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Name	Class				Index Number		
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BROADRICK SECONDARY SCHOOL

SEC 4 EXPRESS / 5 NORMAL (ACADEMIC)

PRELIMINARY EXAMINATION 2022

SCIENCE (CHEMISTRY, BIOLOGY)

5078/01

Paper 1 Multiple Choice

Additional Material: Multiple Choice Answer Sheet

September 2022
1 hour

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.

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

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 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.

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 question paper.

A copy of the Data Sheet is printed on page 2.

A copy of the Periodic Table is printed on page 3.

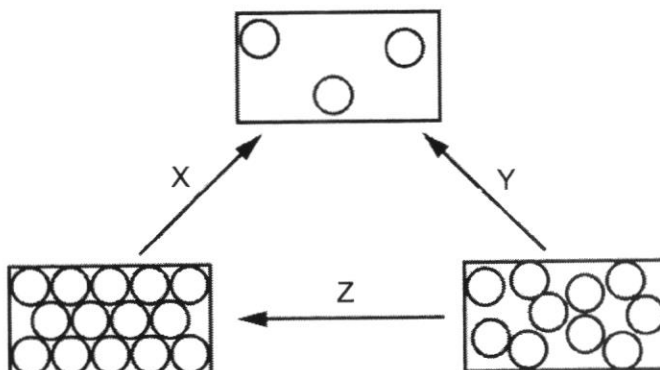
The use of an approved scientific calculator is expected, where appropriate.

This document consists of 18 printed pages including this cover page.

4

- 1 Each diagram shows the arrangement of particles in each of the three states of matter.

X, Y and Z represent the processes needed to change from one state to another.



What are the processes X, Y and Z?

	X	Y	Z
A	evaporation	sublimation	condensation
B	evaporation	sublimation	freezing
C	sublimation	evaporation	condensation
D	sublimation	evaporation	freezing

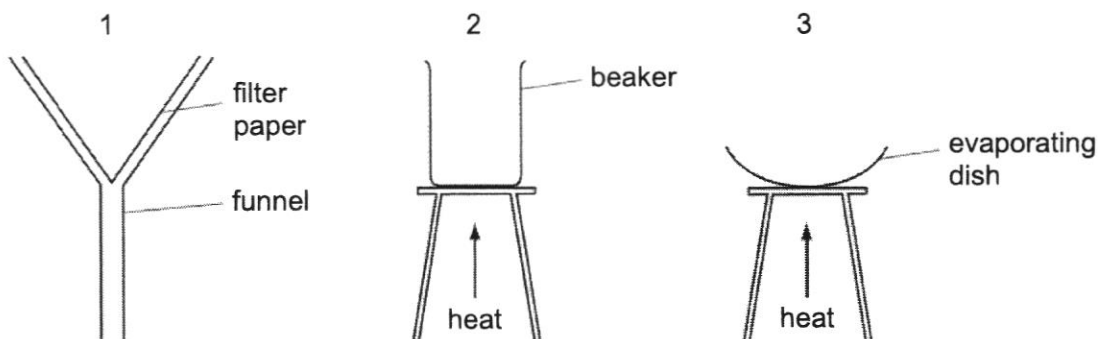
- 2 A student is asked to measure the time taken for 4.00 g of magnesium carbonate to react completely with 25.0 cm³ (an excess) of dilute hydrochloric acid.

Which pieces of apparatus does the student need?

- A** electronic balance, digital stopwatch, pipette
- B** electronic balance, digital stopwatch, thermometer
- C** electronic balance, pipette, thermometer
- D** digital stopwatch, pipette, thermometer

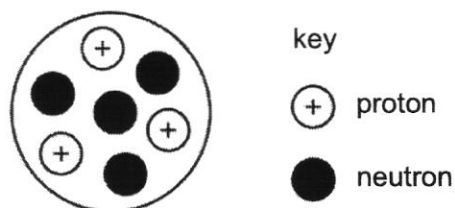
5

- 3 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 1 and 3 C 2 and 3 D 3 only
- 4 The diagram represents a nucleus of element X.



Which of the following symbols best represent this element?

- A ${}^3_4\text{X}$ B ${}^4_3\text{X}$ C ${}^7_3\text{X}$ D ${}^7_4\text{X}$
- 5 Information about some chemical elements is given below.

element	symbol	metal or non-metal	group in Periodic Table
rubidium	Rb	metal	I
indium	In	metal	III
sulfur	S	non-metal	VI
iodine	I	non-metal	VII

Which formula is **not** correct?

- A In_2S_3 B InI_3 C RbI D RbS_2

6

- 6 Methane burns in plentiful supply of oxygen according to the following equation:



10 cm³ of methane was burnt in 25 cm³ of oxygen.

If all the volumes were measured at room temperature and pressure, what would be the total volume of gases at the end of reaction?

- A** 10 cm³ **B** 15 cm³ **C** 30 cm³ **D** 35 cm³
- 7 Ammonium sulfate and potassium sulfate are salts which can be found in fertilisers. A sample of a fertiliser is warmed with aqueous sodium hydroxide and a gas with pH 10 is given off.

Which salt must be present in the fertiliser and what is the gas given off?

	salt in fertiliser	name of gas
A	ammonium sulfate	ammonia
B	ammonium sulfate	sulfur dioxide
C	potassium sulfate	ammonia
D	potassium sulfate	sulfur dioxide

- 8 The table gives information about three indicators.

indicator	colour at pH 1	pH at which colour changes	colour at pH 12
thymol blue	red	3	yellow
congo red	blue	5	red
phenolphthalein	colourless	10	pink

Which colours would be obtained when each indicator was added separately to pure water?

	thymol blue	congo red	phenolphthalein
A	red	blue	pink
B	yellow	blue	colourless
C	yellow	blue	pink
D	yellow	red	colourless

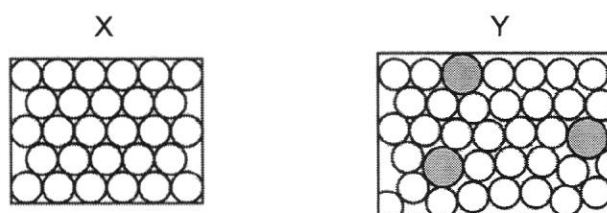
9 A colourless liquid in an unlabelled bottle is tested as shown.

- Litmus paper turns red.
- Magnesium ribbon fizzed.
- Reaction with aqueous barium nitrate produced a white precipitate.

What is the colourless liquid?

- A** aqueous sodium hydroxide
B aqueous sodium sulfate
C dilute hydrochloric acid
D dilute sulfuric acid

10 The diagrams show the structure of two substances used to make electrical conductors.



Which statement correctly describes X and Y?

- A** X is a pure metal and Y is a compound.
B X is a pure metal and Y is an alloy.
C X is a solid and Y is a liquid.
D X is harder and stronger than Y.

