CEDAR GIRLS' SECONDARY SCHOOL
Preliminary Examination 2023
Secondary Four

CANDIDATE NAME				
CLASS	4		INDEX NUMBER	

CHEMISTRY 6092/2

Paper 2 Section A

29 August 2023
1 hour 45 minutes

Additional Materials: NIL

READ THESE INSTRUCTIONS FIRST

Write your name and index number on all the work you hand in.
You may use a pencil for any diagrams, graphs or rough working.
Do not use paper clips, highlighters, glue or correction fluid.

Section A

Answer **all** questions.
Write your answers in the spaces provided on the question paper.

Section B

Answer all **three** questions.
The last question is in the form either/or.
Write your answers in the spaces provided on the question paper.

A copy of the Periodic Table is printed on page 24.

At the end of the examination, hand in your answers to Section A and Section B **separately**.

For Examiner's Use	
Section A	
1	**5**
2	**11**
3	**7**
4	**12**
5	**7**
6	**8**
Total	**50**

For Examiner's Use

Section A

Answer all questions in this section in the spaces provided.
The total mark for this section is 50.

A1 Choose from the following chlorides to answer the questions.

aluminium chloride
ammonium chloride
calcium chloride
hydrogen chloride
silver chloride
sodium chloride

Each chloride may be used once, more than once or not at all.

Which chloride

(a) contains a cation with a +2 charge

…… [1]

(b) reacts with warm aqueous sodium hydroxide to form a gas which turns damp red litmus paper blue

…… [1]

(c) has a molecule which only has 18 protons

…… [1]

(d) forms a white precipitate in aqueous ammonia

…… [1]

(e) is soluble in organic solvents?

…… [1]

[Total:5]

For Examiner's Use

A2 Hydrogen is used as an alternative energy source as it is a clean fuel. The process of making hydrogen has several stages.

The equations show two stages in the process.

Stage 1: $CH_4(g) + H_2O(g) \rightleftharpoons CO(g) + 3H_2(g)$

Stage 2: $CO(g) + H_2O(g) \rightleftharpoons CO_2(g) + H_2(g)$

(a) Both stages require the use of catalysts to increase the rate of reaction. Catalysts are expensive to buy but reduce costs in the long run.

(i) Explain, in terms of collisions and energy, why using a catalyst increases the rate of reaction.

……..

……..

……..

……..

…….. [2]

(ii) Give **two** reasons to explain why catalysts reduce costs in the long run.

……..

……..

……..

…….. [2]

(b) The forward reaction in Stage 2 has a benefit to human health.

Use the equation in Stage 2 to explain the benefit of this stage.

……..

……..

…….. [2]

(c) Deduce the change in oxidation state of hydrogen in Stage 2.

…….. [1]

For Examiner's Use

(d) Explain with the aid of a chemical equation, why hydrogen is considered a 'clean fuel'.

……..

……..

…….. [2]

(e) The enthalpy change when 1 mole of hydrogen is completely burned is −286 kJ/mol.

Calculate the enthalpy change when 1 kg of hydrogen is completely burned in kJ/kg.

[2]

[Total: 11]

For Examiner's Use

A3 Iodine can be extracted from natural sources through a variety of methods.

The flowchart in Fig. 3.1 summarises one such method.

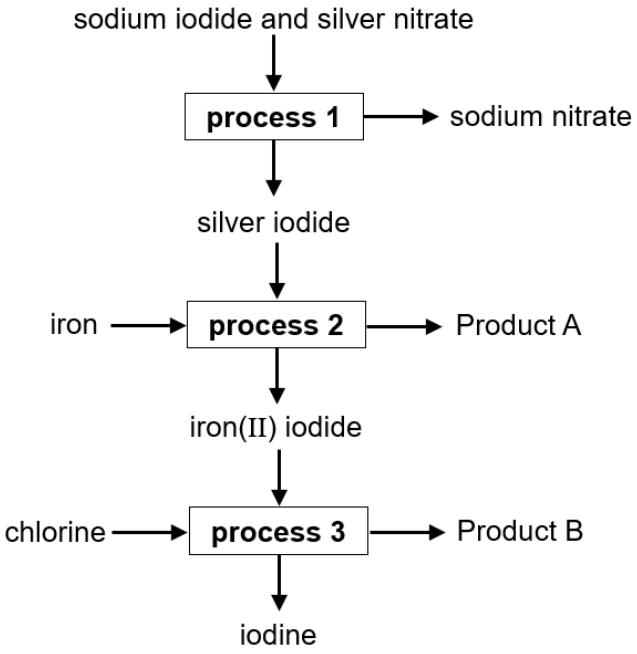

Fig. 3.1

(a) In Process 1, aqueous sodium iodide was reacted with aqueous silver nitrate.

Write an ionic equation for this reaction.

…….. [2]

(b) Processes 2 and 3 occur via displacement reactions.

Explain the reactions that occur in each process. Identify Product A and B in your answer.

……..

……..

……..

……..

……..

