

Name: _____ Index Number: _____ Class: _____



TEMASEK SECONDARY SCHOOL
Preliminary Examination 2020
Secondary 4 Express

CHEMISTRY

6092/02

Paper 2 (Section A)

**Total duration for Sections A and B:
1 hour 45 minutes**

Question and Answer Booklet

READ THESE INSTRUCTIONS FIRST

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

Hand in this booklet at the end of the paper.

Write your name, index number and class in all the work you hand in.
Write in dark blue or black pen.

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

At the end of the examination, submit **Section A and B separately**.

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

A copy of the Periodic Table is printed on page 13.

FOR EXAMINER'S USE	
Section A	/50

Section A

Answer all the questions in this section in the spaces provided.

The total mark for this section is 50.

- A1** In the Periodic Table below, the letters A to K represent some elements but not the symbols of the respective elements.

																H				J		K
A															F							
	C							D					E				I					
B															G							

Use the letter to answer the following questions. You may use the letter once, more than once, or not at all.

- (a)** An element that has different allotropes.

..... [1]

- (b)** An element that can have oxidation states of +2 and +3.

..... [1]

- (c)** A metal that floats on water and reacts readily with water

..... [1]

- (d) An element that is used for galvanizing.

..... [1]

- (e) An element that forms an amphoteric oxide.

..... [1]

- (f)** An element that is used for making lights and advertising signs.

..... [1]

- A2** Amino acids are building blocks of proteins which are necessary for the growth and repair of body tissues. Three amino acids were analysed using two solvents, X and Y. After treatment with a locating agent, the results are indicated in the chromatogram below.

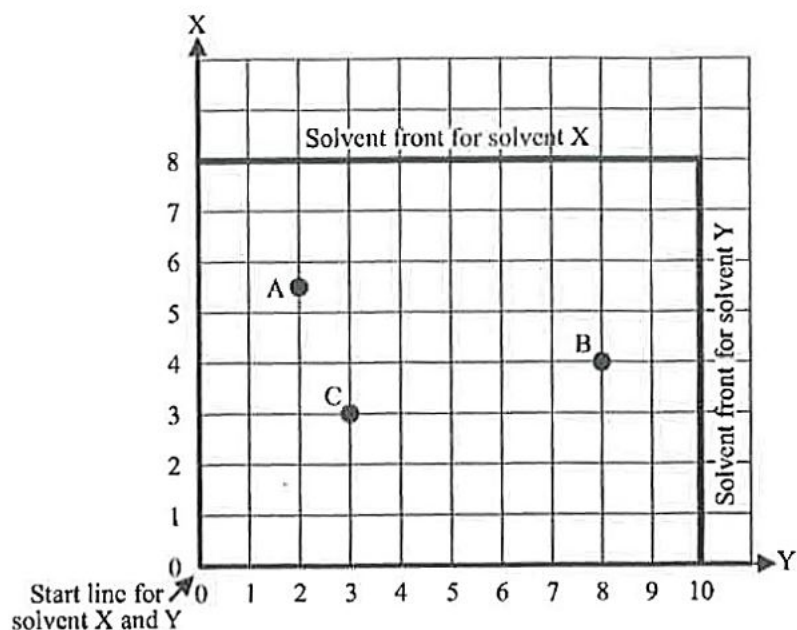


Table 2 shows the R_f values for four amino acids in the two solvents X and Y.

amino acids	R_f value in solvent X	R_f value in solvent Y
glutamic acid	0.38	0.30
glycine	0.50	0.80
arginine	0.69	0.20
leucine	0.91	0.73

Table 2

- (a) Using data from Table 2, state the identity of spots A and B.

Show your workings clearly.

A:

B:

[4]

- (b) On the same chromatogram, draw and label another amino acid, Proline, with the following R_f values:

solvent	R_f values
X	0.94
Y	0.4

[1]

- (c) Suggest another method and its expected observation to determine the purity of these amino acids.

.....

.....

.....

[2]

- (d) Carbon tetrachloride, CCl_4 , is sometimes used as a solvent for chromatography.

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

[2]

- (ii) "Carbon tetrachloride has a high melting point"

Do you agree with this statement? Explain your answer in terms of bonding and structure.

.....

.....

.....

.....

[2]

- (iii) Carbon tetrachloride is formed from a reaction between methane and chlorine. Hydrogen chloride is another product formed in this reaction.

Write a balanced chemical equation for this reaction.

.....

[1]

- (iv) Explain, in terms of oxidation state, whether the reaction in (d)(iii) is a redox reaction.

.....