11 Reactions of three metals and their oxides are listed in the table.

metal	reacts with cold water	metal oxide reacts with carbon
P	no	no
Q	no	yes
R	yes	no

What is the order of reactivity of the metals?

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

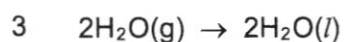
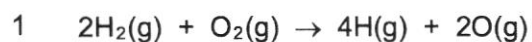
- $$\text{K}_2\text{Cr}_2\text{O}_7 + 2\text{KOH} \rightarrow 2\text{K}_2\text{CrO}_4 + \text{H}_2\text{O}$$
- potassium dichromate(VI)
potassium chromate(VI)
- orange
yellow

	oxidation state of chromium	pH of the mixture
A	decreases	decreases
B	decreases	increases
C	stays the same	decreases
D	stays the same	increases

-
- The diagram shows a simplified periodic table grid. The elements are positioned as follows:
- W** is located in the top row, above the middle of the grid.
 - X** is located in the second row from the top, in the rightmost column.
 - Y** is located in the third row from the top, in the leftmost column.
 - Z** is located in the fourth row from the top, in the rightmost column.

	can donate or share an electron	reacts with water
A	W	X
B	W	Y
C	X	Y
D	Z	W

- 14 The formation of liquid water from hydrogen and oxygen may occur in three stages.



Which of these stages are endothermic?

- A** 1, 2 and 3 **B** 1 only **C** 2 only **D** 3 only
- 15 Calcium carbonate was reacted with an excess of dilute hydrochloric acid at room temperature.

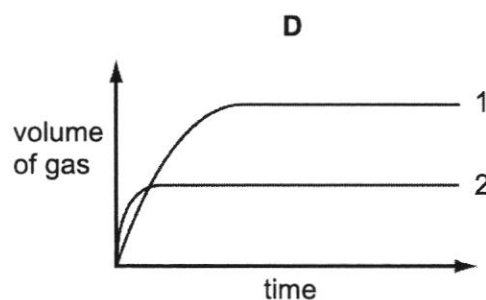
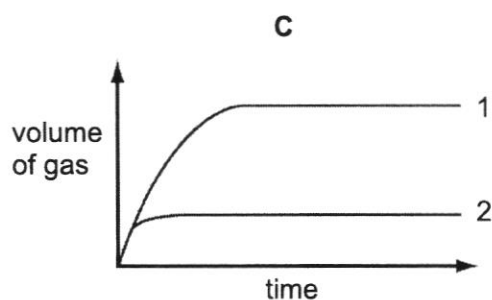
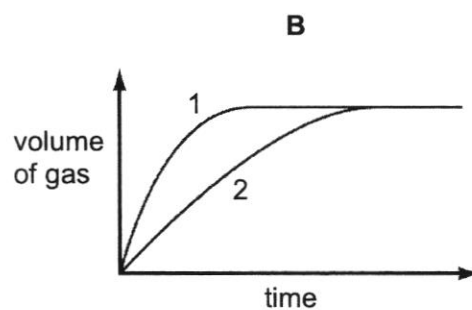
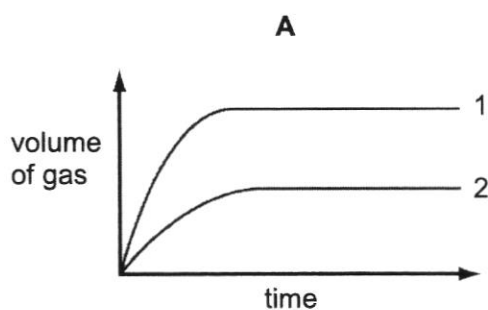


Two experiments were carried out.

Experiment 1: 10 g of calcium carbonate in large lumps

Experiment 2: 5 g of powdered calcium carbonate

Which graph is correct?



- 16 Acid rain is formed when sulfur dioxide and oxides of nitrogen dissolve in rainwater.

Which of the following is **not** caused by acid rain?

- A breathing difficulties
- B corrosion of statues
- C dying trees
- D lowered pH of lakes

- 17 Petroleum is separated into fractions by fractional distillation. Separation occurs in a fractionating column. Some properties of three of these fractions are shown.

fraction	range of boiling points / °C	number of carbon atoms in the molecules
1		5 – 10
2	320 – 350	16 – 24
3	120 – 210	

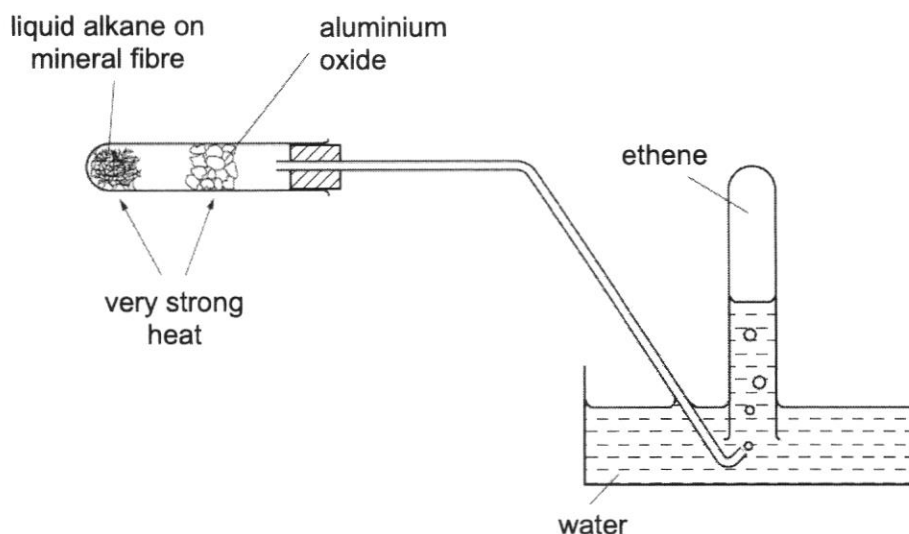
Which statement is correct?

- A Fraction 1 has a higher boiling point range than fraction 2.
 - B Fraction 2 is removed at a higher point in the fractionating column than fraction 1.
 - C Molecules in fraction 3 have shorter carbon chains than those in fraction 2.
 - D None of the fractions are liquid at room temperature.
- 18 A student makes three statements about fat molecules.
- 1 Fat molecules contain only carbon atoms.
 - 2 Fat molecules are hydrocarbons.
 - 3 Fat molecules contain more than one carbon to carbon double bonds.

Which of these statements describe polyunsaturated fat molecules?