…….. [4]

(c) Solid iodine collected in Step 3 was found to be impure.

State a method to obtain a pure sample of solid iodine.

…….. [1]

[Total: 7]

For Examiner's Use

A4 The first chemical source of current electricity was the voltaic pile. It consists of a stack of alternating copper and zinc discs, with a moistened cloth soaked in an aqueous electrolyte placed on top of each copper disc.

Fig. 4.1 shows a voltaic pile. The electrolyte is made up of aqueous copper(II) ions and zinc ions.

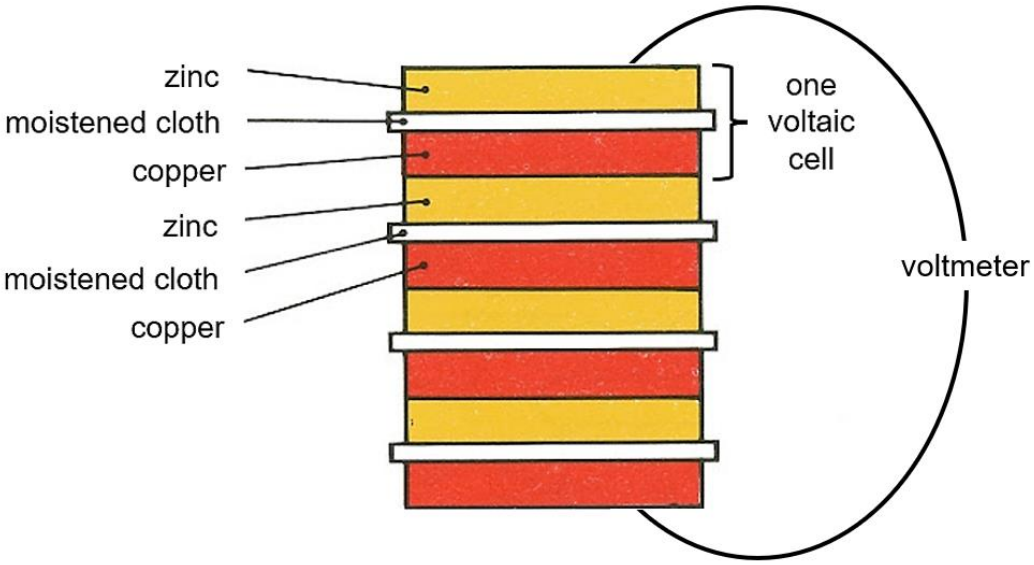

Fig. 4.1

(a) Complete Table 4.1.

Table 4.1

	metal	positive or negative electrode
cathode		
anode		

[2]

(b) When a current is drawn for some time, changes take place for the metal discs.

Describe and explain how the mass of copper and zinc discs will change.

……

……

……

……

……

…… [3]

For Examiner's Use

(c) Explain why a higher voltage was produced when a combination of silver and zinc discs were used instead.

……..

…….. [1]

(d) The electrolysis of concentrated hydrochloric acid was conducted using platinum electrodes as shown in Fig. 4.2.

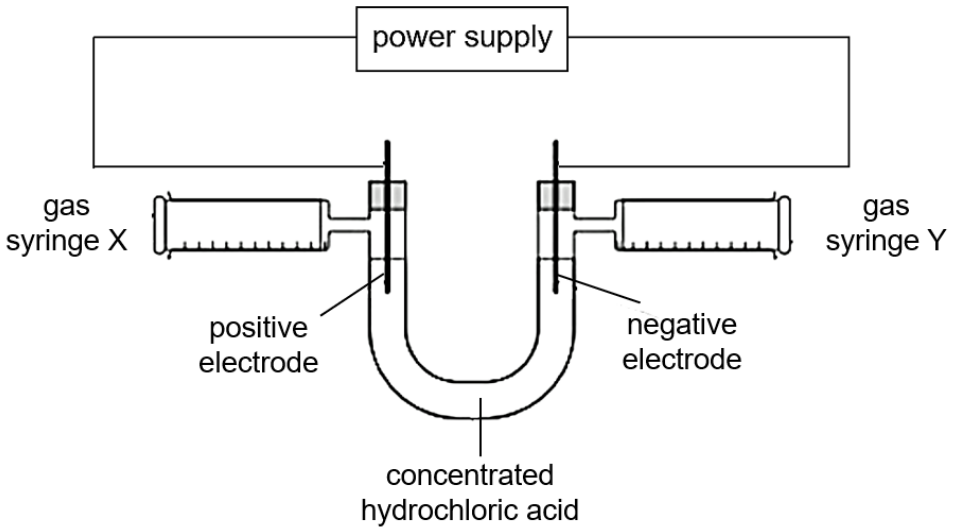

Fig. 4.2

(i) Give half-equations for the reaction at each electrode.

positive electrode ……

negative electrode …….…… [2]

(ii) Using your answer in **(d)(i)**, explain if the expected volume of gases collected at the gas syringe will be the same or different.

