FUCHUN SECONDARY SCHOOL
PRELIMINARY EXAMINATION 2021
SECONDARY FOUR EXPRESS AND FIVE NORMAL (ACADEMIC)

SCIENCE (CHEMISTRY/PHYSICS)   **5076/01**
SCIENCE (CHEMISTRY/BIOLOGY)   **5078/01**
Paper 1 Multiple Choice

2021

Paper 1 : 1 hour

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, index number and class 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.
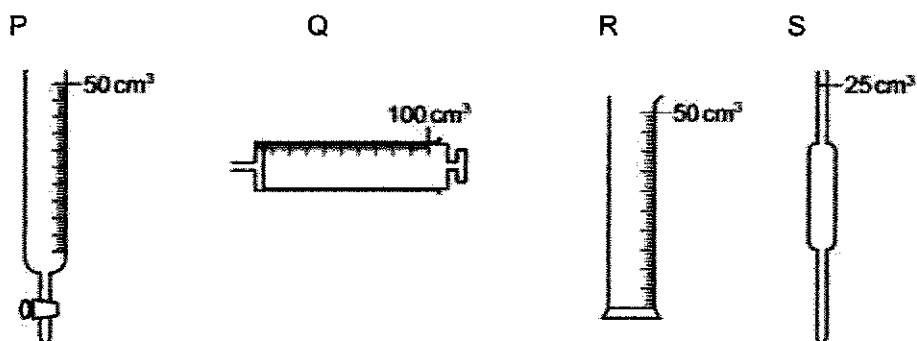A copy of the Periodic Table is provided.

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

Setter: Mdm Yogeswari

This document consists of 9 printed pages

2

1 P, Q, R and S are pieces of apparatus.

P   Q   R   S

Which row describes the correct apparatus for the measurement made?

	apparatus	measurement made
A	**P**	26.10 cm^3 of acid to add to alkali in a titration
B	**Q**	1 cm^3 of acid to add to calcium carbonate in a rate-determining experiment
C	**R**	75 cm^3 of a gas given off in a rate-determining experiment
D	**S**	20 cm^3 of alkali for use in a titration

2 The dot-and-cross diagrams for four compounds are shown.

Which diagram shows a correct covalent compound? (Note that only the outer shell electrons are shown.)

A

B

C

D

3

3   The electronic structures of atoms X and Y are shown.

X and Y form a covalent compound.
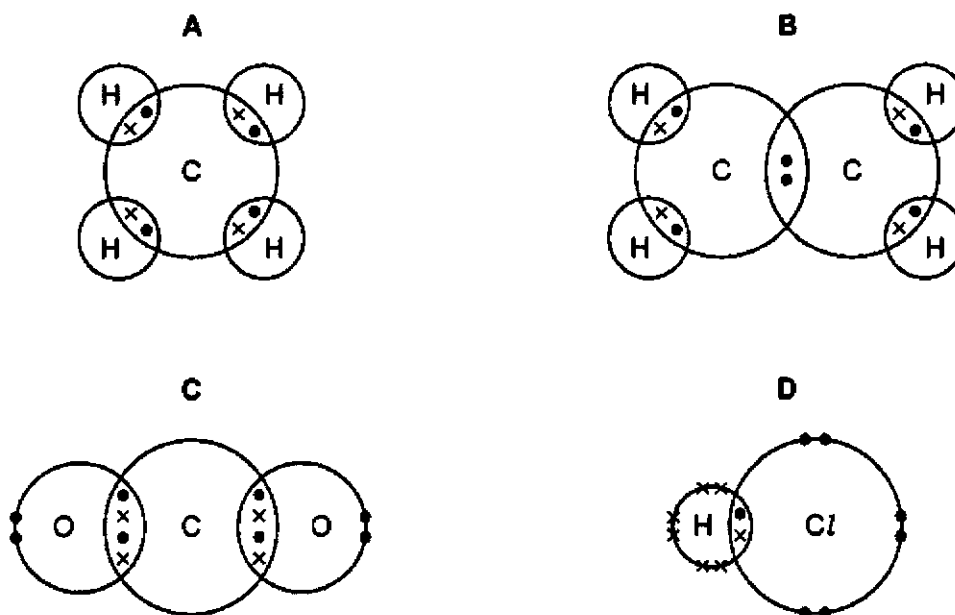
What is its formula?

A   XY

B XY_3

C X_3Y

D XY_5

4   Iodine, I, has a lower relative atomic mass than tellurium, Te, but is placed after it in the Periodic Table. Which of the following statements correctly explains the placement of Te and I in the table?

A   Iodine has fewer neutrons than tellurium.

B   Iodine has fewer protons than tellurium.

C   Iodine has more neutrons than tellurium.

D   Iodine has more protons than tellurium.

