

NAME:

NO:

CLASS:

## RIVERSIDE SECONDARY SCHOOL



### PRELIMINARY EXAMINATION 2022

SUBJECT : Chemistry  
CODE/PAPER : 6092/02  
LEVEL/STREAM : 4 Express  
DURATION : 1 hour 45 minutes

#### READ THESE INSTRUCTIONS FIRST

Write your name, index number and class in the spaces provided in the question paper.  
Write in dark blue or black pen.  
You may use an HB pencil for any diagrams or graphs.  
Do not use staples, paper clips, glue or correction fluid.

#### Section A

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

#### Section B

Answer all **three** questions, the last question is in the form either/or.  
Answer all questions in the spaces provided.

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 23.

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

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This document consists of **23** printed pages.

**Section A**

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

The total mark for this section is 50.

**A1 (a)** Choose from the following list of aqueous ions to answer the questions below.

**ammonium**

**carbonate**

**copper(II)**

**hydrogen**

**hydroxide**

**iodide**

**iron(II)**

**nitrate**

Choose **one** ion from the list above which

**(i)** is responsible for alkaline properties in a solution,  
.....[1]

**(ii)** forms a green precipitate when added to aqueous sodium hydroxide,  
.....[1]

**(iii)** forms a gas when added to acids,  
.....[1]

**(iv)** forms a gas when added to alkalis,  
.....[1]

**(v)** forms a reddish-brown deposit when magnesium is added.  
.....[1]

(b) Which statements about the separation of mixtures are **true** and which are **false**?

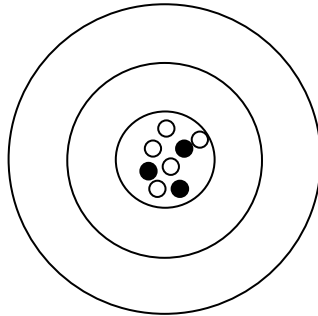
Put a tick (✓) in **one** box in each row.

|                                                                                         | <b>true</b> | <b>false</b> |
|-----------------------------------------------------------------------------------------|-------------|--------------|
| The separation of mixtures is a chemical process.                                       |             |              |
| Simple distillation allows the recovery of ethanol from water.                          |             |              |
| In chromatography, the same substance has different $R_f$ values in different solvents. |             |              |

[2]

[Total: 7]

- A2** Fig. 2.1 shows the structure of an atom.  
The electrons are missing.



**Fig. 2.1**

- (a)** Complete Table 2.2 about the three particles found in this atom.

**Table 2.2**

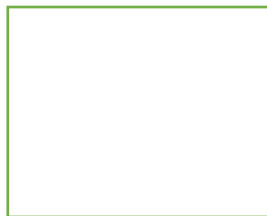
| particle | name of particle | relative mass of the particle | relative charge of the particle |
|----------|------------------|-------------------------------|---------------------------------|
| ○        |                  | 1                             |                                 |
| ●        |                  | 1                             | 1+                              |
| ×        | electron         |                               | 1-                              |

[2]

- (b)** Complete the diagram in Fig. 2.1 to show the arrangement of the electrons in the atom.  
[1]

- (c)** In the manufacture of the body of aircrafts, a small amount of the atom is added to aluminium to make it stronger.

With the help of a labelled diagram, explain how the addition of a small amount of the atom increases the strength of the body of aircrafts.



.....  
 .....  
 .....[3]

[Total: 6]

**A3** This question is about the halogens.

- (a)** Table 3.1 shows data about the densities and melting points of three halogens, chlorine, bromine and iodine.

Complete the table by filling in the name of each halogen.

**Table 3.1**

| name of halogen | density (g/ cm <sup>3</sup> ) | melting point (°C) |
|-----------------|-------------------------------|--------------------|
|                 | 3.21                          | –7.3               |
|                 | 4.94                          | 114                |
|                 | 0.00312                       | –102               |

[1]

- (b)** Seawater contains sodium bromide.

- (i)** Bromine can be produced from seawater by displacement.

Name an element that can displace bromine and give a reason for your choice.

name: .....

reason: .....[2]

- (ii)** Describe a simple test, other than displacement, that can be used to show that sea water also contains iodide ions.