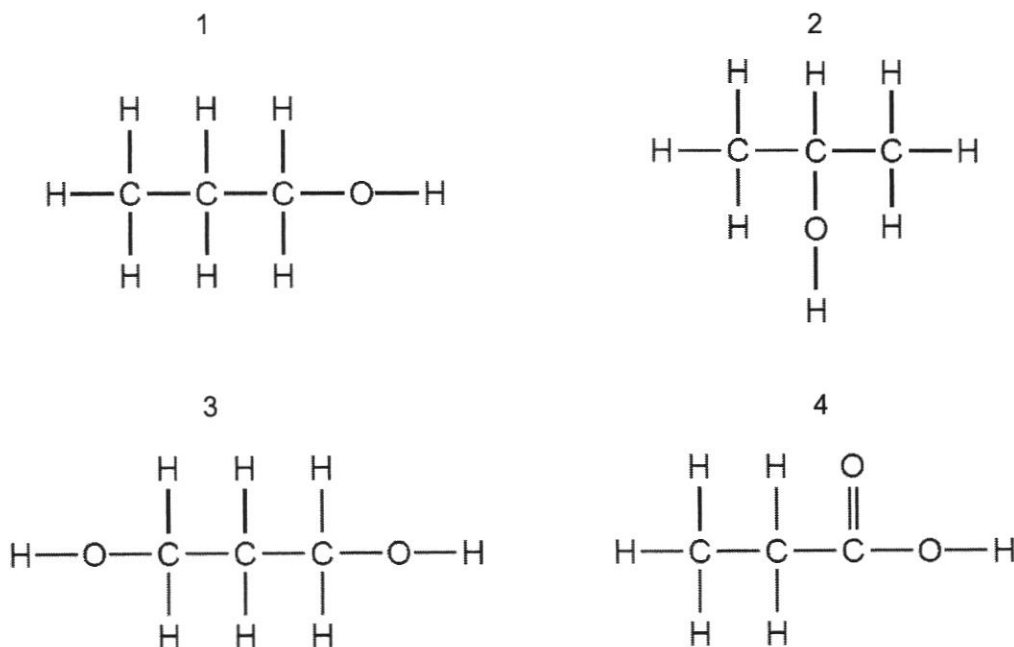
- A 1 only
- B 3 only
- C 1 and 2
- D 2 and 3

- 19 The following experiment is carried out.



Which of the following processes takes place in the experiment shown above?

- | | |
|-----------------------|-------------------------|
| A cracking | B distillation |
| C fermentation | D polymerisation |
- 20 The structural formulae of some organic compounds are shown below.



Which compound(s) is / are classified as alcohols?

- | | |
|--------------------------|-----------------------|
| A 1, 2, 3 and 4 | B 1 and 2 only |
| C 1, 2 and 3 only | D 4 only |

Name

Class			
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Index Number		
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BROADRICK SECONDARY SCHOOL SEC 4 EXPRESS / 5 NORMAL (ACADEMIC) PRELIMINARY EXAMINATION 2022

SCIENCE (PHYSICS, CHEMISTRY)

5076/03

SCIENCE (CHEMISTRY, BIOLOGY)

5078/03

Paper 3 Chemistry

August 2022

1 hour 15 minutes

Candidates answer on Question Paper.

No Additional Materials are required.

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 pencil for any diagrams or graphs, tables or rough working.

Do not use staples, paper clips, highlighters, 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 [45 marks]

Answer **all** questions in the spaces provided on the question paper.

Section B [20 marks]

Answer any **two** questions in the spaces provided on the question paper.

A copy of the Data Sheet is printed on page 2.

A copy of the Periodic Table is printed on page 3.

At the end of the examination, fasten all your work securely.

The number of marks is given in brackets [] at the end of each question or part question.

For Examiner's Use	
Section A	
Section B	
Total	65

This document consists of **18** printed pages including this cover page.

Section A [45 marks]Answer **all** the questions in the spaces provided.

- 1 The following table shows the atomic structure of seven different particles P – W.

The particles are atoms or ions.

The letters are **not** the chemical symbols of the elements.

	P	Q	R	S	T	U	W
nucleon number	4	14	15	19	23	24	40
proton number	2	7	7	9	11	12	20
number of electrons	2	7	7	9	11	10	18

Use the letters P – W to complete the following sentences.

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

- (a) The two particles that are ions are and [1]
- (b) The particles in period 3 of the Periodic Table are and [1]
- (c) The particle in Group VII of the Periodic Table is [1]
- (d) The particle which does **not** react with other elements is [1]
- (e) The two particles that are isotopes of the same element are and [1]

For
Examiners'
Use

5

- 2 (a) A student carried out some experiments to place four metals, W, X, Y and Z in order of reactivity. The table shows the results.

For
Examiners'
Use

Key ✓ shows a reaction happened
 ✕ shows no reaction happened
 — shows the experiment was not performed

	metal W	metal X	metal Y	metal Z
solution of W nitrate	—	✓	✓	✓
solution of X nitrate	✕	—	✓	✕
solution of Y nitrate	✕	✕	—	✕
solution of Z nitrate	✕	✓	✓	—

Place the metals in order of reactivity, starting with the most reactive.

..... > > >

[2]

- (b) A story describes a country where metallic elements are represented by unusual code names.

The story gives the reactivity series for five of these metals, but includes the non-metals hydrogen and carbon.

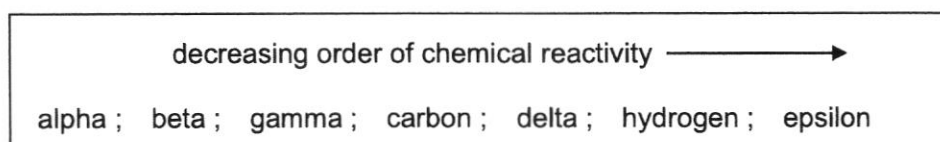


Fig. 8

Use any of the names in Fig. 8 to answer the questions that follow.

- (i) Which metal will react most slowly with hydrochloric acid, forming hydrogen gas?

..... [1]

- (ii) Which element will produce beta metal when heated strongly with beta oxide?

..... [1]

- (iii) Which of the code names most likely represents 'copper'?

..... [1]

6

- 3 Nitrogen can form ionic compounds with metallic elements and covalent compounds with non-metallic elements.

For
Examiners'
Use

- (a) Nitrogen reacts with lithium to form lithium nitride, Li_3N .
Draw a 'dot and cross' diagram to represent lithium nitride.
Show only the outer electrons.

[2]

- (b) Nitrogen reacts with fluorine to form nitrogen fluoride, NF_3 .
Draw a 'dot and cross' diagram to represent a molecule of nitrogen fluoride.
Show only the outer electrons.

[2]

- (c) Lithium nitride has a high melting point of 813°C .
Nitrogen fluoride has a low melting point of -207°C .

In terms of the bonding involved, explain why the melting points are different.

.....