5 Calcium phosphate forms when calcium chloride and sodium phosphate solutions react together.

$$xCaCl_2 + yNa_3PO_4 \rightarrow 2Ca_3(PO4)_2 + 12NaCl$$
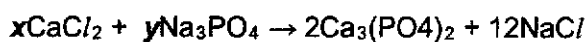
Which values of x and y balance the equation?

	x	y
A	2	2
B	3	4
C	6	3
D	6	4

6 The diagram shows the structure of glycine.
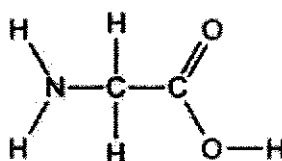
How many bonding pairs of electrons are there in the molecule?

A 7

B 9

C 10

D 20

7 The table gives data about four substances.

In which substance are the particles arranged randomly at room temperature?

	melting point/°C	boiling point/°C
A	-114	-80
B	120	445
C	750	1407
D	1610	2230

5

8   Which properties represent those of an ionic compound?

	conductivity of solid compound	conductivity of molten compound	conductivity of aqueous solution
A	good	good	good
B	good	good	poor
C	poor	good	good
D	poor	poor	good

9   Part of the Periodic Table is shown.

Which element forms an oxide that reacts with dilute acid to form a salt and water?

10   Aqueous sodium hydroxide is added to solid Q in a test-tube.

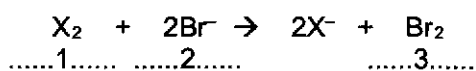A gas is produced which turns damp red litmus blue.

What is Q?

    A   aluminium

    B   ammonia

    C   ammonium chloride

    D   magnesium nitrate

11   What is the ionic equation for the reaction between hydrochloric acid and sodium hydroxide?

    A $H^+ + OH^- \rightarrow H_2O$

    B $2H^+ + O^{2-} \rightarrow H_2O$

    C $Na^+ + Cl^- \rightarrow NaCl$

    D $H^+ + Cl^- \rightarrow HCl$

6

12 The equation shows the reaction between a halogen and aqueous bromide ions.

$$X_2 \quad + \quad 2Br^- \quad \rightarrow \quad 2X^- \quad + \quad Br_2$$
......1...... ......2...... ......3......

Which words complete gaps 1, 2 and 3?

	halogen 1	colour of solution 2	colour of solution 3
A	chlorine	brown	colourless
B	chlorine	colourless	brown
C	iodine	brown	colourless
D	iodine	colourless	brown

13 20 cm^3 of ethene are reacted with 70 cm^3 of oxygen.

The equation for the reaction is shown.

$$C_2H_4(g) \quad + \quad 3O_2(g) \quad \rightarrow \quad 2CO_2(g) \quad + \quad 2H_2O(l)$$

What is the total volume of gas remaining at the end of the reaction?
(all volumes are measured at r.t.p)

A 40 cm^3

B 50 cm^3

C 80 cm^3

D 90 cm^3

14 What is the mass of sodium hydroxide present in 1 dm^3 of 2.0 mol/dm^3 of sodium hydroxide solution?
[Relative atomic masses: Na, 23; O, 16; H, 1.]

A   0.2 g

B   2.0 g

C   8.0 g

D   80.0 g

15 The diagrams show experiments involving the rusting of iron.

tube P	tube Q	tube R
iron nails	oil	
water	water boiled to remove the air	anhydrous calcium chloride to dry the air
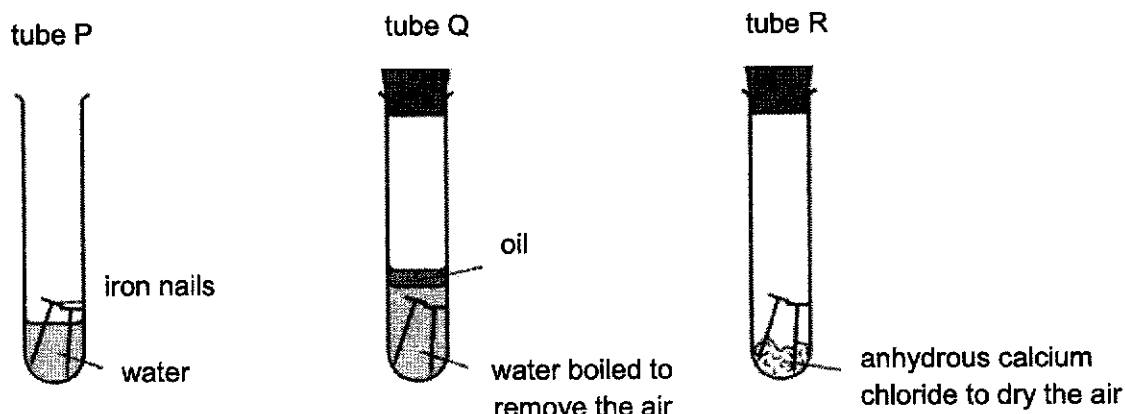
A student predicted the following results.

