AHMAD IBRAHIM SECONDARY SCHOOL
GCE O-LEVEL PRELIMINARY EXAMINATION 2019

SECONDARY 4 EXPRESS / 5 NORMAL (ACADEMIC)

Name:	Class:	Register No.:

SCIENCE (CHEMISTRY) **5076 / 03**
5078 / 03

Paper 3 **28 August 2019**
1 hour 15 minutes

Additional Materials:
Nil

READ THESE INSTRUCTIONS FIRST:
Do not open this booklet until you are told to do so.
Write down your name, class and register number on this page.

You may use an HB pencil for any diagram, 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 it 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 16.
A copy of the Periodic Table is printed on page 17.
The number of marks is given in brackets [ ] at the end of each question or part question.

	Marks
Paper 1	**/20**
Paper 3	**/65**
Paper 5	**/15**
Total	**/100**

Section A

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

1 The following are terms used to describe chemical reactions.

addition	fermentation	neutralisation
rusting	redox	substitution

Using the terms above, identify the type of reaction that each chemical equation represents.

Each term can only be used once, more than once or not at all.

(a) $C_3H_6 + H_2 \rightarrow C_3H_8$ ……..[1]

(b) $KOH + HCl \rightarrow KCl + H_2O$ ……..[1]

(c) $H_2 + F_2 \rightarrow 2HF$ ……..[1]

(d) $C_2H_6 + Cl_2 \rightarrow C_2H_5Cl + HCl$ ……..[1]

2 Two isotopes of sodium are $^{22}_{11}Na$ and $^{23}_{11}Na$.

(a) Complete Table 2.1 about the particles found in one atom of each of these isotopes.

Table 2.1

	number of		
	protons	electrons	neutrons
$^{22}_{11}Na$			
$^{23}_{11}Na$			

[2]

(b) Sodium is a Group I metal.
State two physical properties of Group I, that are not displayed by other metals.

1……

2……..... [2]

(c) Sodium reacts with cold water, as shown in the half equation.

$$Na(s) \rightarrow Na^+(aq) + e^-$$

State the name of the particle with the symbol e^-.

……..[1]

3 **(a)** Sodium chloride and lead(II) chloride are two different salts which require two different methods of preparation.

Fill in the blanks in Table 3.1 to name the possible reactants used to prepare these two different salts.

Table 3.1

salt	reactant 1	reactant 2
sodium chloride		
lead(II) chloride		

[2]

(b) A practical book gives the following instructions for preparing magnesium nitrate crystals.

Place 100 cm^3 of dilute nitric acid in a beaker. Heat the acid until it is almost boiling. Add magnesium powder **until no more can dissolve**. **Filter the mixture**. Place the filtrate in an evaporating dish. Place the evaporating dish on a tripod and heat it until the liquid has been reduced to **about one-third of its volume**. Put the filtrate aside to allow it to cool. Filter off the crystals from the cooled solution and dry them between pieces of filter paper.

State the purpose of the underlined instructions below.

instruction	purpose
until no more can dissolve	
filter the mixture	
about one-third of its volume	

[3]

(c) The concentration of magnesium nitrate solution is 0.5 mol/dm^3.

(i) Calculate the concentration in g/dm^3.

concentration = ... g/dm^3 [2]

(ii) Calculate the volume of the solution that contains 7.40 g of magnesium nitrate.

volume = ... cm^2 [2]

4 Fig. 4.1 shows some of the stages in the manufacture of a fertiliser, ammonium sulfate.

In reaction vessel **1**, nitrogen gas and hydrogen gas react to produce ammonia, which enters reaction vessel **4** through connecting pipe **B**. Sulfuric acid is made from sulfur dioxide in two stages. Ammonia and sulfuric acid will then react in the reaction vessel **4** to form ammonium sulfate.