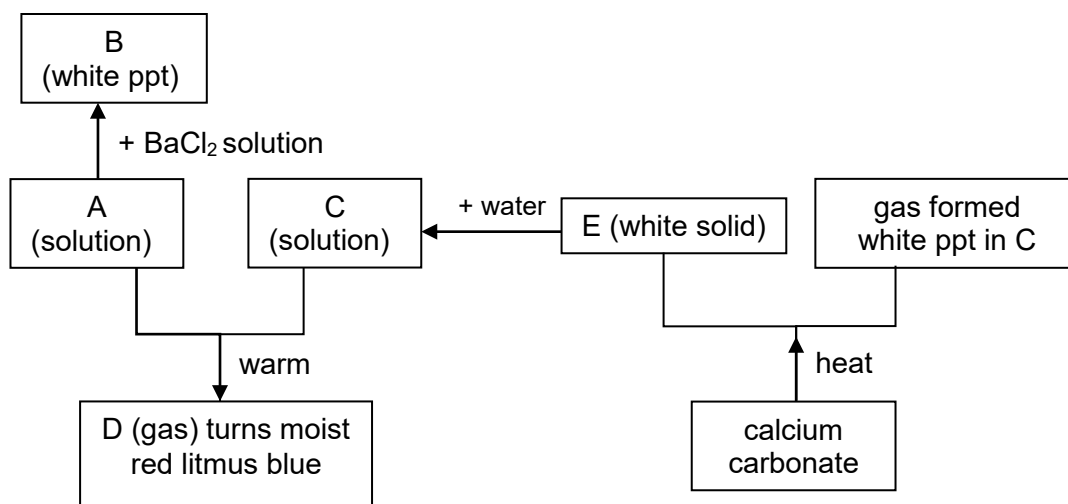
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[3]

A3 The flow chart below shows some reactions involving substances A, B, C, D and E.



(a) Identify B and E.

B

E

[2]

(b) Write a balanced equation, with state symbols, for the reaction between A and C.

.....

[2]

(c) State the observation if gas D is continuously passed through aqueous copper(II) sulfate until no further change is seen.

.....

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[2]

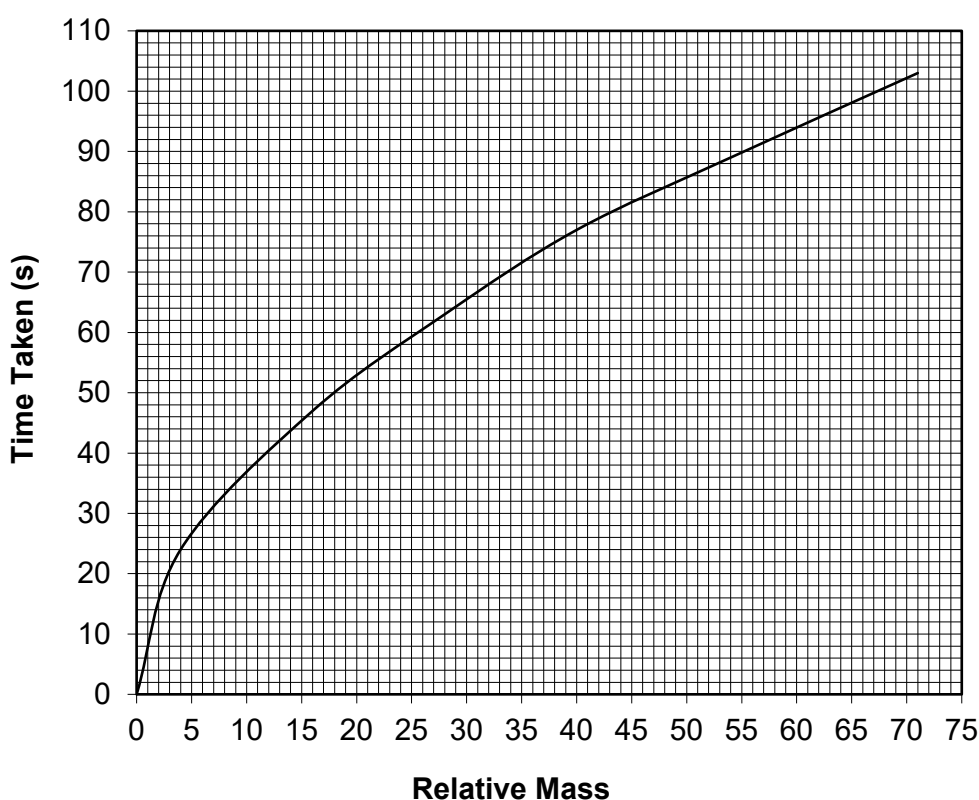
- A4** A student carried out an experiment to investigate the speed of diffusion of different gases at room temperature.

He recorded the time taken for equal volumes of different gases to pass through a small hole, as given in the Table 4.

gas	time taken (s)	relative mass of gas
helium	24	4
methane	47	16
nitrogen	63	28
argon	77	40
chlorine	103	71

Table 4

He then plotted a graph of time taken against relative mass for the gases in the table, as shown below.



- (a) Use the graph to estimate the time that would be taken by the same volume of carbon dioxide to pass through the same hole under the same conditions.

.....