1 In tube P, the iron nails rust.

2 In tube Q, the iron nails do not rust.

3 In tube R, the iron nails do not rust.

Which predictions are correct?

A 1 and 2 only

B 1 and 3 only

C 2 and 3 only

D 1, 2 and 3

16 The element vanadium, V, forms several oxides.

In which change is oxidation taking place?

A $VO_2 \rightarrow V_2O_3$

B $V_2O_5 \rightarrow VO_2$

C $V_2O_3 \rightarrow VO$

D $V_2O_3 \rightarrow V_2O_5$

8

17 Solid hydrated sodium carbonate was added to solid citric acid.

The mixture was stirred and the temperature recorded every 10 seconds.

The results are shown on the graph:
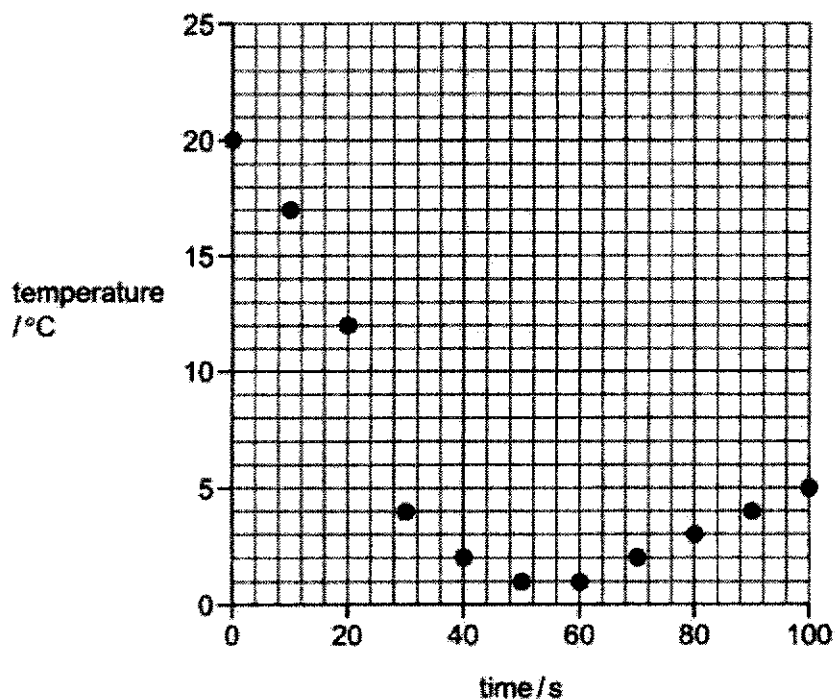
Which row describes the reaction?

	reaction type	energy change
A	neutralisation	endothermic
B	neutralisation	exothermic
C	thermal decomposition	endothermic
D	thermal decomposition	exothermic

18 Which list shows the fractions obtained from distilling petroleum, in order of increasing boiling point?

A   bitumen → diesel oil → lubricating oil → petrol

B   diesel oil → kerosene → naphtha → petrol

C   petrol → diesel oil → lubricating oil → methane

D   methane → petrol → kerosene → bitumen

19 Calcium carbonate reacts with dilute hydrochloric acid to make carbon dioxide gas. Graph X shows the results of this experiment.

The particle size of the calcium carbonate is increased and the experiment is repeated.
All other conditions are kept the same. Graph Y shows the results of this experiment.

Which diagram is correct for the two experiments?
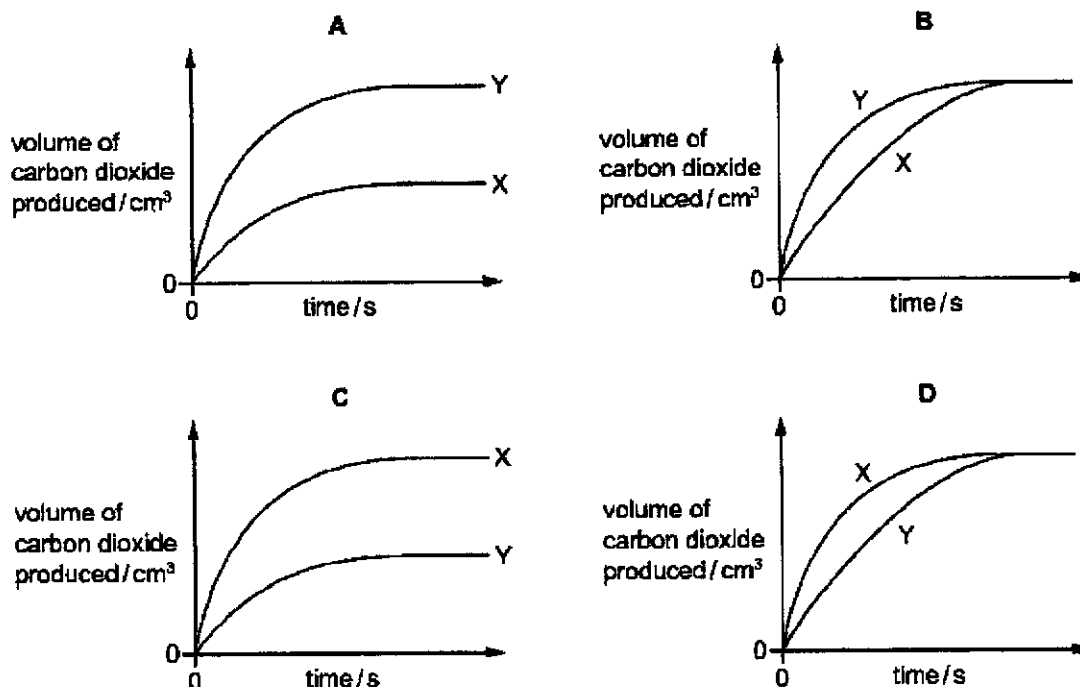
20 The molecules of two hydrocarbon compounds X and Y each contain only four carbon atoms.

