YUHUA SECONDARY SCHOOL
PRELIMINARY EXAMINATION 2019
SECONDARY 4 EXPRESS / 5 NORMAL ACADEMIC

4E/5N	CANDIDATE NAME			
	CLASS		INDEX NUMBER	

SCIENCE (CHEMISTRY, BIOLOGY) 5078/01

Paper 1 Multiple Choice **26 August 2019**
1 hour

Additional Materials : Multiple Choice Answer Sheet

Setter: Ms Cheong Ai Hwa
Ms Bo Yiting

READ THESE INSTRUCTIONS FIRST

Do not open this booklet until you are told to do so.

Use soft pencil.
Do not use staples, paper clips, glue or correction fluid.
Write your *Class*, *Name* and *Class Index Number* in the spaces at the top of this page and on the Multiple Choice Answer Sheet.

Read the instructions on the Multiple Choice Answer Sheet carefully

There are **forty** questions in 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 Multiple Choice Answer Sheet.

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 Data Sheet is printed on page **13**.
A copy of the Periodic Table is included on page **14**.

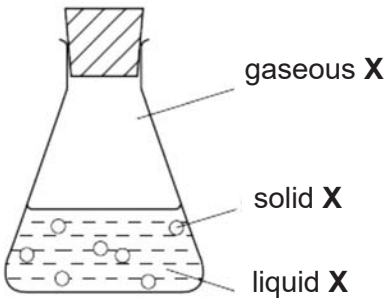
The use of an approved scientific calculator is expected, where appropriate.

This document consists of **14** printed pages, inclusive of this page.

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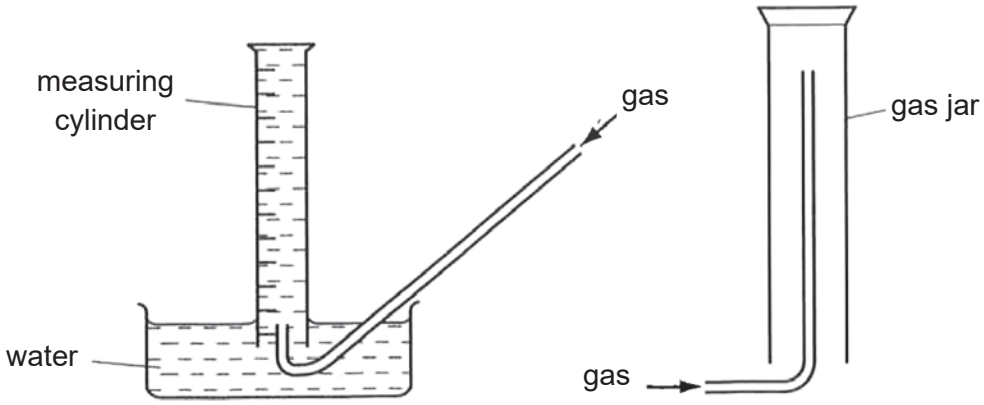
1 The conical flask contains compound **X** which is present in solid, liquid and gaseous states.



Which of the following is **not** correct?

A A gaseous **X** molecule has a lower mass than a liquid **X** molecule.
B Energy is released when **X** changes from gas to liquid.
C Gas **X** molecules occupy a larger space than same number of liquid **X** molecules.
D Solid **X** molecules vibrate about fixed positions.

2 The following diagrams show two methods of gas collection.



Which row gives the properties of a gas which could be collected by both methods?

	property 1	property 2
A	insoluble in water	denser than air
B	insoluble in water	less dense than air
C	soluble in water	denser than air
D	soluble in water	less dense than air

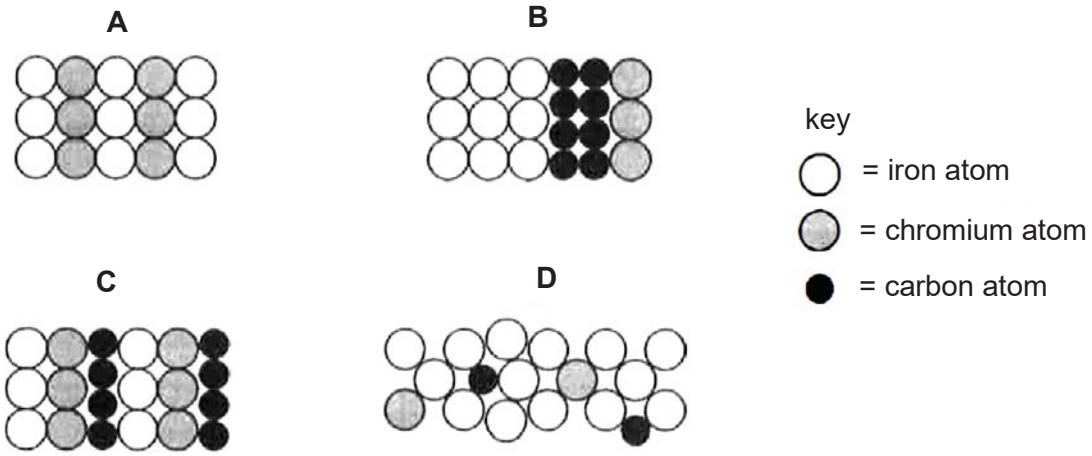
3 Substance **E** melts at -114 °C and boils at 78 °C. It is soluble in water.