[1]

- (b)** Boron forms a gaseous hydride with the molecular formula B_nH_{10} .

The same volume of this gas took 89 seconds to pass through the same hole as the gases in the table, under the same conditions.

- (i)** Use the graph to estimate the relative molecular mass of this gas.

..... [1]

- (ii)** Calculate the value of n .

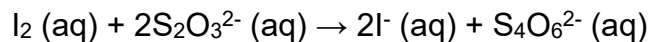
[1]

- (c)** The same volume of carbon dioxide was allowed to pass through the same hole, but at a temperature of $10\text{ }^{\circ}\text{C}$.

Explain how and why the time taken for the carbon dioxide to pass through the hole would be different from your answer in **(a)**.

.....
.....
..... [2]

- A5** Aqueous iodine reacts with aqueous thiosulfate, $\text{S}_2\text{O}_3^{2-}$ (aq) according to the equation below.



In a titration, 40.0 cm^3 of 0.100 mol/dm^3 $\text{S}_2\text{O}_3^{2-}$ (aq) was required to react with 26.7 cm^3 of aqueous iodine.

- (a) Describe what is observed during the reaction.

..... [1]

- (b) Determine the concentration of aqueous iodine in mol/dm^3 .

[3]

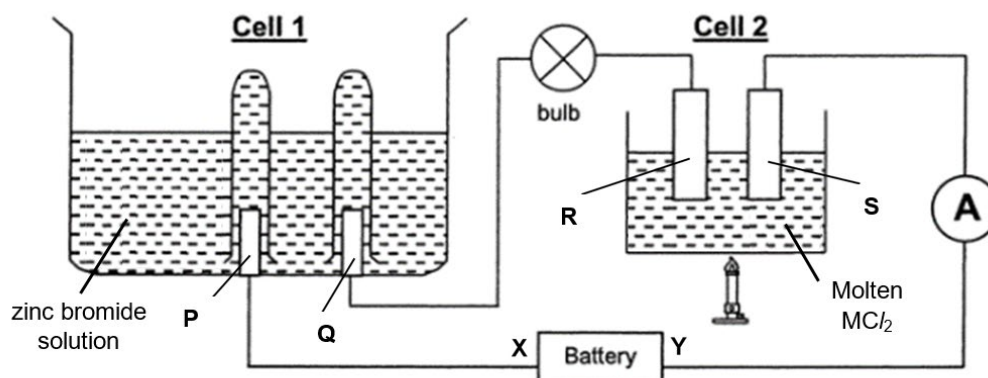
- (c) Name another suitable reagent that can be used to confirm that aqueous thiosulfate is a reducing agent. State the observation you would expect in this test.

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..... [2]

- A6 (a)** The following set up can be used for the electrolysis of zinc bromide solution in cell 1, and molten metal chloride, MC_2 in cell 2.

Four electrodes P, Q, R and S in the circuit are graphite rods. X and Y are the terminals of the battery.



When the switch is turned on, metal M begins to deposit on electrode R.

- (i) Deduce the polarity of the battery at terminals X and Y.

X: Y: [1]

- (ii) With the aid of a half equation, describe and explain the observation happening at electrode P.

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 [3]

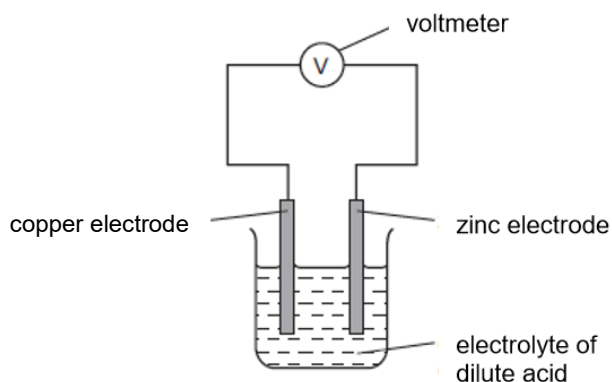
- (iii) In cell 2, the electrolysis of molten metal chloride $MC{l}_2$ was carried out for 30 minutes at a constant current.

300 cm³ of gas is collected (measured at room temperature and pressure) at electrode S while the gain in mass at electrode R is 0.7 g.

Determine the unknown metal M.

[3]

- (b) An experiment with two different metal electrodes is set-up as shown in the diagram below.



- (i) Explain, in terms of electron transfer, which electrode is the negative electrode.

.....

[2]

- (ii) Table 6 gives the polarity of cells using unknown metal R and the metals copper, manganese and zinc.

cell	electrode 1	polarity	electrode 2	polarity
A	zinc	-	metal R	+
B	manganese	-	metal R	+
C	copper	+	metal R	-

Table 6

What information about the order of reactivity of these four metals can be deduced Table 6 alone?

.....

[2]

- (iii) What additional information is needed to establish the order of reactivity of these four metals in (d)(ii) using the set-up provided above?

.....

[1]

END OF SECTION A