X is saturated and Y is unsaturated.

Which statements are correct?

1   Under suitable conditions, Y polymerises.

2   The complete combustion of 1 mole of Y produces more carbon dioxide than the complete combustion of 1 mole of X.

3   One molecule of Y contains more hydrogen atoms than one molecule of X

A   1 only

B   3 only

C   1 and 2

D   2 and 3

End of paper

FUCHUN SECONDARY SCHOOL
PRELIMINARY EXAMINATION 2021
SECONDARY FOUR EXPRESS / FIVE NORMAL (ACADEMIC)

CANDIDATE NAME		CLASS	

CENTRE NUMBER	S					INDEX NUMBER				

SCIENCE (PHYSICS, CHEMISTRY)   **5076/03**
SCIENCE (CHEMISTRY, BIOLOGY)   **5078/03**
Paper 3 Chemistry   **1 September 2021**
                                           1 hour 15 minutes

Candidates answer on the Question Paper.
No Additional Materials are required.

READ THESE INSTRUCTIONS FIRST

Write your Centre number, index number, name and class on all the work you hand in.
You may use an HB pencil for any diagrams, graphs, tables or rough working.
Write in dark blue or black pen.
Do not use staples, 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 Periodic Table is provided.

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.

For Examiner's Use	
Section A	/45
Section B	/20
TOTAL	/65

Setter: Mdm Yogeswari

2

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

1 Fig. 1.1 shows the chromatogram of food products **1**, **2** and **3** and permitted food dyes **A**, **B** and **C**.
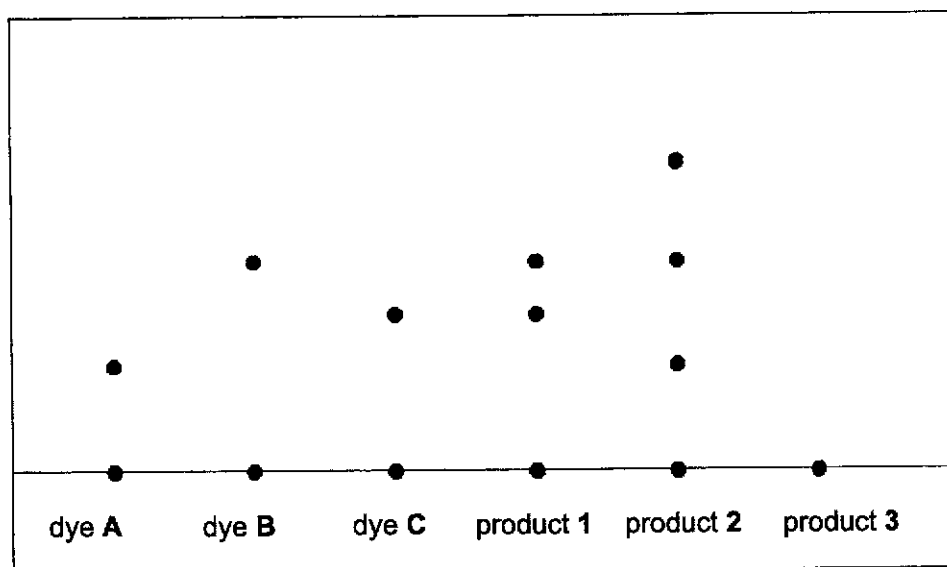
Fig. 1.1

(a) State and explain which food product(s) are safe for consumption.

....

.... [2]

(b) Explain why the sample of product **3** did **not** separate into different spots.

.... [1]

3

2 For each of the following statements in Table 2.1, state whether it is **true** or **false**. [4]

Table 2.1

	statement	true or false
(a)	Isotopes have the same nucleon number but different atomic number.	
(b)	An alkali is a soluble metal.	
(c)	Aluminium oxide can react with both acids and alkalis.	
(d)	The oxides of both iron and copper can be reduced by carbon.	