Which method can be used to obtain a significant amount of a pure sample of **E** from a mixture of **E** and water?

A crystallisation
B filtration
C fractional distillation
D paper chromatography

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4 Which of the following diagrams shows the arrangement of the atoms in stainless steel?



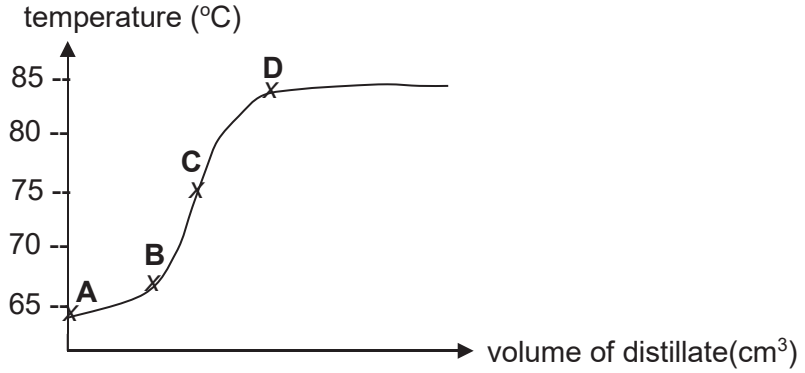
5 The following apparatus can be used in the measurement of volumes of liquids:

I 25 ml beaker
II 50 ml burette
III 25 ml graduated measuring cylinder
IV 25 ml pipette

Which of the following shows the correct order of increasing accuracy of these apparatus?

A **I**, **III**, **IV**, **II**
B **II**, **III**, **IV**, **I**
C **II**, **IV**, **III**, **I**
D **I**, **IV**, **III**, **II**

6 The following graph shows the temperature changes when a 1:1 mixture of methanol (melting point: −97 ºC, boiling point 65 ºC) and propanol (melting point: −89 ºC, boiling point: 82 ºC) was distilled.



If a 3 cm^3 fraction of the distillate was collected at each of the points **A**, **B**, **C** and **D** indicated on the graph, which fraction would contain the highest proportion of propanol?

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7 Nitric acid can be decomposed into nitrogen dioxide, water and oxygen as shown in the equation given below.

$$4HNO_3(aq) \rightarrow 4NO_2(g) + 2H_2O(l) + O_2(g)$$

What volume of gas would be produced if 12.6 g of nitric acid was used?

A 1.2 dm^3
B 4.8 dm^3
C 6.0 dm^3
D 8.4 dm^3

8 An element **X** has two isotopes, ^{238}**X** and ^{235}**X**.

How does ^{238}**X** differ from ^{235}**X**?

A It has 3 more neutrons.
B It has 3 more neutrons and 3 more electrons.
C It has 3 more protons.
D It has 3 more protons and 3 more electrons.

9 Which of the following pairs of ions **cannot** be distinguished using aqueous sodium hydroxide?

A Ca^{2+} and Fe^{2+}
B Cu^{2+} and Fe^{3+}
C NH_4^+ and H^+
D Pb^{2+} and Zn^{2+}

10 What are the two reagents that **cannot** be used to prepare a soluble salt of magnesium ethanoate?

A magnesium and ethanoic acid
B magnesium carbonate and ethanoic acid
C magnesium hydroxide and ethanoic acid
D magnesium nitrate solution and potassium ethanoate solution

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11 The electrical properties of four substances **W**, **X**, **Y** and **Z** are shown below:

substance	electrical property
W	conducts electricity only in aqueous solution
X	conducts electricity when molten and in solid state
Y	conducts electricity when molten and in aqueous state
Z	does not conduct electricity under any conditions

What could these four substances be?

	W	**X**	**Y**	**Z**
A	$CaCl_2$	HCl	P	Pb
B	HCl	Pb	$CaCl_2$	P
C	P	$CaCl_2$	HCl	Pb
D	Pb	P	$CaCl_2$	HCl

12 Metals **W**, **X**, **Y** and **Z** are placed in salt solutions as shown in the table

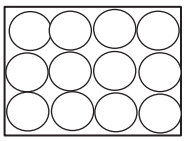
	result of placing metal in solution of			
	salt of **W**	salt of **X**	salt of **Y**	salt of **Z**
W	no reaction	**X** displaced	**Y** displaced	no reaction
X	no reaction	no reaction	no reaction	no reaction
Y	no reaction	**X** displaced	no reaction	no reaction
Z	**W** displaced	**X** displaced	**Y** displaced	no reaction

What is the order of reactivity of the metals from most reactive to least reactive?

