Pearson Edexcel

# Additional Assessment Materials Summer 2021

## Pearson Edexcel GCSE in Chemistry (1CH0) Higher

## Resource Set Topic F: Electrolytic processes

## Questions

(Public release version)

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Additional Assessment Materials, Summer 2021

**General guidance to Additional Assessment Materials for use in 2021**

**Context**

- Additional Assessment Materials are being produced for GCSE, AS and A levels (with the exception of Art and Design).
- The Additional Assessment Materials presented in this booklet are an **optional** part of the range of evidence teachers may use when deciding on a candidate's grade.
- 2021 Additional Assessment Materials have been drawn from previous examination materials, namely past papers.
- Additional Assessment Materials have come from past papers both published (those materials available publicly) and unpublished (those currently under padlock to our centres) presented in a different format to allow teachers to adapt them for use with candidate.

**Purpose**

- The purpose of this resource to provide qualification-specific sets/groups of questions covering the knowledge, skills and understanding relevant to this Pearson qualification.
- This document should be used in conjunction with the mapping guidance which will map content and/or skills covered within each set of questions.
- These materials are only intended to support the summer 2021 series.

**6** (a) Molten zinc chloride is an electrolyte.

(i) Which row shows the products formed at the anode and at the cathode when molten zinc chloride is electrolysed?

**(1)**

| | | product at anode | product at cathode |
|---|---|---|---|
| ☒ | **A** | oxygen | zinc |
| ☒ | **B** | chlorine | hydrogen |
| ☒ | **C** | chlorine | zinc |
| ☒ | **D** | oxygen | hydrogen |

(ii) Which of the following is the reason why molten zinc chloride is an electrolyte?

**(1)**

☒ **A** it contains molecules that can move

☒ **B** it has a giant structure

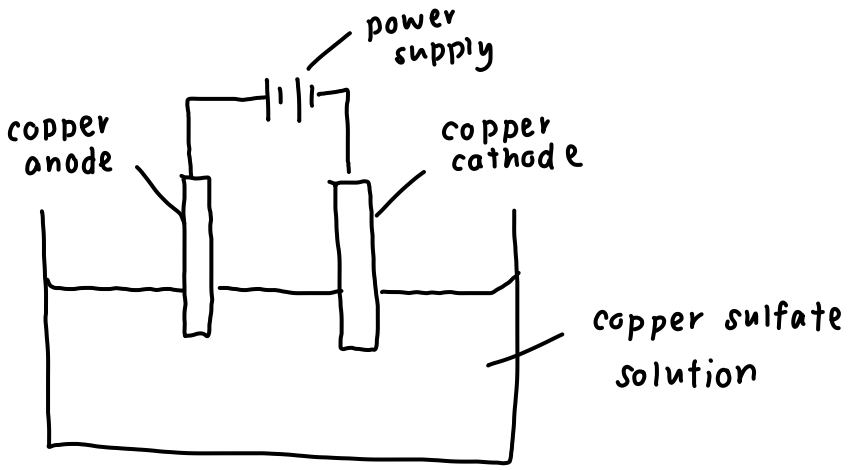
☒ **C** it contains delocalised electrons

☒ **D** it contains ions that can move

(b) Copper sulfate solution was electrolysed using copper electrodes.

(i) Draw a labelled diagram to show the apparatus that is used to carry out this electrolysis in the laboratory.

**(2)**



(ii) Before the electrolysis, the masses of the electrodes were determined.
After the electrolysis, the electrodes were washed and dried and their masses re-determined.

Figure 6 shows these masses and the resulting changes in masses of the electrodes.

| | mass of electrode before electrolysis in g | mass of electrode after electrolysis in g | change in mass of electrode in g |
|---|---|---|---|
| anode | 11.27 | 10.42 | −0.85 |
| cathode | 11.32 | 12.17 | +0.85 |

**Figure 6**

Explain these results.

(4)

At the anode, copper is oxidised into copper ions and enter the solution. ($Cu(s) \rightarrow Cu^{2+}(aq) + 2e^-$) Mass is lost at the anode as copper is lost. At the cathode, copper ions are reduced to copper which deposit at the cathode, so there is a gain of mass. ($Cu^{2+}(aq) + 2e^- \rightarrow Cu(s)$).

(c) When sodium sulfate solution is electrolysed, using inert electrodes, hydrogen is formed at the cathode.

Write the half equation for the formation of hydrogen gas, $H_2$, from hydrogen ions, $H^+$.

(2)

$2H^+(aq) + 2e^- \rightarrow H_2(g)$

3a

(ii) Throughout the experiment the volume of hydrogen and the volume of oxygen are measured at two-minute intervals.

The results are shown in Figure 2.

| time in minutes | volume of hydrogen in $cm^3$ | volume of oxygen in $cm^3$ |
|---|---|---|
| 0 | 0 | 0 |
| 2 | 4 | 2 |
| 4 | 8 | 4 |
| 6 | 12 | 6 |
| 8 | 16 | 8 |

**Figure 2**

Describe, using the data in Figure 2, what the results show about the volumes of hydrogen and of oxygen produced in this experiment.

**(2)**

$4cm^3$ of hydrogen and $2cm^3$ of oxygen are produced in each 2 minutes interval. The rate of production remains constant throughout the 8 minutes for both gases. The volume of hydrogen produced was twice of the volume of oxygen produced.

3

(b) Molten lead bromide is electrolysed.

The products of this electrolysis are

(1)

☒ **A** hydrogen and bromine

☒ **B** hydrogen and oxygen

☒ **C** lead and bromine

☒ **D** lead and oxygen

(c) Calcium nitrate and calcium carbonate are both ionic compounds.

Calcium nitrate mixed with water behaves as an electrolyte.
Calcium carbonate mixed with water does not behave as an electrolyte.

Explain, in terms of solubility and movement of ions, this difference in behaviour.

(2)

Calcium nitrate is soluble in water so ions carrying charge are free to move around. Calcium carbonate is insoluble so the ions are held together in place.

(d) When molten zinc chloride is electrolysed, zinc ions, $Zn^{2+}$, form zinc atoms.

Write the half equation for this reaction.

(2)

$Zn^{2+}(aq) + 2e^- \rightarrow Zn(s)$

**3** The word equation for the reaction between copper carbonate and dilute sulfuric acid is

$$\text{copper carbonate} + \text{sulfuric acid} \rightarrow \text{copper sulfate} + \text{carbon dioxide} + \text{water}$$

(a) (i) Complete the balanced equation for this reaction.

**(2)**

$$CuCO_3 + \underline{H_2SO_4} \rightarrow \underline{CuSO_4} + CO_2 + H_2O$$

(ii) Calculate the relative formula mass of copper carbonate, $CuCO_3$.
(relative atomic masses: C = 12.0, O = 16.0, Cu = 63.5)

**(2)**

$12.0 + 3(16.0) + 63.5 = 123.5$

relative formula mass of $CuCO_3$ = 123.5

(iii) What is the chemical test to show that a gas is carbon dioxide?

**(1)**

☒ **A** bubble the gas through limewater, limewater turns cloudy

☒ **B** put damp blue litmus paper in the gas, litmus paper turns red

☒ **C** put a lighted splint into the gas, the splint is extinguished

☒ **D** measure the pH of the gas, pH = 4

**TOTAL FOR PAPER IS 22 MARKS**