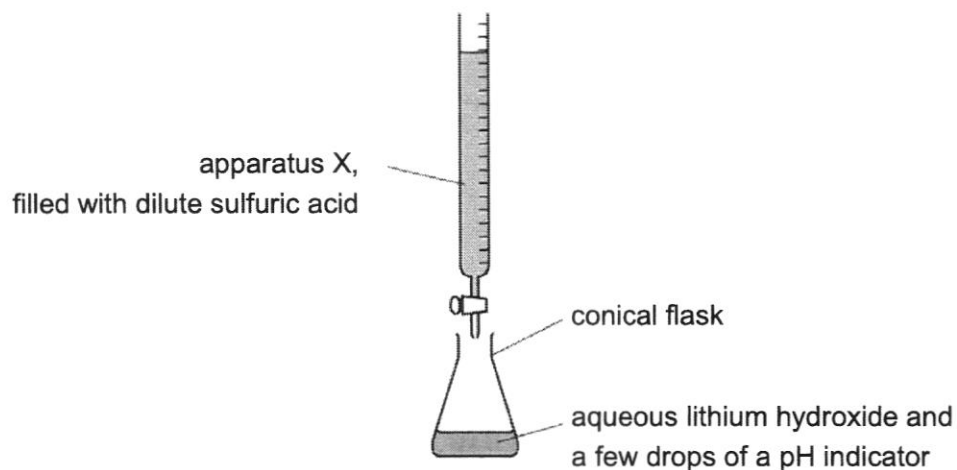
.....

.....

[2]

- 4 The soluble salt, lithium sulfate, is prepared by titration from the soluble base lithium hydroxide.

For
Examiners'
Use



(a) Name apparatus X. [1]

(b) Provide the ionic equation for the reaction between dilute sulfuric acid and aqueous lithium hydroxide.

..... [1]

(c) The dilute sulfuric acid is added slowly from apparatus X into the conical flask, until the indicator just changes colour. The volume of dilute sulfuric acid needed to just neutralise the aqueous lithium hydroxide is noted.

Describe how you would continue the experiment to obtain pure dry crystals of lithium sulfate.

.....

.....

.....

.....

.....

.....

.....

..... [4]

- 5 Aqueous ammonium nitrite, $\text{NH}_4\text{NO}_2(\text{aq})$, decomposes when heated, as shown.



- (a) A 25.0 cm^3 sample of 0.150 mol/dm^3 of aqueous ammonium nitrite is heated.

Calculate the maximum volume of nitrogen formed, in dm^3 , measured at room temperature and pressure.

volume of nitrogen dm^3 [2]

- (b) Another type of ammonium salt, ammonium nitrate, NH_4NO_3 , is commonly used as fertiliser in farms.

The bags of ammonium nitrate fertiliser have the following warning printed on them.

**Do not add fertiliser to soil that
has been recently treated with
any lime-containing product.**

The main lime-containing product used on farms is calcium hydroxide.

- (i) Why is calcium hydroxide added to soils?

.....

[1]

- (ii) Why is it important **not** to add ammonium compounds to soils that have been treated with calcium hydroxide?

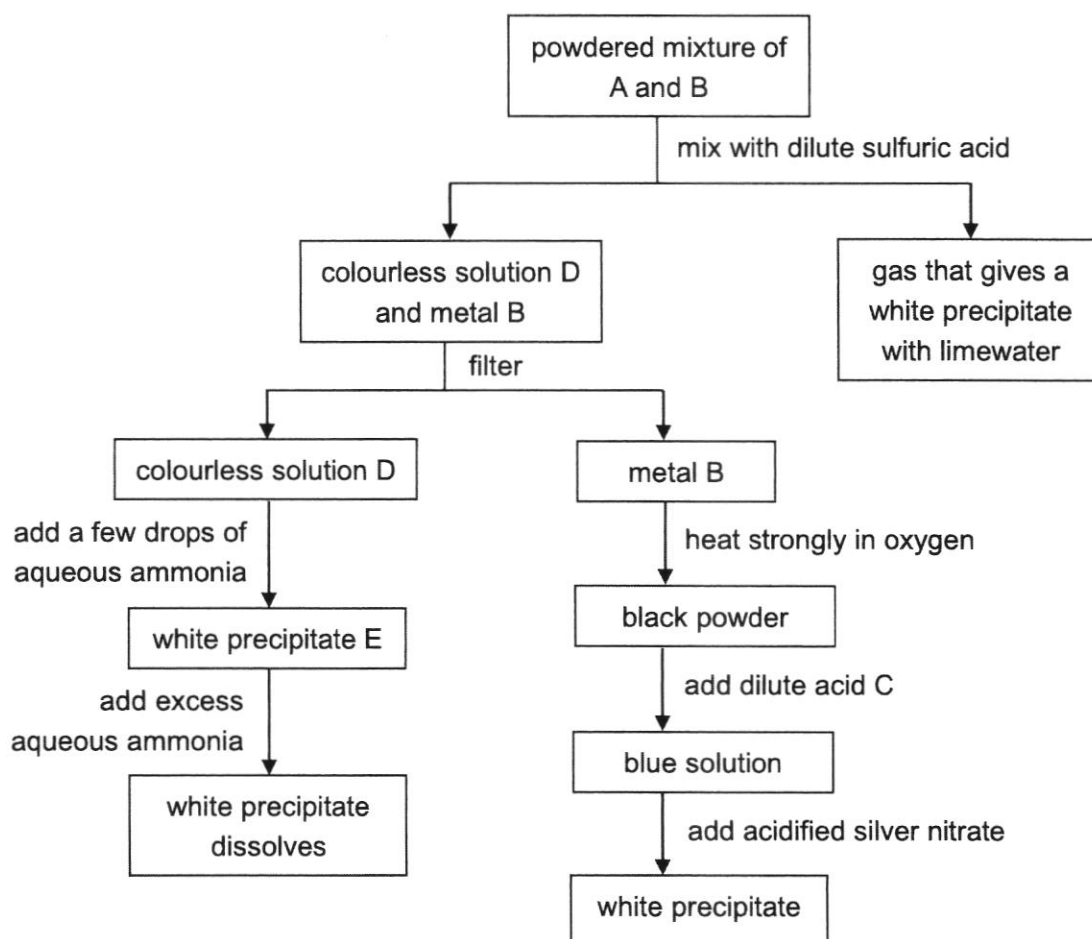
.....

.....

[1]

- 6 The following reaction scheme describe properties of a powdered mixture of compound A and a metal B.

For
Examiners'
Use



- (a) Name A, B, C, D and E.

- (i) A
- (ii) B
- (iii) C
- (iv) D
- (v) E

[5]

- (b) Write a balanced chemical equation, with state symbols, for any of the reactions described in the reaction scheme above.

.....