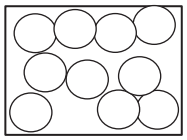
A **Y → X → W → Z**
B **Y → W → Z → X**
C **Z → W → Y → X**
D **Z → Y → X → W**

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13 The figures below show the particles in a substance at two different temperatures but at the same pressure.



-90 ºC



-5 ºC

Which of the following most likely indicates the melting point and boiling point of the substance?

	melting point / ºC	boiling point / ºC
A	180	200
B	23	80
C	-78	13
D	-123	-10

14 Which of the following shows the correct trends down the group for the melting point, density and atomic radius of alkali metals?

	melting point	density	atomic radius
A	increasing	decreasing	increasing
B	decreasing	increasing	increasing
C	increasing	increasing	decreasing
D	decreasing	decreasing	decreasing

15 In which of the reaction is the underlined substance acting as an oxidising agent?

A $Cl_2 + 2\underline{FeCl_2} \rightarrow 2FeCl_3$

B $2HCl + \underline{MgO} \rightarrow MgCl_2 + H_2O$

C $\underline{CuO} + H_2 \rightarrow Cu + H_2O$

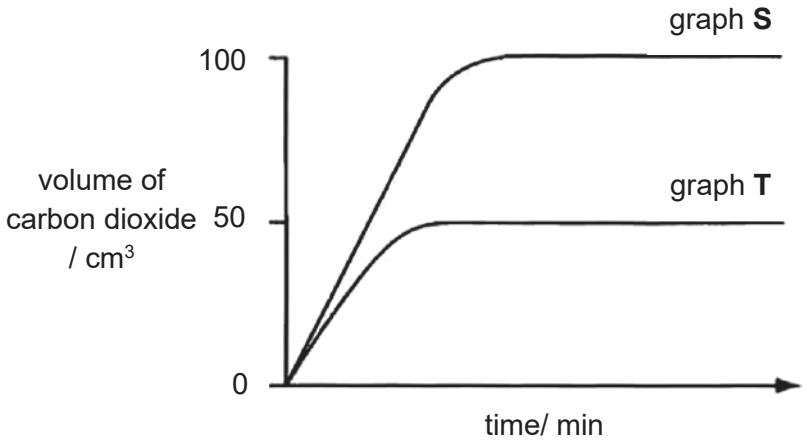
D $ZnO + \underline{CO} \rightarrow Zn + CO_2$

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16 Some crystals of magnesium carbonate were added to an excess of sulfuric acid at room temperature.

The volume of carbon dioxide produced was measured over a period of time. The results are shown in graph **S**.

The experiment was repeated and graph **T** was obtained.



Which change was used to obtain the results shown in graph **T**?

A Acid of the same volume and half the original concertation was used.
B Half the mass of magnesium carbonate was used.
C Larger crystals of magnesium carbonate were used.
D Using a lower temperature.

17 Rice mills face a greater threat of explosion from production of rice flour compared to rice silos which store rice grains.

Below are four statements which can explain why rice mills have a higher possibility of explosion occurring.

I The combustion of rice flour is exothermic.
II Rice flour is less combustible than rice grains.
III Rice flour dust has a larger surface area than rice grains.
IV Rice flour catalyses the combustion of gaseous fuel in the mills.

Which of the above are true?

A **I** and **III** only
B **II** and **IV** only
C **I** and **IV** only
D **I**, **III** and **IV** only

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18 A student investigated the reaction of vegetable oils with hydrogen. 100 cm^3 of hydrogen was bubbled through 1 g samples of four vegetable oils containing a suitable catalyst. The volume of hydrogen gas remaining after each experiment was recorded in the table below.

vegetable oil	volume of hydrogen gas remaining/ cm^3
P	**100**
Q	**87**
R	**63**
S	**0**

Which vegetable oils are unsaturated?

A **P**, **Q** and **R**
B **Q** and **R**
C **Q**, **R** and **S**
D **S** only

19 When ethanol is left standing in the air for some time, it becomes acidic.

Which chemical equation represents this change?

A $CH_3CH_2OH + CO \rightarrow CH_3CH_2CO_2H$
B $CH_3CH_2OH + O_2 \rightarrow CH_3CO_2H + H_2O$
C $CH_3CH_2OH + 3O_2 \rightarrow 2CO_2 + 3H_2O$
D $2CH_3CH_2OH + O_2 \rightarrow 2CH_3CO_2H + 2H_2$

20 The table shows the observations made when an organic compound **X** reacts with aqueous bromine and acidified potassium manganate(VII)

reagent	observation
aqueous bromine	no visible reaction
acidified potassium manganate(VII)	purple solution turns colourless

What is compound **X**?