3 A new element named "Alchemium", with chemical symbol, A, has been isolated. It has a silvery appearance and a low density. It is also an excellent conductor of heat and electricity.

It is extremely reactive with air and water, and has to be stored in oil. When it reacts with water, it forms a solution that turns blue when Universal Indicator is added to it. Bubbles of hydrogen gas are formed too.

Alchemium forms a stable carbonate that does not decompose under heat.

(a) Which group in the Periodic Table is alchemium likely to fall in? Give a reason for your answer.

....

.... [2]

(b) (i) How many electron(s) does an alchemium atom most likely have in its outermost shell?

.... [1]

(ii) Give the chemical formula of the carbonate formed by alchemium.

.... [1]

(c) Write the balanced chemical equation for the reaction between alchemium and water.

.... [2]

(d) Alchemium also reacts with air to form alchemium oxide. Draw the "dot and cross" diagram to show the arrangement of the outer shell electrons in alchemium oxide, using the symbol, A, to represent alchemium.

[2]

4 A student investigates the decomposition of five different metal carbonates. The student heats a 0.010 mol sample of each carbonate using the blue flame of the same Bunsen burner. He then measures the time taken for 100 cm³ of gas to be collected.

Complete Fig. 4.1 to show how the volume for the gas can be collected and measured every few seconds.

(a) Complete Fig. 4.1 to show how the volume for the gas can be collected and measured every few seconds.

[1]

Fig. 4.1

5
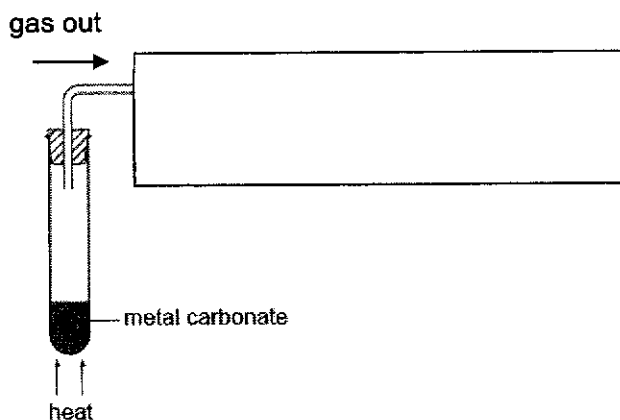
The results of this experiment are shown in Table 4.1

Table 4.1

metal carbonate	chemical formula of metal carbonate	time taken to collect 100 cm³ of gas / s
copper(II) carbonate		25
magnesium carbonate		300
calcium carbonate		500
sodium carbonate		no gas produced after 1000 seconds
zinc carbonate		100

(b) Fill in the chemical formulaes of the metal carbonates in the table above. [5]

(c) From the results above, arrange the metals: copper, magnesium, calcium, sodium and zinc from the most reactive to the least reactive.

.... -> .... -> .... -> .... -> .... [2]

most reactive   least reactive

(d) The student wants to prepare the salt crystals of copper(II) sulfate using copper(II) carbonate. What is the other reagent needed for the salt preparation?

.... [1]

(e) Describe the steps needed to prepare a dry sample of copper(II) sulfate from the above mentioned reactants.

....

....

....

....

.... [4]

6

(f) The gas collected from the decomposition of the metal carbonates is carbon dioxide.

Describe the chemical test for the identification of the gas.

test: ....

observation: .... [2]

5 Complete the Table 5.1 below.

Table 5.1

gas	volume at r.t.p/ dm^3	number of moles	molar mass/ g/mol	mass/ g
ammonia, NH_3	24		17	
hydrogen, H_2	48	2		
nitrogen, N_2		4		112
oxygen, O_2	24	1		

[8]

6   Fig. 6.1 describes the tests and results that were carried out on **R** and **S** from an unknown mixture.

```
                          ┌─────────────────────┐
                          │   unknown mixture   │
                          └─────────────────────┘
                                filtration
              ┌─────────────┐                  ┌──────────────────┐
              │ filtrate R  │                  │   residue S,     │
              └─────────────┘                  │   lead(II) salt  │
                                               └──────────────────┘
          add aqueous NaOH                         add dilute nitric
          dropwise until in                        acid
          excess
    ┌─────────────────────────┐          ┌────────────────────────────────┐
    │ green ppt, T, insoluble │          │ effervescence, colourless gas  │
    │     in excess NaOH      │          │ evolved. White ppt, U, formed  │
    └─────────────────────────┘          │ when bubbled through limewater │
                                         └────────────────────────────────┘
          aluminium powder
          added, warm gently
    ┌─────────────────────────────┐
    │ colourless pungent gas V    │
    │ evolved which turned moist  │
    │ red litmus paper blue       │
    └─────────────────────────────┘
```

Fig. 6.1

(a)   Identify each of **R**, **S**, **T**, **U** and **V**.