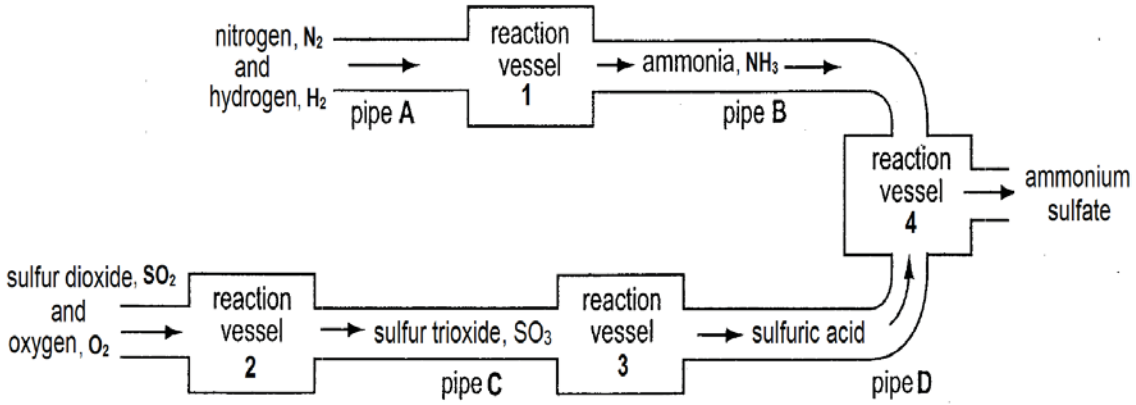


Fig. 4.1

(a) **(i)** Write a balanced chemical equation, for the reaction that takes place in reaction vessel **1**.

.....[1]

(ii) Calculate the volume of hydrogen needed to produce 900 dm^3 of ammonia gas, at room temperature and pressure, for the manufacture of ammonium sulfate.

volume of hydrogen needed = …….. dm^3 [2]

(b) **(i)** From which connecting pipe would a major leak cause a decrease in the pH value of rain? Explain your answer.

……

……

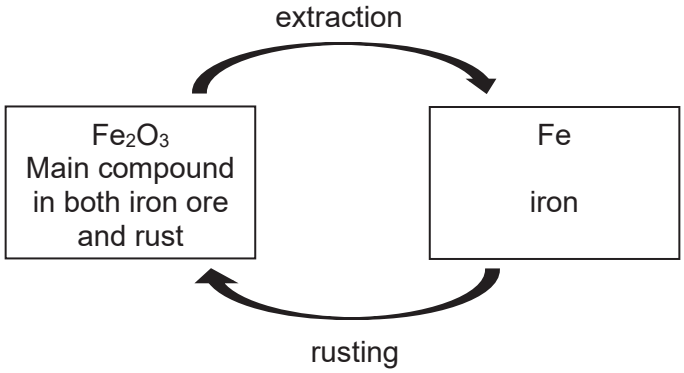
…...……[2]

(ii) State one effect on the environment from the decrease in the pH value of rain.

……

…...……[1]

5 **(a)** The diagram shows the cycle of changes when iron is extracted and then rusts.



Identify the change that involves oxidation and the change that involves reduction. Give reasons for your answers.

……..

……

……

…….....[2]

(b) One of the methods of rust prevention is by spraying the metal surface with a layer of oil.

(i) Explain how this method prevents rusting.

……..…

…….[1]

(ii) Anti-rust spray can also be applied to surfaces to prevent rusting.
The figure below shows the active ingredient in a bottle of anti-rust spray.

Anti-rust spray

Active ingredient: Tannic acid, Zinc powder

Explain how the anti-rust spray helps to prevent rusting.

……..

……..

…….[2]