A ethane
B ethanoic acid
C methanol
D propene

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21

A		
B		
C		
D		

22

A
B
C
D

23

A
B
C
D

24

25

A
B
C
D

26

A		
B		
C		

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D		

27

A **B** **C** **D**		

28

A **B** **C** **D**			

29

30

A
B
C
D

31

A
B
C
D

32

A **B**		

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C		
D		

33

A
B
C
D

34

A
B
C
D

35

A		
B		
C		
D		

36

A
B
C
D

37

A		
B		
C		
D		

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38

A
B
C
D

39

A **B** **C** **D**			

40

A **B** **C** **D**			

END OF PAPER

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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

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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											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.).

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4E/5N	CANDIDATE NAME			
	CLASS		INDEX NUMBER	

SCIENCE (CHEMISTRY) 5076/03, 5078/03

Paper 3 **29 Aug 2019**
1 hour 15 minutes

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

Setter: Ms Cheong Ai Hwa

READ THESE INSTRUCTIONS FIRST
Write your name, class and index number on all the work you hand in.
Write in dark blue and black pen.
You may use a soft pencil for any diagrams or graphs.
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
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.

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.

A copy of the Data Sheet is printed on page **12**.
A copy of the Periodic Table is printed on page **13**.

For Examiner's Use	
Section A	
Section B	
……..	
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Total	

This document consists of **13** printed pages, inclusive of this page.

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Section A

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

1 **(a)** Copper(II) sulfate is an ionic compound. Its crystals can be prepared by using dilute sulfuric acid and a suitable solid compound.

(i) Name a suitable solid compound that can be used to prepare copper(II) sulfate.

……... [1]

(ii) Describe in four steps how a pure, dry sample of copper(II) sulfate crystals can be prepared using the reactants in **(a)(i)**.

……...

……...

……...

……...

……...

……...

……... [4]

(b) When iron is extracted from haematite, Fe_2O_3, in the blast furnace, waste gases and solid waste products are formed.

(i) Name the two main waste products of this process.

……... [2]

(ii) Write chemical equations to show how each of them are produced.

equation 1: ……..

equation 2: …….. [2]

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2 Carbon disulfide, CS_2, is a simple covalent compound used in manufacturing polymers and fibres.

(a) Draw a 'dot-and-cross' diagram to show the bonding in carbon disulfide.
Show valence electrons only.

[2]

(b) Using your understanding of chemical bonding and structure, suggest why carbon disulfide has a low melting point of 46.3 ºC.

……

……

…… [2]

(c) Sulfur reacts with magnesium to form an ionic compound called magnesium sulfide.

Write the chemical formula for magnesium sulfide.

…… [1]

3 **Table 3** shows the average concentration of carbon monoxide in the air in Orchid Road in country **X** for two years.

	time interval (h)					
	6 am – 8 am		**8 am – 10 am**		**10 am – 12 pm**	
year	**2011**	**2012**	**2011**	**2012**	**2011**	**2012**
concentration of carbon monoxide (volume of carbon monoxide per 1000 000 cm^3 of air)	2	3	4	5	1	2

Table 3

(a) Suggest the main source of carbon monoxide at Orchid Road.

…….... [1]

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(b) **(i)** In which time period is the concentration of the carbon monoxide the highest?

……... [1]

(ii) Suggest an explanation for this phenomenon

……... [1]

(c) State a reason why carbon monoxide is harmful to our health.

……

……...

……

……... [2]

4 **Fig. 4** shows the series of reactions involving a blue solid **W**.