   (i)   **R**   ....

   (ii)   **S**   ....

   (iii) **T**   ....

   (iv)   **U**   ....

   (v)   **V**   ....   [5]

(b)   Write a balanced chemical equation for any one of the reactions in Fig. 6.1.

   .... [2]

8

Section B
Answer any **two** questions in this section.
Write your answers in the spaces provided

7 Lean burn engines are a type of engine. Lean-burn engines enjoy higher fuel economy and cleaner emissions. They use less fuel and emit fewer unburned hydrocarbons and greenhouse gases with similar efficiency as a normal combustion engine.

Table 7.1 shows some information about lean burn engines compared to normal car engines.

Table 7.1

type of engine	volume of air mixed with petrol	operating temperature	concentration of carbon monoxide in exhaust gases	concentration of nitrogen oxides in exhaust gases
normal	less air	higher	higher	higher
lean burn	more air	lower	lower	lower

(a) (i) How is carbon monoxide formed in the car engine?

.... [1]

(ii) Using the information from the table, suggest why lean burn engines produce lower concentration of carbon monoxide.

....

.... [2]

(iii) Explain how nitrogen oxides are formed in a car engine.

....

.... [2]

(iv) Suggest why lean burn engines produce lower concentration of nitrogen oxides.

.... [1]

(b) A coal used in power station contains 1% by mass of sulfur. When this coal is burned, the pollutant gas sulfur dioxide is produced as shown by the equation below.

$$S + O_2 \rightarrow SO_2$$
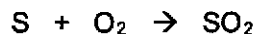
Calculate the volume of sulfur dioxide formed when 20 000 g of this coal is burned completely in air.

[Relative atomic masses: A_r: O, 16; S, 32]

[The volume of one mole of any gas is 24 dm^3 at room temperature and pressure.]

volume of sulfur dioxide = …………………………….dm^3 [4]

8 A student carried out three experiments using lithium and water.

In **experiment 1**, a piece of lithium of mass 0.70 g was added to 150 cm³ of water.

The volume of hydrogen formed was measured at intervals until all the lithium had dissolved. The following graph was obtained.
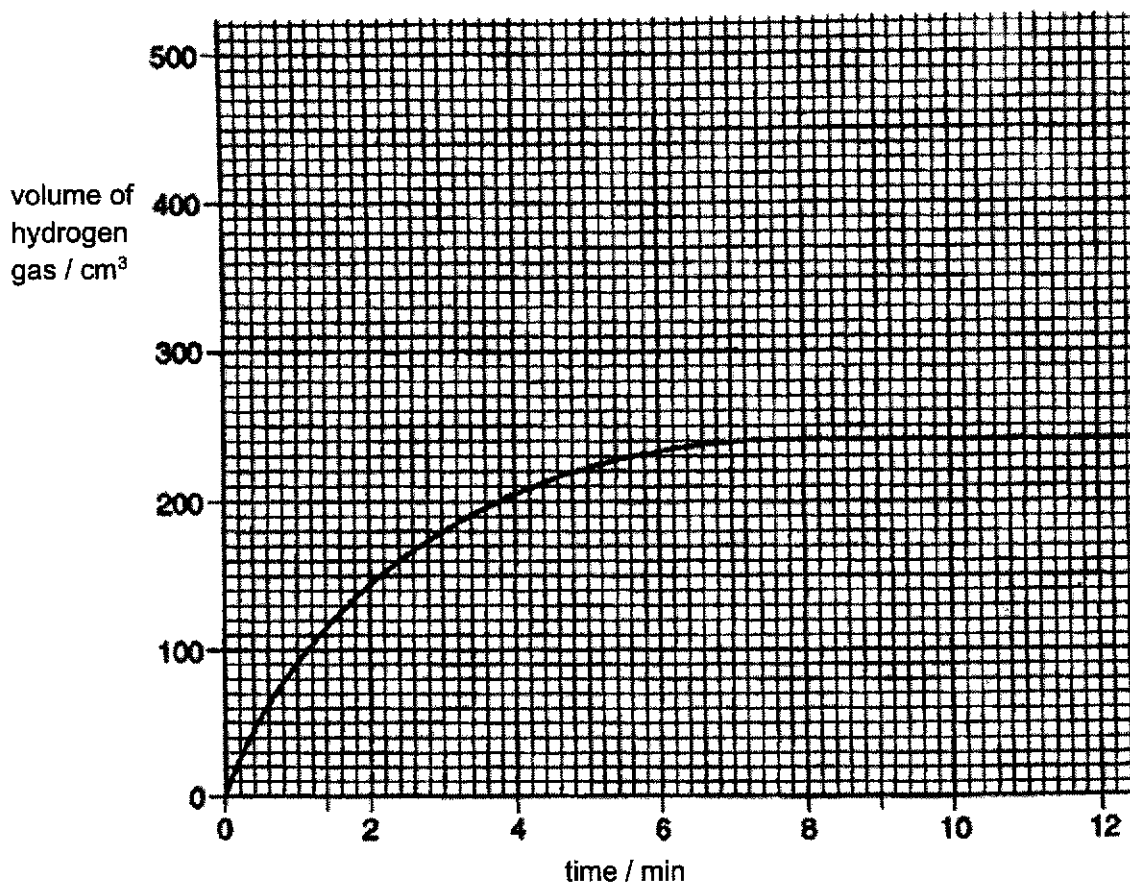
(a) What can you tell from the graph about the speed of this reaction during the first 12 minutes?