[2]

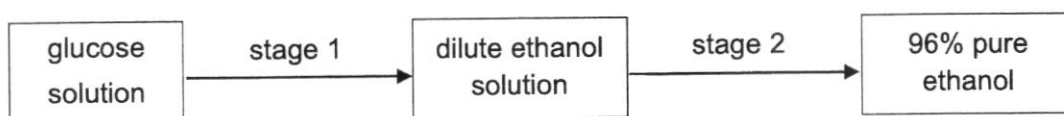
7 In some countries, ethanol is produced from the glucose in sugar cane.

For
Examiners'
Use

(a) Draw the full structural formula of ethanol.

[1]

(b) This flowchart summarises the production process for ethanol.



(i) Name the processes that took place in stage 1 and stage 2.

stage 1: stage 2: [2]

(ii) Write a balanced chemical equation, with state symbols, for the process that took place in stage 1.

..... [2]

(iii) What are the conditions required for stage 1 to take place?

..... [1]

(c) One of the uses of ethanol is fuel for cars.

An environmentalist claims that ethanol as a fuel is 'carbon neutral' because it does **not** add to the amount of carbon dioxide in the atmosphere.

Explain why this is true.

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

- 8 The table below shows the percentage by volume of each of the gases present in the exhaust gases from a petrol engine.

For
Examiners'
Use

gas	percentage by volume
carbon dioxide	1.0
carbon monoxide	
hydrogen	0.2
nitrogen	77.0
nitrogen dioxide	0.3
oxygen	0.7
hydrocarbons	0.3
water vapour	5.0
total	100.0

- (a) (i) Calculate the percentage by volume of carbon monoxide in the exhaust gases.

..... % [1]

- (ii) Which gas shown in the table is present in the lowest percentage by volume?

..... [1]

- (iii) Where does the nitrogen in the exhaust gases come from?

..... [1]

- (b) The carbon monoxide in the exhaust gases come from the incomplete combustion of hydrocarbons.

- (i) What is meant by the term *hydrocarbon*?

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

- (ii) Describe one adverse effect of carbon monoxide on health.

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

Section B [20 marks]

Answer any **two** questions in the spaces provided.

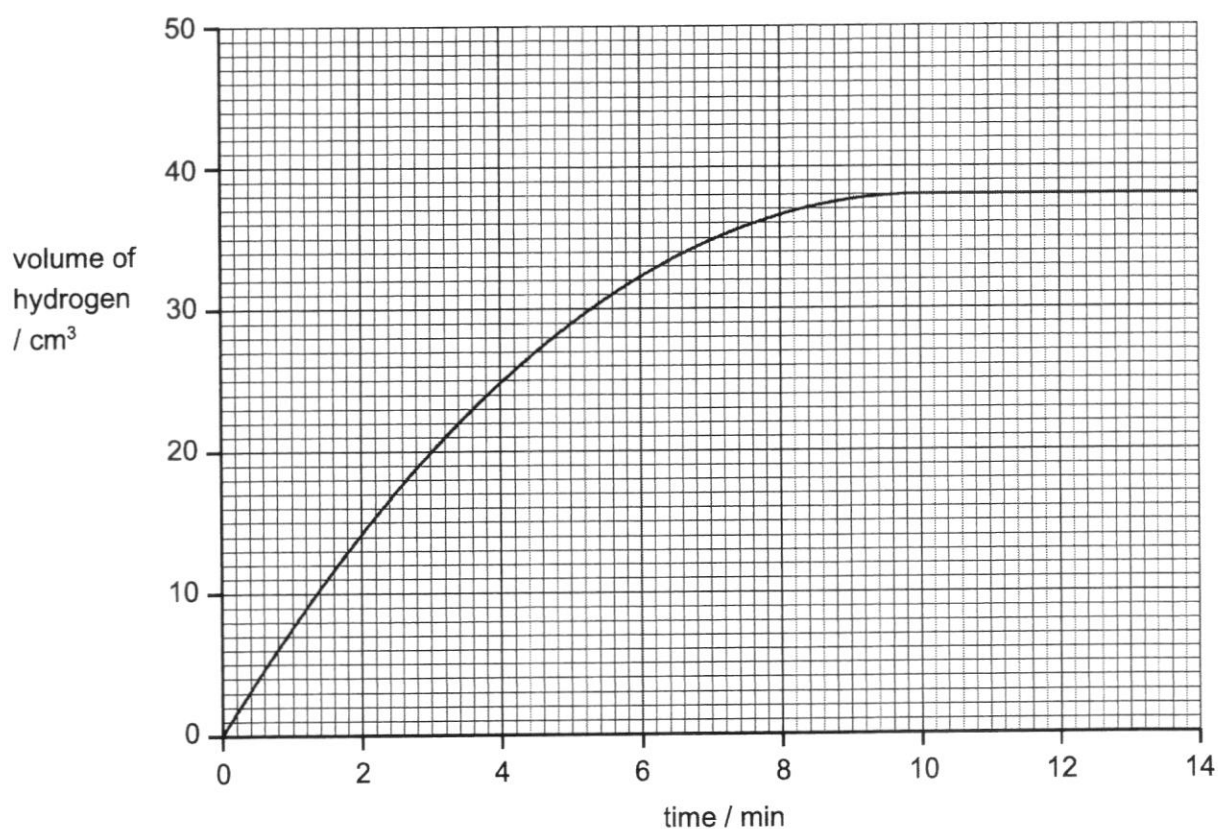
- 9 A student investigated the rate of reaction between magnesium ribbon and excess dilute sulfuric acid at room temperature by measuring the volume of hydrogen gas produced.

For
Examiners'
Use

- (a) Draw a well-labelled diagram to show the experimental set-up for this investigation.

[3]

- (b) The graph shows the volume of hydrogen collected as the reaction proceeds.



13

- (i) Explain why the volume of gas remained the same after 10 minutes.

For
Examiners'
Use

[1]

- (ii) How long did it take for the first 20 cm³ of gas to be collected?

[1]

- (iii) The student repeated the experiment at 40 °C.
All other conditions remained the same.

To the graph on page 12, sketch a curve to show the expected results for this experiment.

[2]

- (c) The student repeated the experiment using powdered magnesium of the same mass instead of magnesium ribbon.

Use your knowledge of reacting particles, explain how the rate of reaction differs when powdered magnesium is used.

[3]

- 10** Iron is one of the most important metals.
Iron can be mixed with another element to produce alloy steel.

(a) (i) Name the element that is added to iron in the production of steel.

.....

[1]

(ii) Describe how the addition of the element named in **(i)**, can increase the strength of iron.

.....

.....

.....

[2]

(b) Objects made of iron can rust.
Explain why coating iron with grease prevents iron from rusting.

.....

.....