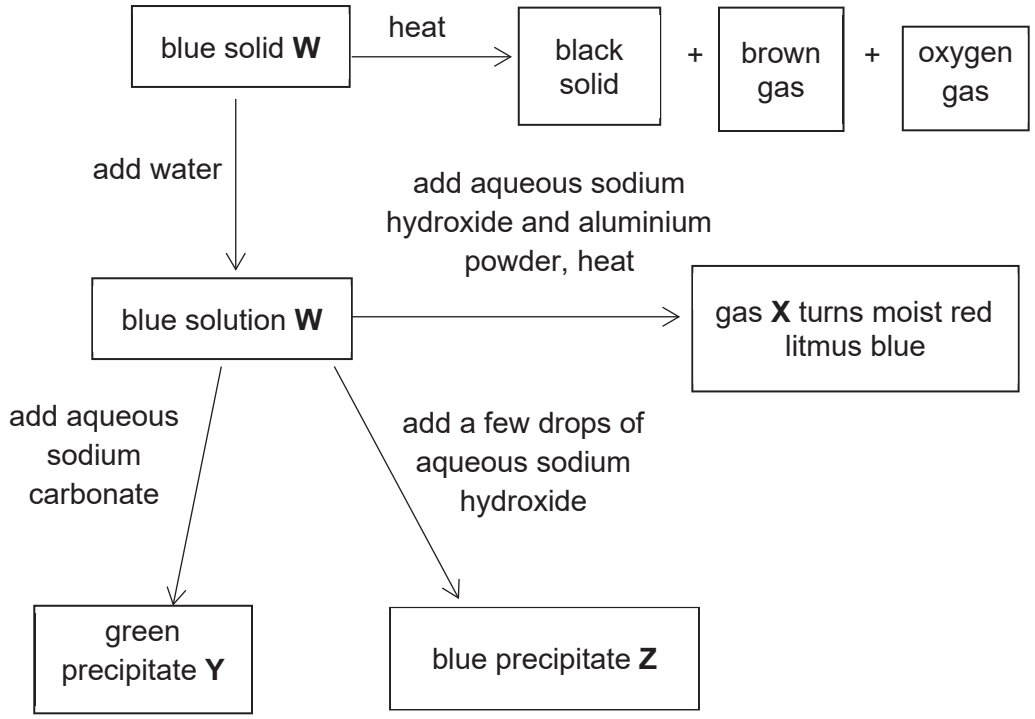


Fig. 4

(a) Identify substances **W**, **X**, **Y** and **Z**.

W: ……. **X**: ……

Y: …….. **Z**: …… [4]

(b) Write a balanced chemical equation for the formation of blue precipitate **Z**.

……... [1]

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(c) Green precipitate **Y** was heated strongly in the boiling tube for 10 minutes.

(i) State what you would observe.

……... [1]

(ii) Explain your observation.

……... [1]

5 Urea, CON_2H_4 is commonly used as a fertiliser in agriculture. Ammonia gas and carbon dioxide gas can react to form urea in a chemical reaction as follows.

$$2NH_3 + CO_2 \rightarrow CON_2H_4 + H_2O$$

A fertiliser plant produces 120 kg of urea on a daily basis.

(a) Calculate the relative molecular mass of urea.

relative molecular mass = …….. [1]

(b) What is the mass of ammonia required to produce 120 kg of urea?

mass of ammonia = …… g [3]

(c) Find the volume of carbon dioxide gas needed in the reaction.

volume of carbon dioxide = ……. dm^3 [2]

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6 Hydrogen peroxide is a colourless liquid at room temperature and pressure.
An aqueous solution of hydrogen peroxide reacts with the iodide ions in acidified potassium iodide to form water and iodine as shown in the following ionic equation.

$$H_2O_2(aq) + 2H^+(aq) + 2I^-(aq) \rightarrow 2H_2O(l) + I_2(aq)$$

Table 6 shows the speed of this reaction when different concentrations of potassium iodide and sulfuric acid are used. The concentration of the products was measured once at the same time interval. The hydrogen peroxide is always in excess and the temperature remains constant.

experiment	concentration of potassium iodide (mol/dm^3)	concentration of sulfuric acid (mol/dm^3)	speed of reaction (mol/dm^3)
1	0.1	0.1	0.00017
2	0.2	0.1	0.00034
3	0.1	0.2	0.00017
4	0.3	0.1	0.00051
5	0.1	0.3	0.00017

Table 6

(a) **(i)** Explain why iodide ions act as the reducing agent in this reaction.

……...

……..... [1]

(ii) Describe the colour change that will be observed.

……..... [1]

(b) Use the information in **Table 6** to describe how the concentration of potassium iodide affects the time a colour change is first observed in the reaction.

……

……... [1]

(c) Does the concentration of H^+ ions affect the rate of reaction?
Explain your reasoning.

……

……...

…….. [2]

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(d) Apart from changing the concentration of the reagents, suggest a method of prolonging the time for a colour change to be first observed. Use your knowledge of reacting particles to explain your answer.