....

.... [2]

(b) How long does it take for half of the given piece of lithium metal to be reacted?

.... [1]

(c) Calculate the concentration, in mol/dm^3, of the resulting lithium hydroxide solution.

[2]

(d) The student carried out two further experiments.

Experiment 2 was the same as **experiment 1**, except 0.35 g of lithium were used.

Experiment 3 was the same as **experiment 1**, except the water temperature was raised by 10 °C.

(i) On the grid sketch and label the graphs you would expect for **experiment 2** and **experiment 3**.   [2]

(ii) Use your knowledge of collisions between reacting particles to explain how and why rate of the reaction for **experiment 3** would be different from **experiment 1**.

....

....

.... [3]

9 Fig. 9.1 shows four test tubes which were set up to investigate fermentation.

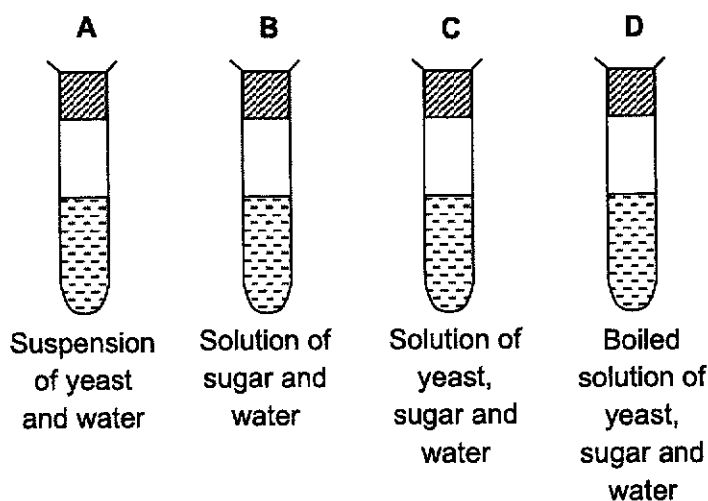| A	B	C	D
Suspension of yeast and water	Solution of sugar and water	Solution of yeast, sugar and water	Boiled solution of yeast, sugar and water

Fig. 9.1

(a) Did fermentation take place in every test tube? Explain your answer for each test tube.

....

....

....

....

....

.... [4]

(b) (i) The labels on three reagent bottles have dropped off. However, the bottles were known to contain the organic liquids with the following molecular formulae:

$$\textbf{P}: CH_2CHCH_3 \quad \textbf{Q}: CH_3CH_2COOH \quad \textbf{R}: CH_3CH_2CH_3$$

Describe how you would identify each of these liquids by carrying out any **two** chemical tests. Provide any observations that you would see.

....

....

....

....

....

.... [4]

(ii) **Q**, CH_3CH_2COOH, is formed when an alcohol, **S**, is left open in the air. Draw the structure of **S**, showing every atom and every bond. State the name of **S**.

name of **S**: ....   [2]

End Of Paper

FUCHUN SECONDARY SCHOOL
PRELIMINARY EXAMINATION 2021
SECONDARY 4E/5NA

SCIENCE(CHEMISTRY)
Paper 1 Multiple Choice

5076/5078

MARK SCHEME

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

FUCHUN SECONDARY SCHOOL
PRELIMINARY EXAMINATION 2021
SECONDARY 4E5NA
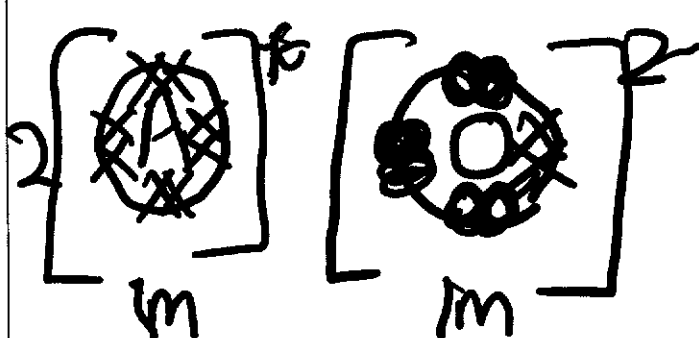
SCIENCE
Paper 3 Chemistry