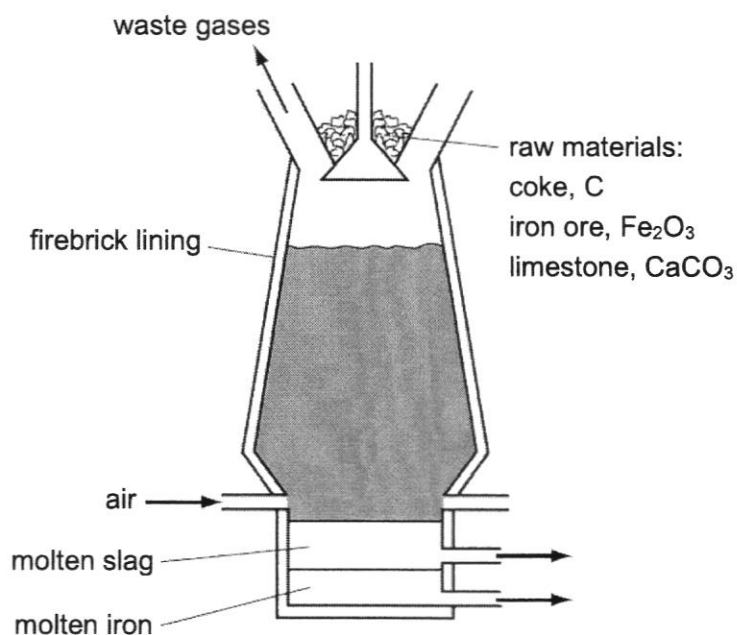
.....

[2]

15

- (c) Iron is extracted from its ore in the Blast Furnace.

For
Examiners'
Use



- (i) Explain why the molten iron and the molten slag form two layers and why molten iron is at the lower layer.

.....

.....

.....

[2]

- (ii) The oxide of iron is present in iron ore and is used as a raw material for the extraction of iron in a Blast Furnace.

Include suitable chemical equations in your answer to explain how iron is extracted from the oxide of iron. There is no need to include details on how the impurities are removed from the iron ore.

.....

.....

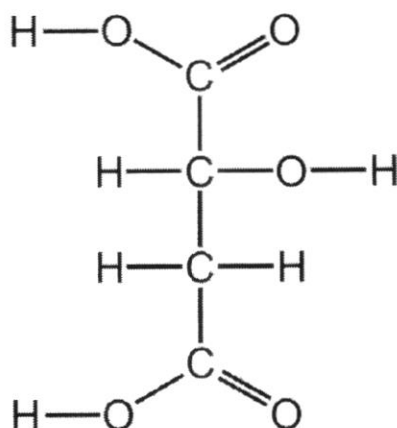
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.....

[3]

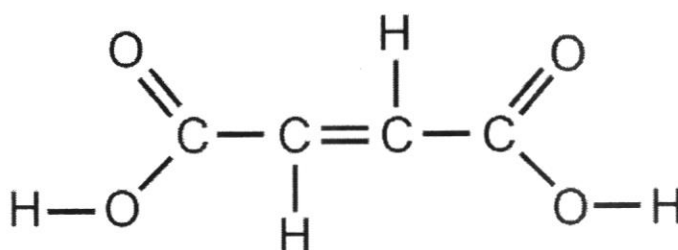
For
Examiners'
Use

11 The structure of malic acid is shown.



- (a) (i) To the structure above, draw a circle around the alcohol functional group.
- (ii) Deduce the molecular formula of malic acid to show the number of carbon, hydrogen and oxygen atoms.

(b) When malic acid is heated, it forms compound F. The structure of compound F is shown.



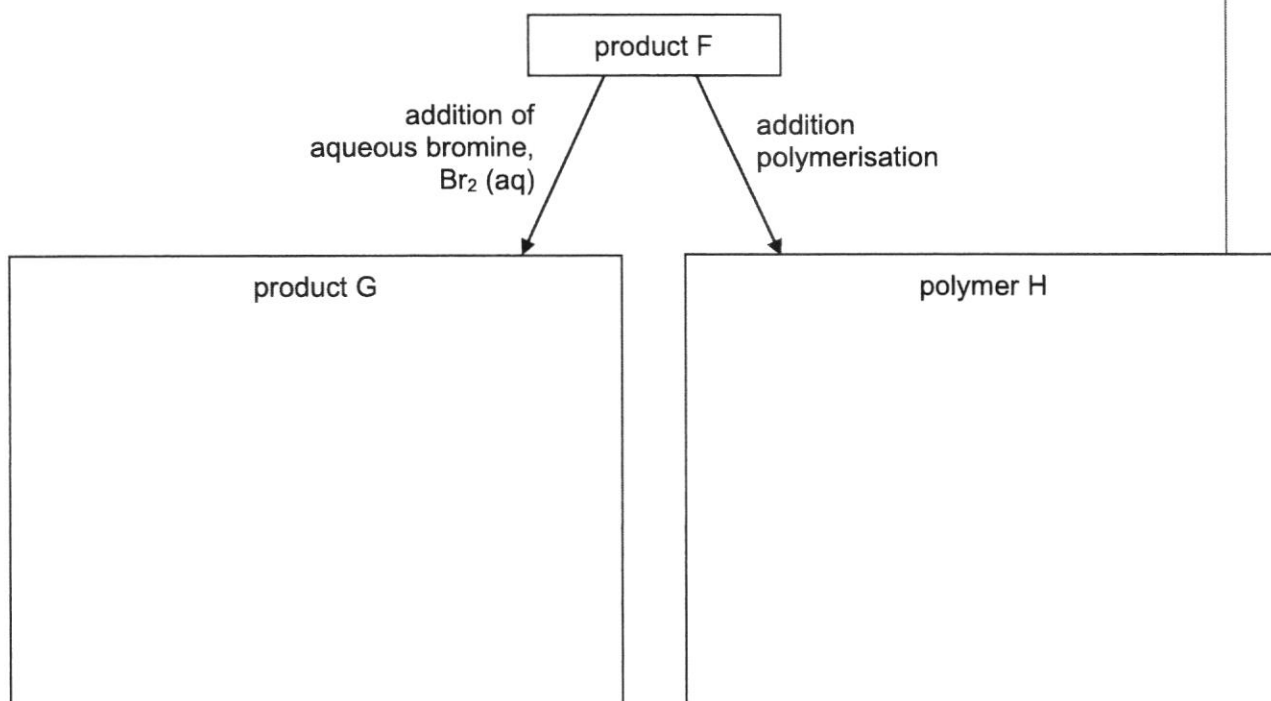
- (i) Explain why compound F is described as *unsaturated*.

.....

17

(ii) Product F can undergo addition reactions as shown.

For
Examiners'
Use



Draw the structures of product G and polymer H in the boxes above.

[3]

(c) Ethanoic acid is a carboxylic acid.

(i) Ethanol can be converted to ethanoic acid when a chemical is added to ethanol. Give the name of this reaction and the name of the chemical to be used.