……

……

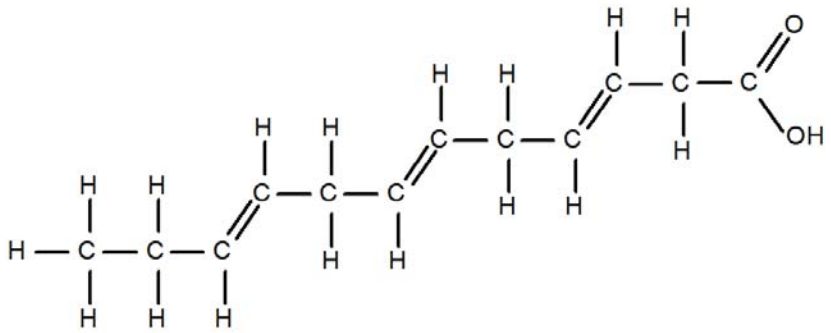
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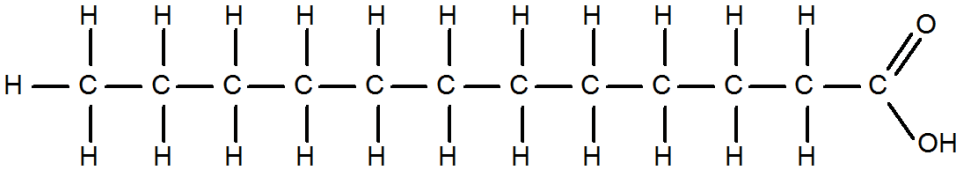
……

…… [4]

7 Fatty acids play a role in managing inflammation in the body.
Fig. 7 shows the structures of two fatty acids **P** and **Q**.



fatty acid **P**



fatty acid **Q**

Fig. 7

(a) Circle the functional groups found in fatty acid **P**. [1]

(b) **(i)** State a chemical test that can be carried out to differentiate between fatty acid **P** and fatty acid **Q**.

…… [1]

(ii) Briefly describe the observations you would see for the test described in **(b)(i)**.

……

…… [2]

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Section B

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

8 (a) **Fig. 8.1** and **Fig. 8.2** shows the arrangement of apparatus used to try to dissolve hydrogen chloride in methylbenzene and in water respectively.

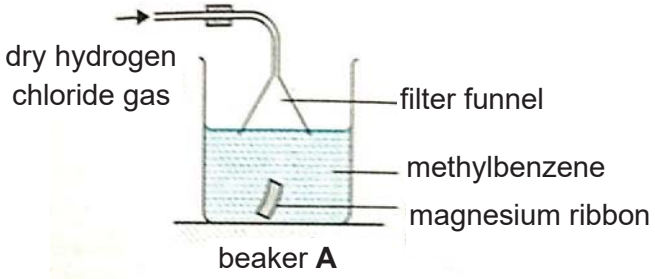


Fig. 8.1

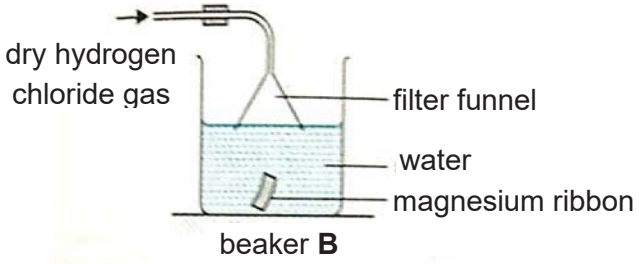


Fig. 8.2

(a) (i) State the observations made when magnesium ribbon is placed in beaker **A** and **B** respectively?

……

……

…… [2]

(ii) Explain your answers in **(a)(i)**.

……

……

……

…… [2]

(iii) Write the chemical equation for the reaction in beaker **B**.

…… [1]

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(b) **Fig. 8.3** shows the apparatus used to separate a mixture of octane, C_8H_{18} and decane, $C_{10}H_{22}$.

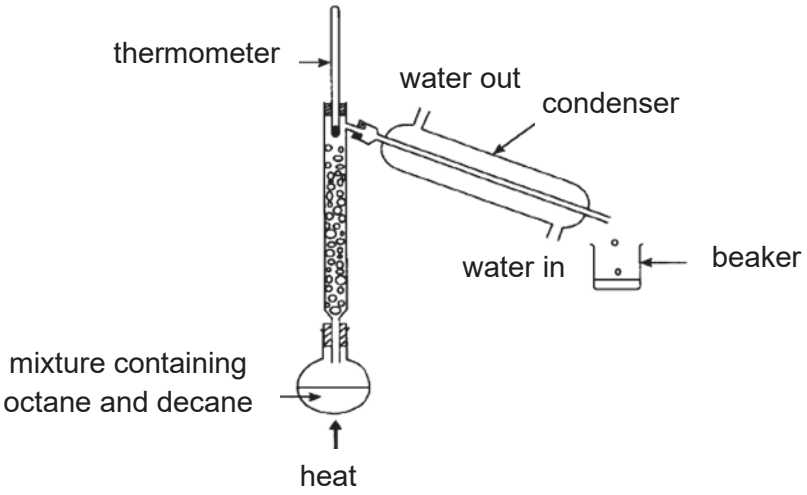


Fig. 8.3

(i) State the general name for this method of separation.

…… [1]

(ii) What property must the two liquids have to be separated by this method?

…… [1]

(iii) State the purpose of the water in the condenser.

…… [1]

(iv) Which one of these alkanes will give a smokier flame when burnt? Explain your answer.