5076/5078

MARK SCHEME

Section A (45 marks)

Qn	Answer	Marks
1a	product 1.	1
	It contain the permitted dyes	1
1b	The dyes are not soluble in the solvent	1
2	false	1
	false	1

2

	true	1
	true	1
3a	Group I.	1
	It is extremely reactive in air and water/ It reacts in water to form an alkaline solution/low denisty	1
3bi	1	1
3bii	A_2CO_3	1
3c	$2A + 2H_2O \rightarrow 2AOH + H_2$ correct formula	1
	balanced eqn	1
3d		2m
4a	draw a gas syringe	1

3

4b	metal carbonate	chemical formula of metal carbonate	5
	copper(II) carbonate	CuCO₃	[1]
	magnesium carbonate	MgCO₃	
	calcium carbonate	CaCO₃	
	sodium carbonate	Na₂CO₃	
	zinc carbonate	ZnCO₃	

4c	sodium ->calcium -> magnesium-> zinc ->copper all correct trend, 1m if two subsequent metals are interchanged then 1m.	max 2
4d	sulfuric acid	1
4e	Add excess copper(II) carbonate to sulfuric acid till it no longer dissolves. Filter off the unreacted copper(II) carbonate and collect the filtrate of salt. Heat the salt solution till saturation. Leave it to cool and crystallise Filter the crystals and press dry between the sheets of filter paper.	1 1 1 1
4f	test: bubble the gas into limewater observation: white precipitate formed.	1 1
5		
6ai	R : Iron(II) nitrate/ Fe(NO₃)₂	[1]
6aii	S: Lead(II) carbonate/ PbCO₃	[1]
6aiii	T: Iron(II) hydroxide/ Fe(OH)₂	[1]

4

6aiv	U: Calcium carbonate/ $CaCO_3$	[1]
6av	V: Ammonia/ NH_3	[1]
6b	$Fe(NO_3)_2 + 2NaOH \rightarrow Fe(OH)_2 + 2NaNO_3$ **OR** $PbCO_3 + 2HNO_3 \rightarrow Pb(NO_3)_2 + CO_2 + H_2O$ **OR** $Ca(OH)_2 + CO_2 \rightarrow CaCO_3 + H_2O$	[1] – correct formula [1] – balanced

Section B (20 marks)
*Candidates should answer **two** questions. Where all three questions are answered, ignore answers to last question.*

7ai	incomplete combustion of fuels	1
7aii	In the lean engines, there is **more air**[1] for **complete combustion**[1] of fuels so less carbon monoxide	2
7aiii	Nitrogen reacts with oxygen[1] at high temperatures[1] to form oxides of nitrogen.	2
7aiv	Lean burn engines works at lower temperatures.	1
7b	amount of sulfur =20000g x 1/100= 200g no of moles of sulfur= 200/32 =6.25 moles no of moles of sulfur dioxide = 6.25 moles vol of sulfur dioxide= 6.25 x 24dm³ = 150 dm³	1 1 1 1
8a	The reaction is fastest at the start, slows down with time and eventually stops	1 1
8b	1.4min	1
8c	no. of mol of Li = 0.70 / 7 = 0.1 mol conc. Of LiOH = 0.1/0.150 = 0.667 mol/dm³	1 1

8di	experiment 2: approximately the same initial gradient as experiment 1 but plateaus at 120 cm³ of hydrogen gas. experiment 3: steeper initial gradient as experiment 1 but plateaus at 240 cm³ of hydrogen gas. Note: 0m if graphs are not labelled.	1m each total 2m
8dii	Experiment 3 would have a faster speed of reaction. Experiment 3 was conducted at a higher temperature, hence the particles will <u>move faster/more kinetic energy</u>, <u>increases the frequency of</u> effective collision. Since the frequency of effective collision is proportional to the <u>speed of the reaction</u>, the speed would increase/react more quickly	3
9a	Fermentation will not take place in test tube A because there is no sugar in test tube A. Fermentation will not take place in test tube B because there is no yeast in test tube A. Fermentation will take place in test tube C because fermentation can take place with sugar, yeast and water. Fermentation will not take place in test tube D because enyzmes in the yeast are destroyed/ denatured. (1M for each correct points)	max 4m
9b	1) Add **universal indicator** [1m]to each of the 3 liquids. The one that turns the universal indicator from green to orange / pink is **the acid Q** [1m]. *[Accept any other test for acid]* 2) Add **aqueous bromine**[1m] solution to remaining two solutions. The solution hat decolourises aqueous bromine from brown to colourless is **unsaturated P**. The solution that **remains brown is R**. [1m]	each test 1m results 1m total 4m
9c	name of S: propanol 	1 1