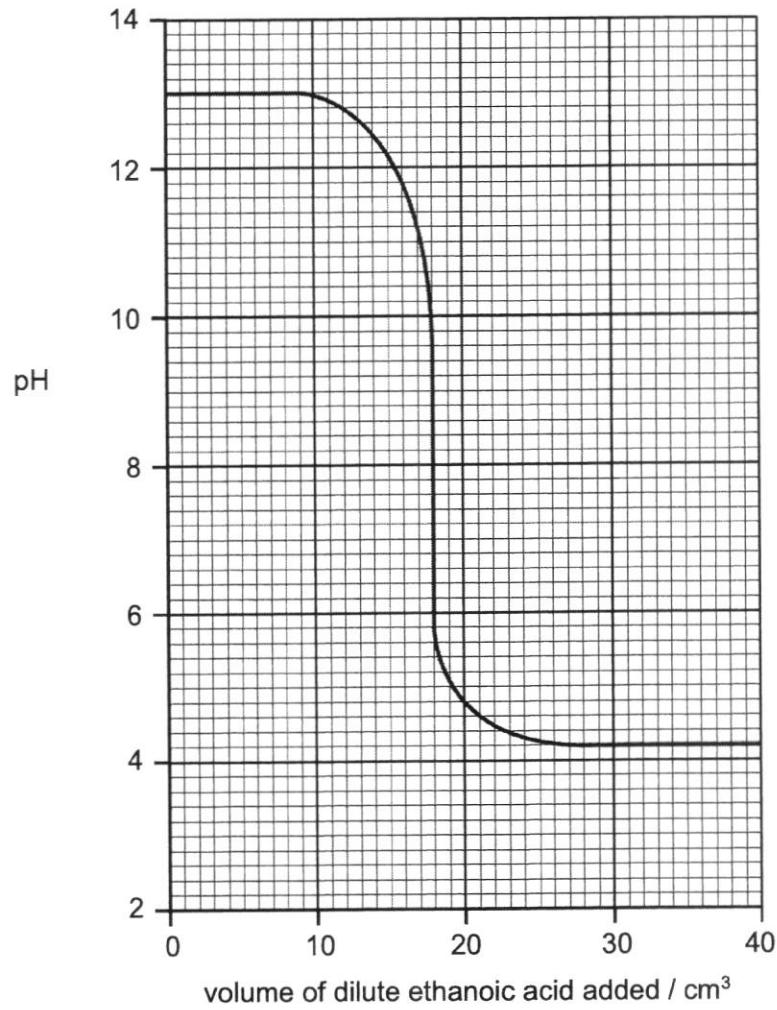
reaction name

name of chemical used

[2]

- (ii) The graph shows how the pH changes when dilute ethanoic acid is added slowly to aqueous sodium hydroxide.

For
Examiners'
Use



Deduce the pH of dilute ethanoic acid.

pH =

[1]

Deduce the volume of dilute ethanoic acid added during neutralisation.

..... cm³

[1]

---- End of Paper 3 ----

Broadrick Secondary School
Sec 4E5N Science (Chemistry) 5076 / 5078
Preliminary Examination 2022 Mark Scheme

Paper 1

Answer to MCQ [20 marks]

1	2	3	4	5	6	7	8	9	10
D	A	B	C	D	D	A	D	D	B

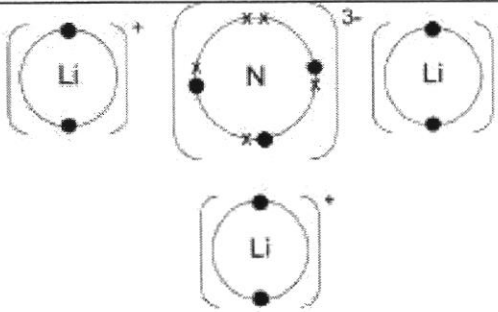
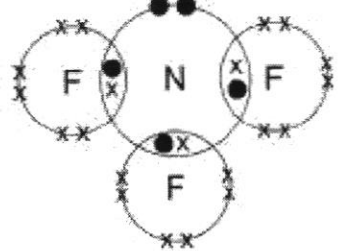
11	12	13	14	15	16	17	18	19	20
B	D	B	B	D	A	C	D	A	C

Paper 3

Answer to Section A [45 marks]

No.			Answers	Mk	Tot mk
1	a		U and W	1	5
	b		T and U	1	
	c		S	1	
	d		P	1	
	e		Q and R	1	
2	a		(most reactive) Y > X > Z > W (least reactive) Max 1m for given in reverse order Max 1m for sequencing the most and least reactive metal correctly (i.e., only X and Z are in wrong order)	2	5
	b	i	delta	1	
		ii	alpha	1	
		iii	epsilon	1	

Broadrick Secondary School
 Sec 4E5N Science (Chemistry) 5076 / 5078
 Preliminary Examination 2022 Mark Scheme

3	a	 Legend /key: • electron of lithium x electron of nitrogen [1] correct Li⁺ ion [1] correct N³⁻ ion	2	6
	b	 Legend /key: • electron of nitrogen x electron of fluorine [1] correct bond pairs [1] correct unshared electrons	2	
	c	Lithium nitride is held by strong electrostatic forces of attraction between its oppositely charged ions (Li⁺ and N³⁻); Nitrogen fluoride is held by weak intermolecular forces of attraction;	2	
4	a	burette	1	6
	b	$\text{H}^+(\text{aq}) + \text{OH}^-(\text{aq}) \rightarrow \text{H}_2\text{O}(\text{l})$	1	
	c	1 mark for each step • <u>Repeat</u> the titration using the same / known volumes of acid and alkali, but <u>without indicator</u> • <u>Heat</u> to evaporate / remove most of the water to obtain a <u>saturated</u> salt solution. • Allow the saturated salt solution to <u>cool</u> for <u>crystallisation</u> to occur; • <u>Filter</u> and collect the crystals, <u>rinse</u> with small amount of cold <u>distilled water</u> and <u>dry</u> between filter papers;	4	