……

……

……

…… [2]

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9 (a) Experiments can be conducted to determine the chemical reactivity of metals.

(i) Briefly describe an experiment using water that shows the order of chemical reactivity of the three metals lithium, sodium and potassium.

……..

……...

……...

……...

……..

……...

……...

……... [4]

(ii) List the metals from **(a)(i)** in decreasing order of reactivity.

…… [1]

(ii) What would be observed if a piece of francium was used instead of sodium? Explain your answer.

……...

……...

……...

……...

……... [2]

(b) Fluorine, bromine and iodine are in Group VII.

(i) Why are the halogens above placed in the same group?

……... [1]

(ii) What would be observed if bromine is introduced into a solution of sodium iodide? Explain your answer.

……...

……...

……... [2]

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10 (a) (i) Petroleum can be separated into several useful substances in a fractionating tower. Describe the separation process.

……..

……..

……..

……..

……..

……..

…….. [4]

(ii) Name one of the substance produced and give a use for this named substance.

……..

……... [2]

(b) The alkenes form a homologous series.

(i) State the general formula of alkenes.

……... [1]

(ii) One alkene contains 3 carbon atoms in its molecule. Draw the full structural formula for this molecule.

[1]

(iii) The alkene in **(b)(ii)** undergoes addition polymerisation. Draw the polymer showing two repeat units.

[2]

END OF PAPER

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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

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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											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.).

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Model Answers for 2019 4E Sci Chem PRELIM
Paper1 [20m]
Paper 3 Section A [45 marks]

Section A: Multiple-Choice Questions (20 marks)

Answer all the questions by writing your answers in the table provided.

Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10
A	B	C	D	A	D	C	A	D	D
Q11	Q12	Q13	Q14	Q15	Q16	Q17	Q18	Q19	Q20
B	C	C	B	C	B	A	C	B	C

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Section B: Structured Questions (30 marks)

Answer all the questions by writing your answers in the space provided.

1 **(a)** (i) Copper(II) carbonate or copper(II) oxide or copper(II) hydroxide can be used.[1]

(ii) The four steps:

1. Add excess solid ($CuCO_3$, CuO or $Cu(OH)_2$) to a fixed volume of dilute sulfuric acid and stir. [1]
2. Filter the mixture and collect the filtrate.[1]
3. Heat the filtrate till saturated/ to remove excess water.[1]
4. Cool the solution/filtrate to allow crystals to form. [1]

essential points/keywords are underlined.

0 marks awarded if steps 1 and 2 are missing. No mark for step 4 if step 3 is missing

(b) (i) Any Two correct: carbon dioxide; carbon monoxide; calcium silicate/slag [2]

(ii) Any Two correct :

$C + O_2 \rightarrow CO_2$

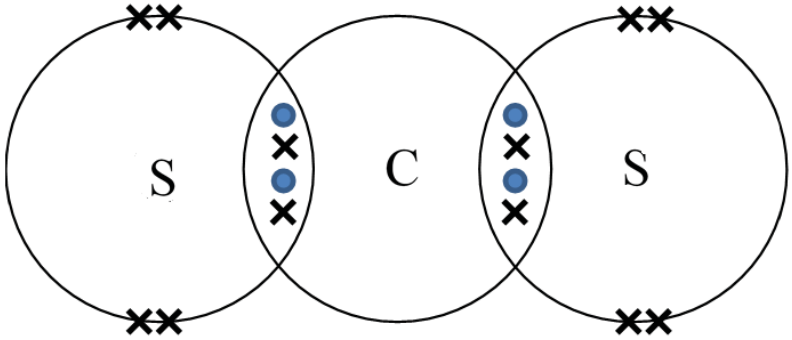
$Fe_2O_3 + 3CO \rightarrow 2Fe + 3CO_2$

$C + CO_2 \rightarrow 2CO$

$CaO + SiO_2 \rightarrow CaSiO_3$

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2 (a)



double covalent bond between C and S[1]
correct no of valence electrons[1]

(b) There are weak intermolecular forces of attraction between molecules [1]
Thus need a little amount of energy to overcome these forces [1]

(c) MgS [1]

3 (a) Incomplete combustion of fuels in car engine.[1]

(b) **(i) The concentration is highest during 8am to 10am.[1]**
(ii) Many people are travelling to work using motor vehicles.[1]

(c) Carbon monoxide is binded to the haemoglobin, preventing oxygen from being transported around the body.[1]
This causes breathing difficulties or even death[1]

4 (a) W: copper(II) nitrate / $Cu(NO_3)_2$ [1]
X: ammonia/NH_3 [1]
Y: copper(II) carbonate/$CuCO_3$ [1]
Z: copper(II) hydroxide / $Cu(OH)_2$ [1]

