H_2O \rightarrow C_2H_5OH$ Conditions: 300°C, 60 atm, phosphoric (V) acid as catalyst	1 1	
	(c) $C_2H_5OH + O_2 \rightarrow CH_3COOH + H_2O$ Ethanol can be oxidised by atmospheric oxygen or by potassium manganite(VII) to ethanoic acid.	1 1	
	(d) Number of mole of W, C_2H_5OH = 0.42/ (2x12+5+16+1) = 0.00913 Volume of W, C_2H_5OH = 0.00913 x 24 = **0.219 dm^3**	1 1	
10	(a) (i) $2NaN_3$ (s) → 2Na (s) + $3N_2$ (g)	2	
	(ii) 	2	
	(iii) Number of moles of NaN_3 = 130/(23+3x14) = 2 NaN_3 : N_2 2 : 3 Volume of N_2 that should be produced from 130 g of NaN_3 = 3 x 24 = 72 dm^3	1 1 1	

	The volume of nitrogen gas produced is 60 dm^3 instead of 72 dm^3. Hence the thermal decomposition of sodium azide has not been efficient.		
	(b) The reaction is cracking. $C_{20}H_{42} \rightarrow 10C_2H_4 + H_2$ Under heat and catalyst, the alkane molecules are cracked into smaller ones which are more useful.	1 1 1	
11	(a)(i) Halogens		
	(ii) Experiment 1: reddish-brown solution decolourises and purple/black solid seen formed. Br_2 (aq) + 2KI (aq) → 2KBr (aq) + I_2 (s) Experiment 2: reddish-brown solution formed. Cl_2 (aq) + 2KBr (aq) → 2KCl (aq) + Br_2 (l) Experiment 3: No reaction *(no need state symbols for equations)*	½ ½ ½ ½ 1	
	(iii) iodine, bromine, chlorine **Reactivity decreases** down the group as it gets **harder for the atom to gain 1 more electron** down the group.	1 ½,½	
	(b)(i) hydrochloric acid and magnesium/ magnesium carbonate/ magnesium oxide/ magnesium hydroxide	½ ½	
	(ii) Add excess magnesium/ magnesium carbonate/ magnesium oxide/ magnesium hydroxide to hydrochloric acid. Filter to remove excess magnesium/ magnesium carbonate/ magnesium oxide/ magnesium hydroxide as the residue. Heat filtrate to obtain a saturated solution of magnesium chloride. Cool to form crystals of magnesium chloride. Dry magnesium chloride crystals in between 2 pieces of filter papers.	1 ½ ½ ½ ½	