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5	a		No of moles of $\text{NH}_4\text{NO}_2 = \frac{25.0}{1000} \times 0.150 = 0.00375 \text{ mol}$ No of moles of $\text{N}_2 = 0.00375 \text{ mol}$; Maximum volume of $\text{N}_2 = 0.00375 \times 24 = 0.09 \text{ dm}^3$; <i>note: Allow ECF for (a)</i>	2	4
	b	i	to increase the pH of acidic soils / to neutralise the acidity in soil	1	
		ii	calcium hydroxide will react with ammonium nitrate / ammonium salts / ammonium compounds to release ammonia gas, resulting a loss of nitrogen.	1	
6	a	i	A: zinc carbonate	1	7
		ii	B: copper	1	
		iii	C: (dilute) hydrochloric acid	1	
		iv	D: zinc sulfate	1	
		v	E: zinc hydroxide	1	
	b		Any of the following equation: 1m : balanced chemical equation 1m: all correct state symbols, only awarded if equation is correct $\text{ZnCO}_3(\text{aq}) + \text{H}_2\text{SO}_4(\text{aq}) \rightarrow \text{ZnSO}_4(\text{aq}) + \text{CO}_2(\text{g}) + \text{H}_2\text{O}(\text{l})$ $\text{CO}_2(\text{g}) + \text{Ca}(\text{OH})_2(\text{aq}) \rightarrow \text{CaCO}_3(\text{s}) + \text{H}_2\text{O}(\text{l})$ $\text{ZnSO}_4(\text{aq}) + 2\text{NH}_4\text{OH}(\text{aq}) \rightarrow \text{Zn}(\text{OH})_2(\text{s}) + (\text{NH}_4)_2\text{SO}_4(\text{aq})$ $2\text{Cu}(\text{s}) + \text{O}_2(\text{g}) \rightarrow 2\text{CuO}(\text{s})$ $\text{CuO}(\text{s}) + 2\text{HCl}(\text{aq}) \rightarrow \text{CuCl}_2(\text{aq}) + \text{H}_2\text{O}(\text{l})$ $\text{CuCl}_2(\text{aq}) + 2\text{AgNO}_3(\text{aq}) \rightarrow 2\text{AgCl}(\text{s}) + \text{Cu}(\text{NO}_3)_2(\text{aq})$	2	

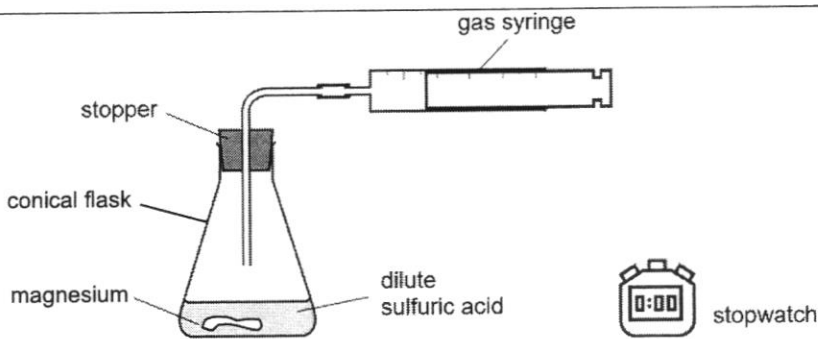
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7	a	$ \begin{array}{c} \text{H} \quad \text{H} \\ \quad \\ \text{H}-\text{C}-\text{C}-\text{O}-\text{H} \\ \quad \\ \text{H} \quad \text{H} \end{array} $ Reject '- OH' as qn asks for full structure	1	7
	b	i Fermentation ; Fractional distillation ;	2	
		ii $\text{C}_6\text{H}_{12}\text{O}_6(\text{aq}) \rightarrow 2\text{C}_2\text{H}_5\text{OH}(\text{aq}) + 2\text{CO}_2(\text{g})$	2	
		iii 37 – 40 °C, yeast, absence of oxygen / anaerobic condition	1	
	c	The amount of carbon dioxide emitted in the combustion of ethanol is balanced by the taking in of carbon dioxide by sugar cane during photosynthesis.	1	
8	a	i 15.5 (%) working is not required	1	5
		ii hydrogen / H_2	1	
		iii the air / the atmosphere	1	
	b	i compounds made up of carbon and hydrogen atoms only	1	
		ii prevents red blood cells from transporting oxygen in the body, leading to suffocation, brain damage and eventually death	1	

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Section B [20 marks]

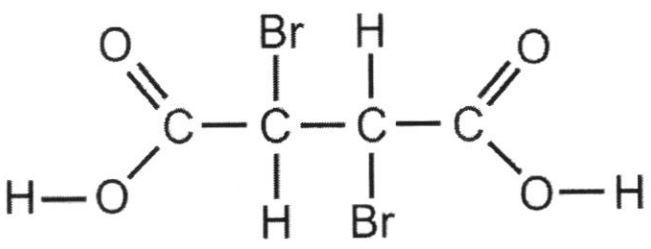
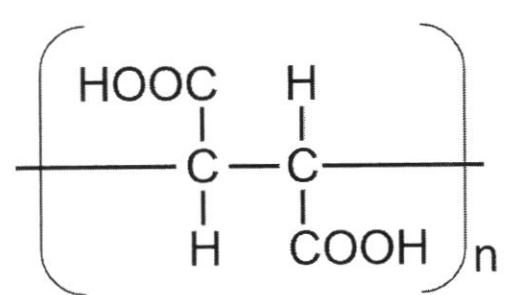
Answer two out of three questions from this section.

No.		Answers	Mk	Tot mk
9	a	 [1] correct drawing of gas syringe + label [1] correct drawing of stoppered conical flask with contents + label [1] correct drawing of stopwatch + label Max 2 marks for correct drawing of the full set-up but w/o labels	3	10
	b	i all magnesium has reacted / reaction has completed ii 3 min / 180 s (units required) iii Curve sketched • has steeper initial gradient and starts at (0,0) ; • ends at the same volume of gas collected and reaches this volume earlier ;	1 1 2	
	c	rate of reaction will be <u>faster</u> ; powdered magnesium has a <u>greater total surface area / higher surface area to volume ratio</u> when compared with magnesium ribbon ; hence resulting in <u>increased frequency of effective collision</u> ;	3	

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10	a	i	carbon	1	10
		ii	different atomic size of carbon disrupts the regular arrangement of the main iron atom layers ; hence preventing the iron atom layers from sliding past one another ;	2	
	b		grease acts as a <u>barrier to prevent contact</u> between iron with <u>oxygen and water / water vapour / moisture</u> .	2	
	c	i	molten iron has a <u>higher density</u> / is <u>denser</u> than molten slag [2] 'different density' – 1 mark awarded	2	
		ii	- Carbon dioxide is formed when coke undergoes combustion in hot air: $C(s) + O_2(g) \rightarrow CO_2(g)$ [1] - Further reaction takes place between coke and carbon dioxide to form carbon monoxide. $C(s) + CO_2(g) \rightarrow 2CO(g)$ [1] - Iron metal is formed when haematite is reduced by carbon monoxide. $Fe_2O_3(s) + 3CO(g) \rightarrow 2Fe(l) + 3CO_2(g)$ [1] 1 mark awarded for each balanced chemical equation, state symbols are not required	3	

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11	a	i	circle drawn at the hydroxyl (-OH) group	1	10
		ii	$C_4H_6O_5$	1	
	b	i	It has a C=C double bond / carbon-carbon double bond.	1	
		ii	product G:	1	
					
			polymer H [1] correct repeat unit [1] bracket and 'n' indicated 	2	
	c	i	oxidation	1	
			acidified potassium manganate (VII)	1	
		ii	1. (pH) 4.2	1	
			2. 18 (cm ³)	1	