(b) $Cu(NO_3)_2 + 2\ NaOH \rightarrow Cu(OH)_2 + 2NaNO_3$
(correct formulae-1m; correct balancing-1m)

(c) (i) Green precipitate turned black.[1]
(ii) It has been decomposed by the heat[1]

5 (a) Calculate the relative molecular mass of urea. [1]

$M_r[\ CON_2H_4] = 60$[1]

(b) What is the mass of ammonia required to produce 120 kg of urea? [3]

No of mole of CON_2H_4 produced = 120 000/60
= 2000[1]

Mole ratio of CON_2H_4 : NH_3 = 1: 2

Hence no of mole of NH_3 used = 2 X 2000 = 4000 [1]

Mass of ammonia required = 4000 X 17 g = 68 000 g[1]

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(c) What is the volume of carbon dioxide gas needed in **(b)**? [2]

Mole ratio of CON_2H_4 : CO_2 = 1: 1

No of mole of CO_2 needed =2000 [1]

Volume of CO_2 =24 dm^3 X 2000 = 48 000 dm^3 [1]

6 **(a)** **(i)** It is because iodide ions are oxidised to iodine, the oxidation state of iodine has increased -1 in iodide ion to 0 in iodine **OR electrons lost when I^- is converted to I_2 [1]**

(ii) The solution turned from **colourless to brown / yellow** [1]

(b) The higher the concentration of potassium iodide used, the shorter the time taken **OR the faster the reaction**[1]

(c) the concentration of H+ ions does not affect the rate of reaction[1]. It is because the amount of products produced remained constant at 0.00017 mol/dm^3 when its concentration changes from 0.1 mol/dm^3 to 0.3 mol/dm^3[1]

(d) It can be done by reducing the temperature of the solution [1]. When the kinetic energy of the reactant molecules is lowered[1], they will move slower[1] and will reduce the frequency of effective collision to result in reaction[1]

7 **(a)** Functional groups present:

- C=C (carbon-carbon double bond)[1]
- □ COOH (carboxyl group)[1]

(b) (i) Test with aqueous bromine or bromine solution[1]

(ii) Observation with fatty acid **P** : reddish-brown bromine solution decolourised / turns colourless.[1]

Observation with fatty acid **Q** : bromine solution remains reddish-brown[1]

8 **(a)** (i) Beaker A – No visible reaction[1]

Beaker B – Effervescence is seen OR Mg dissolved in acid to form a colourless solution. [1]

(ii) In beaker A, HCl in methylbenzene does not dissociate into H^+ ions and is not acidic. [1]

In beaker B, the presence of water causes HCl to dissociate to form H^+ ions which react with magnesium to form hydrogen gas. [1]

(iii) $Mg + 2HCl \rightarrow MgCl_2 + H_2$ [1]

(b) (i) fractional distillation [1]

(ii) The 2 liquids must have different boiling points which are close together. [1]

(iii) the water will cool down the hot vapour and changes/ condenses it into liquid[1]

(iv)Decane will give a smokier flame. [1]

It has a higher percentage by mass of carbon[1], hence will be less likely to be completely burnt in oxygen [1]

9 **(a)** **(i)**

- Add a small piece of lithium into a beaker of water. [1]

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- Effervescence was observed and metal darts and float on the water.[1]
- The experiment was repeated using different metals and the observation was recorded.[1]
- The reaction which produces most gas / reaction being the most vigorously will be the most reactive metal[1]

(ii) Potassium > sodium>lithium[1]

(ii) The reaction will be more vigorous when a piece of francium is used as compared to sodium [1].
Francium is more reactive than sodium[1]

(b) **(i)** All of them have seven valence electrons [1]

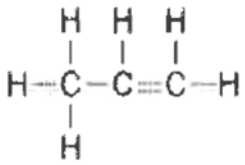
(ii) Observations: **the colourless solution** turned into a yellow/ brown solution [1]
Explanation: Bromine is more reactive than iodine and displaces it from its aqueous solution[1]

10 **(a)**

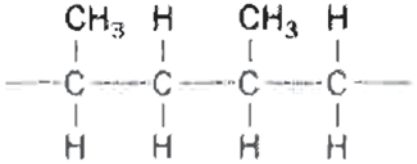
- In the furnace, petroleum is heated and turned into vapour (vapourised)[1]
- The hot vapour rises up the column, it begins to cool and condense.[1]
- Lighter fractions have lower boiling points will be condensed and collected at the top of the fractionating column as gases.[1]
- Heavier fractions have higher boiling point will be condensed and collected at the lower sections of the column.[1]

One of the useful substance is **bitumen[1]**. It is **used to surface road[1]**
(Accept any of the correct fraction and its use from the column.)

(b) (i) C_nH_{2n} [1]



(ii) [1]



(iii) [2]
All bonds correct [1] no of C and H atoms correct[1]

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