……

……

…… [1]

(iii) In the actual experiment, the volume of gas collected in gas syringe X was always less than that collected in gas syringe Y.

Suggest why this was observed.

……

…… [1]

For Examiner's Use

(iv) The platinum electrodes were replaced with silver electrodes.

A white precipitate was observed at one of the electrodes.

Identify the white precipitate and explain why this was observed.

……

……

……

…… [2]

[Total: 12]

For Examiner's Use

A5 Malachite is an ore of copper. The formula of malachite is $CuCO_3 \cdot Cu(OH)_2$. In this formula, one formula unit of copper(II) carbonate combines with one formula unit of copper(II) hydroxide.

Malachite undergoes reactions in a similar manner as a mixture of copper(II) carbonate and copper(II) hydroxide.

A small solid sample of malachite is added to excess dilute nitric acid. The carbon dioxide formed is collected and has a volume of 96 cm^3 at room temperature and pressure.

(a) Describe two observations that would be made when malachite reacts with dilute nitric acid.

……..

……..

…….. [2]

(b) Construct the equation for the reaction between malachite and dilute nitric acid.

…….. [2]

(c) Calculate the mass of carbonate ion in the sample of malachite.

[3]

[Total: 7]

For Examiner's Use

A6 A student conducted two experiments with solid sodium hydroxide and dilute sulfuric acid.

She used a data logger with a temperature probe to record the changes in temperature of the reaction mixture for 2 minutes for each experiment.

The results of her experiments are shown in Fig. 6.1.

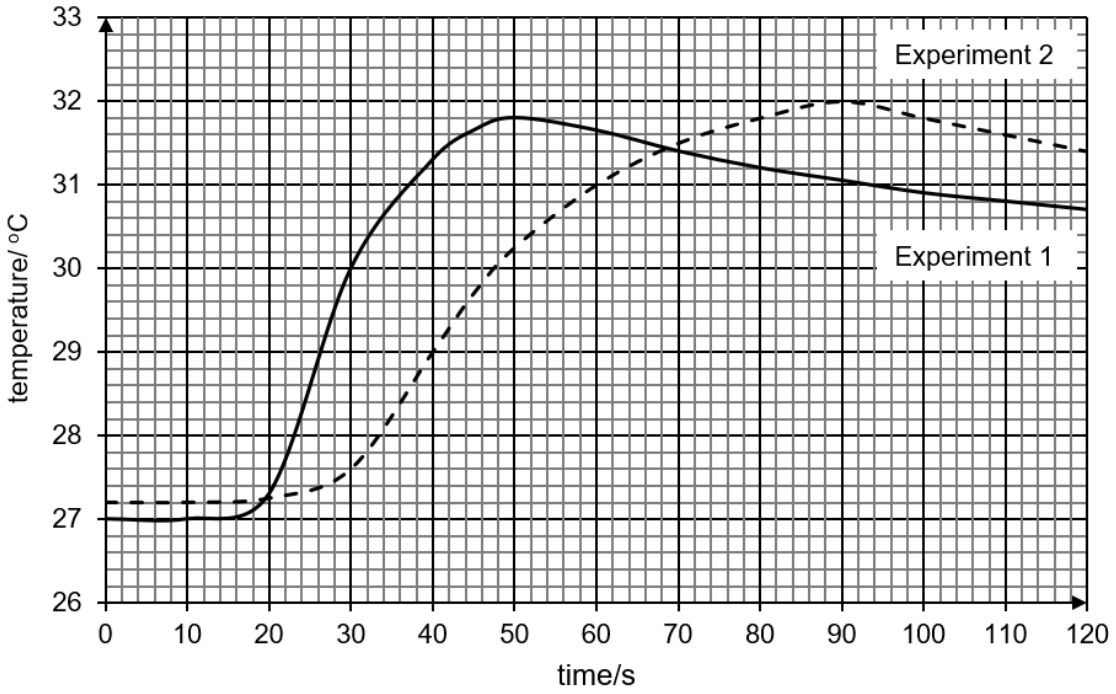

Fig. 6.1

(a) Based on Fig. 6.1, state and explain if this reaction is endothermic or exothermic.

……..

…….. [1]

(b) In Experiment 1, the student added 4.0 g of solid sodium hydroxide to 100 cm^3 of 1.0 mol/dm^3 of dilute sulfuric acid.

.

(i) Write the chemical equation for this reaction.

…….. [1]

(ii) Determine the limiting reactant in this experiment.

[2]

For Examiner's Use

(c) Both experiments were conducted using the same quantity of reactants.

(i) Based on information from Fig. 6.1, explain how this can be deduced.

……..

…….. [1]

(ii) Hence, describe the difference in the shape of the graphs and suggest one reason for the difference.

……..

……..

……..

……..

…….. [2]

(d) Experiment 1 was repeated using 100 cm^3 of 1.0 mol/dm^3 of dilute ethanoic acid instead of dilute sulfuric acid.

Suggest the time taken for this reaction to be complete.

…….. [1]

[Total: 8]

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