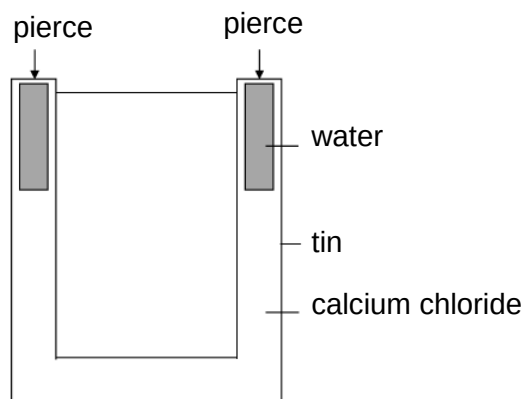
test: .....

result: .....[2]

[Total: 5]

**A4** Fig. 4.1 shows a can of soup in a self-heating device.

Piercing an internal water sachet with a special tool causes the solid anhydrous calcium chloride to mix with the water.



**Fig. 4.1**

**(a)** The temperature of the soup rises by 60 °C within 10 minutes.

Name the type of reaction that occurred when anhydrous calcium chloride mixes with water.

.....[1]

**(b)** Table 4.2 shows the changes in heat energy for the reaction involving some substances with water.

**Table 4.2**

| substances                 | $\Delta H$ (kJ/ mol) |
|----------------------------|----------------------|
| ammonium nitrate           | +25                  |
| concentrated sulfuric acid | -71                  |
| lithium chloride           | -37                  |

Discuss why lithium chloride is the most suitable replacement for calcium chloride to warm the soup.

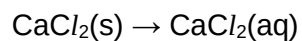
.....

.....

.....

.....[3]

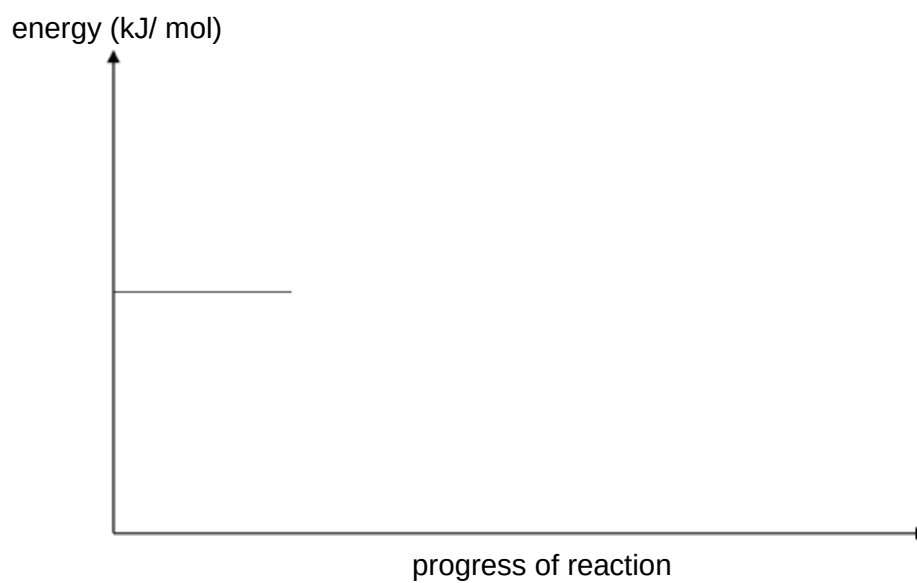
(c) When the can is pierced, aqueous calcium chloride forms.



Complete the energy profile diagram below.

Your diagram should include:

- the reactants and products,
- labels to show the enthalpy change and the activation energy.

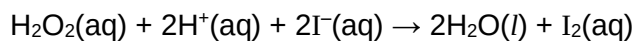


[3]

[Total: 7]

**A5** Hydrogen peroxide is a colourless liquid.

An aqueous solution of hydrogen peroxide reacts with the iodide ions in acidified potassium iodide to form water and iodine according to the equation shown below.



- (a) (i)** Complete Table 5.1 to show the oxidation states of oxygen and iodine before and after the reaction.

**Table 5.1**

| element | oxidation state <i>before</i><br>the reaction | oxidation state <i>after</i><br>the reaction |
|---------|-----------------------------------------------|----------------------------------------------|
| oxygen  |                                               |                                              |
| iodine  |                                               |                                              |

[2]

- (ii)** Use the information in Table 5.1 to explain why this is a redox reaction.

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

- (iii)** Describe the colour change for the above reaction.

.....[1]



- (b) Table 5.2 shows how the speed of this reaction changes when different concentrations of aqueous potassium iodide and dilute sulfuric acid are used.

The hydrogen peroxide is always added in excess and the temperature remains constant.