6 Fig. 6.1 shows the reactions of some substances.

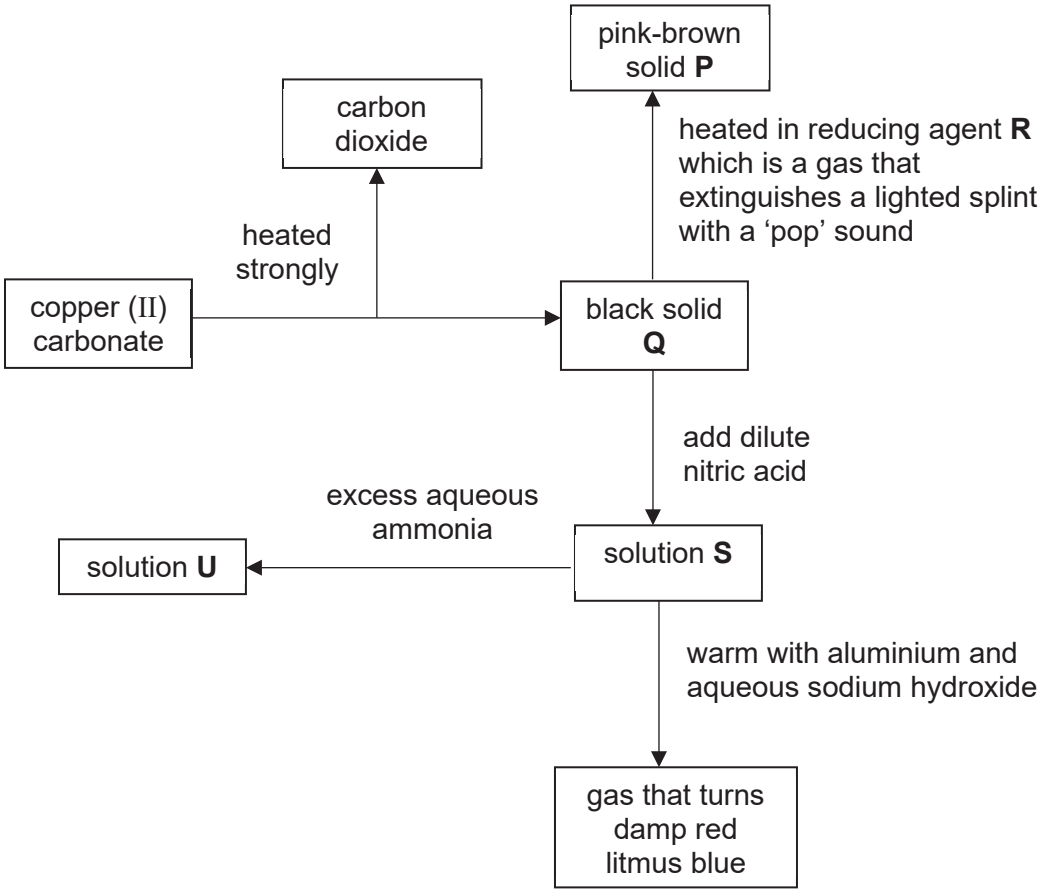


Fig. 6.1

(a) Name the substances **P**, **Q**, **R** and **S**.

P: ……

Q: ……

R: ……

S: ……

[4]

(b) Write the chemical equation for the formation of **S** from **Q**.

……[1]

(c) State the colour of solution **U**.

……[1]

7 Aldehydes are a homologous series of organic compounds like alkanes and alkenes. Table 7.1 shows the names, formulae and boiling points of three aldehydes.

Table 7.1

name	formula	boiling point (°C)
methanal	HCHO	−19
ethanal	CH_3CHO	20
propanal	C_2H_5CHO	49

(a) Use the information in Table 7.1 to give two pieces of evidence that suggest that these aldehydes are a homologous series.

……

……

……[2]

(b) Predict the name, formula and boiling point of the next member of this homologous series.

name: ……

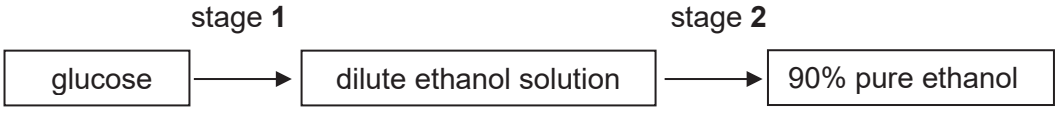
formula: ……

boiling point: ……

[3]

(c) In some countries, ethanol is made from glucose for use as a fuel.

The flowchart summarises the production process for ethanol.



(i) Name the processes that take place at stage **1** and **2**.

stage **1**: ……..

stage **2**: ……..

[2]

(ii) Write a balanced chemical equation for the reaction in stage **1**.

……[1]

(iii) State two conditions for the reaction to occur in stage **1**.

……

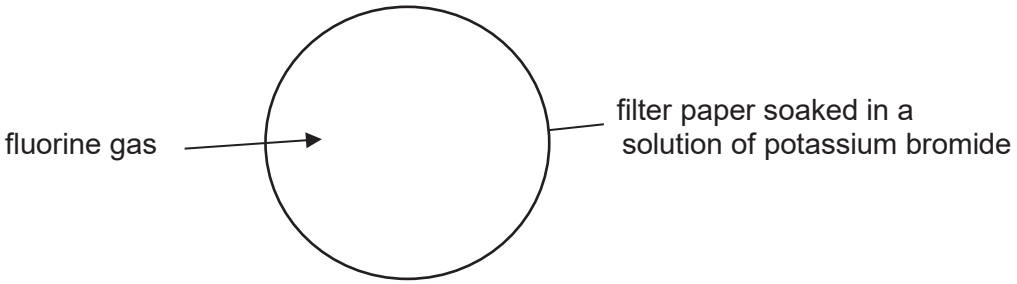
……[2]

Section B

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

8 Fluorine is an element in Group VII.

A jet of fluorine gas is aimed at a piece of filter paper soaked in a solution of potassium bromi de.



The solution on the filter paper quickly turns brown.

(a) Explain why the solution turns brown. Include an equation to support your answer.

……..

……..

……..

……..[3]

(b) 50 cm^3 of fluorine gas reacts with excess water to give oxygen and hydrogen fluoride, HF, which is weakly acidic. The chemical equation is given below.

$$2F_2\,(g) + 2H_2O\,(l) \rightarrow O_2\,(g) + 4HF\,(aq)$$

(i) Universal Indicator can be used to determine when the reaction is completed. State the possible colour changes as the reactants react until the reaction is completed.