**Table 5.2**

| experiment | concentration of aqueous potassium iodide ( $\text{mol dm}^{-3}$ ) | concentration of dilute sulfuric acid ( $\text{mol dm}^{-3}$ ) | speed of reaction ( $\text{mol dm}^{-3}/\text{s}$ ) |
|------------|--------------------------------------------------------------------|----------------------------------------------------------------|-----------------------------------------------------|
| 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                                             |

A student made the following statement,

*“The speed of this reaction is more dependent on the concentration of aqueous potassium iodide than dilute sulfuric acid.”*

Using the information in Table 5.2, explain if the student is right.

.....

.....

.....

.....

.....[2]

- (c) The experiment was repeated by increasing the temperature of aqueous potassium iodide, with other variables being kept constant.

Explain, using ideas about particles colliding, how the rate of reaction is affected.

.....

.....

.....

.....[3]

. [Total: 9]

**A6** Paraffin (kerosene) is a mixture of hydrocarbons. It is used as a fuel for the jet engines of an aircraft.

Paraffin is separated from crude oil using fractional distillation.

**(a)** What property is used to separate paraffin from crude oil?

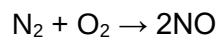
.....[1]

**(b)** There is an alkane molecule in paraffin which contains 11 carbon atoms.

What is the chemical formula of this alkane?

chemical formula of alkane: ..... [1]

**(c)** When paraffin burns in a jet engine, nitrogen monoxide, NO, is formed.



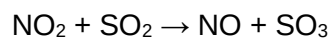
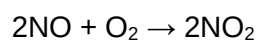
**(i)** Explain how nitrogen monoxide is formed in the jet engine.

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

**(ii)** Calculate the mass of nitrogen monoxide formed from 55 kg of nitrogen.

mass of nitrogen monoxide = ..... [2]

- (d) Nitrogen monoxide is involved in the formation of sulfur trioxide from sulfur dioxide.



- (i) Write the overall equation for the formation of sulfur trioxide from sulfur dioxide.

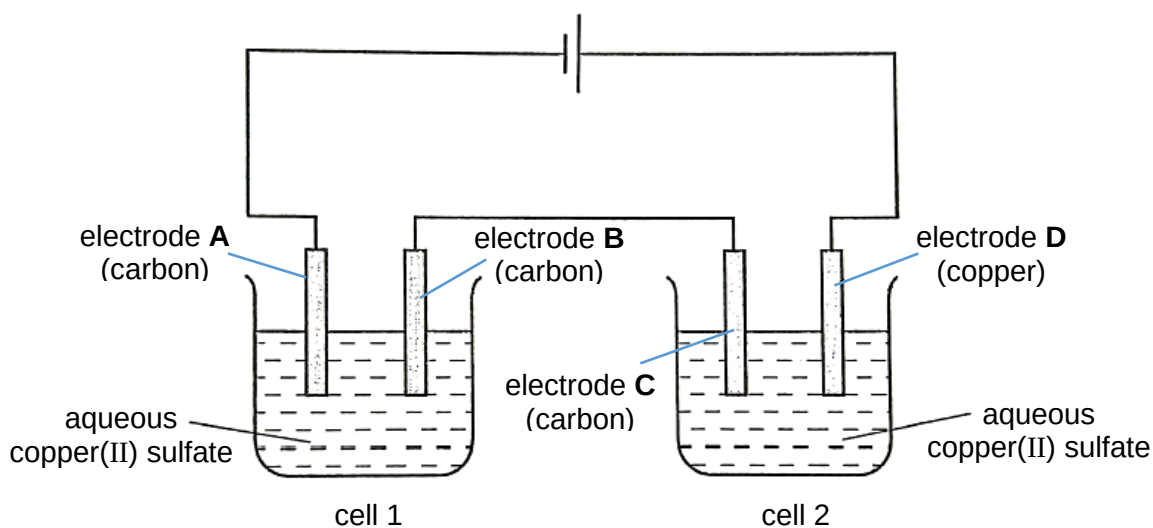
.....[1]

- (ii) Explain how the reactions above suggest that nitrogen monoxide is acting as a catalyst.

.....[1]

[Total: 8]

**A7** An electrolytic set-up consisting of two cells is shown in Fig. 7.1.



**Fig. 7.1**

**(a)** Draw arrows in Fig. 7.1 to indicate the flow of electrons. [1]

**(b)** At which electrodes do oxidation take place in both cells 1 and 2?  
 .....[1]

**(c)** Write the half-equation, with state symbols, for the reaction at electrodes **A** and **B**.  
 electrode **A**: .....  
 electrode **B**: .....[3]

**(d)** State and explain the difference in the colour of the electrolyte in cell 1 and cell 2 after the electrolysis is conducted for some time.  
 .....  
 .....  
 .....  
 .....[3]

[Total: 8]