……

……..…[1]

(ii) Calculate the mass of oxygen gas produced at room temperature and pressure. [The volume of one mole of any gas is 24 dm^3 at room temperature and pressure.]

mass of oxygen gas = ……[2]

(c) **(i)** Draw a 'dot and cross' diagram to show the arrangement of the outer shell electrons in one molecule of fluorine.

[2]

(ii) Fluorine can be liquified and has a low boiling point.

Explain why the boiling point of fluorine is low.

……

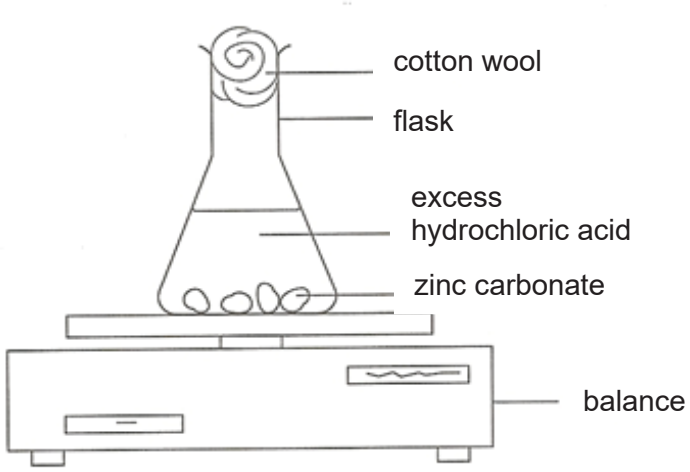
……

……

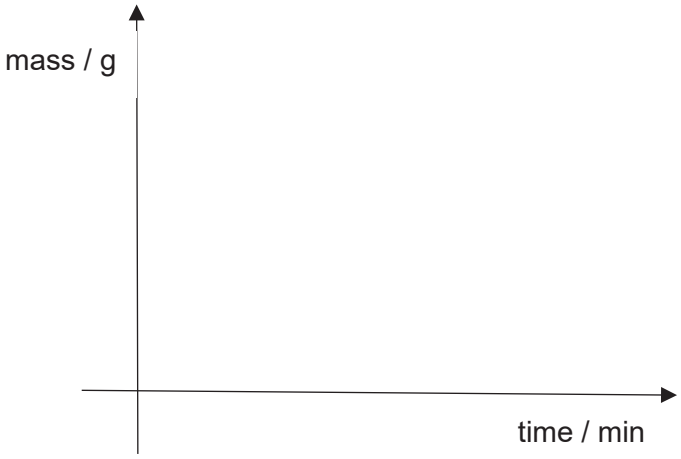
……..…[2]

9 The following set-up is used to investigate the effects of particle size on the rate of reaction. Small lumps of zinc carbonate were added to excess hydrochloric acid.

The time taken for the reaction to complete is 5 minutes.



(a) (i) Sketch a labelled graph to show the progress of this reaction.



[2]

(ii) With reference to the graph that you had sketched, explain the progress of the reaction.

……...

……...

……...

……...

……...

……..…[3]

(b) The experiment was repeated but with powdered zinc carbonate.

(i) Sketch on the same axes in **(a)(i)**, the new graph that you would expect for the experiment with powdered zinc carbonate. Label this graph **X**.

[1]

(ii) Use the collision theory to explain your graph.

…….....

…….....

…….....

…….....

……..…….....[2]

(c) Sketch a different experimental set up that can be used to determine the rate of reaction.

[2]

10 **(a)** Cracking involves a breakdown of large hydrocarbon molecules into smaller ones. During cracking, molecules of octane, C_8H_{18}, produce two different products.

(i) Complete the equation to show the formula of product **X**.

C_8H_{18} → C_4H_{10} + 2 _____ [1]
octane butane (product **X**)

(ii) State the name and draw the structural formula of product **X** in the box below.

Name of product **X**: _____

structural formula of product **X**

[2]

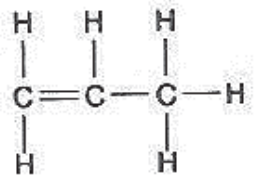
(iii) Describe a chemical test to distinguish between butane and product **X** and give the results of the test.

……

……

……[2]

(b) Propene is a hydrocarbon that can be polymerised. The structure of propene is shown below.



(i) Use the structure of propene to explain how it can form a polymer.

……...

……...

……[2]

(ii) State the name of the polymer formed.

……..[1]

(iii) Draw the structure of the polymer which is formed.
(Show at least three repeat units.)

[2]

END OF PAPER

Setter: Mdm Phua MH

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.).