



Additional Assessment Materials

Summer 2021

Pearson Edexcel GCE in Chemistry 8CH0

Resource Set 1 – Topic Group 2

Topics included:

Topic 3: Redox I

Topic 4: Inorganic Chemistry and the  
Periodic Table

Topic 5: Formulae, Equations and Amounts  
of Substance

(Public release version)

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Additional Assessment Materials, Summer 2021

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## 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- Additional Assessment Materials have come from past papers both published (those materials available publicly) and unpublished (those currently under padlock to our centres) presented in a different format to allow teachers to adapt them for use with candidate.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 is 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.

4 This question is about trends within Group 2 of the Periodic Table.

(a) Which of the following describes the trends in thermal stability of the Group 2 carbonates and nitrates going down the group?

(1)

		Thermal stability	
		Carbonates	Nitrates
<input type="checkbox"/>	A	increases	increases
<input type="checkbox"/>	B	increases	decreases
<input type="checkbox"/>	C	decreases	increases
<input type="checkbox"/>	D	decreases	decreases

(b) Describe, with the aid of a labelled diagram, how you would compare the thermal stability of two different Group 2 nitrates using simple laboratory equipment.

Your answer **must** include **one** safety precaution (excluding the use of gloves, laboratory coat and eye protection).

(4)

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(c) Which of the following describes the trends in the solubility in water of the Group 2 hydroxides and sulfates going down the group?

(1)

Solubility in water		
Hydroxides	Sulfates	
<input type="checkbox"/> <b>A</b>	increases	increases
<input type="checkbox"/> <b>B</b>	increases	decreases
<input type="checkbox"/> <b>C</b>	decreases	increases
<input type="checkbox"/> <b>D</b>	decreases	decreases

(Total for Question 4 = 6 marks)

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5 This question is about the reactions of the halogens and halide ions.

(a) (i) When chlorine gas is bubbled through an aqueous solution of potassium iodide, the reaction involves

(1)

- A oxidation only
- B reduction only
- C redox
- D disproportionation

(ii) Cyclohexane was added to the resulting solution from (a)(i). The mixture was shaken and then allowed to stand for a few minutes. Two layers were formed.

[Density: aqueous layer solution =  $1.10 \text{ g cm}^{-3}$ , cyclohexane layer =  $0.78 \text{ g cm}^{-3}$ ]

The colour of the **lower** layer was

(1)

- A pale yellow
- B purple
- C red
- D pale green

(b) Concentrated sulfuric acid was added to a small quantity of solid potassium iodide in a test tube.

(i) In this exothermic reaction, which of the following mixtures of gases would be produced?

(1)

- A hydrogen iodide and sulfur dioxide only
- B hydrogen iodide and hydrogen sulfide only
- C hydrogen iodide, sulfur dioxide and hydrogen sulfide
- D hydrogen iodide, hydrogen sulfide and iodine

(ii) Hydrogen iodide is a gas which reacts in a similar way to hydrogen chloride.

State the observation when the hydrogen iodide gas is passed over the mouth of an open bottle of concentrated ammonia solution.  
Write an equation, including state symbols, for the reaction.

(3)

Observation .....

Equation

(c) Potassium iodate(V) can be prepared by adding solid iodine to a **hot** aqueous solution of potassium hydroxide.

The equation for the reaction is



Potassium iodate(V) can be separated from the other reaction product using their differing solubilities in water.

	Solubility in water at 25 °C / mol dm <sup>-3</sup>
KI	8.92
KIO <sub>3</sub>	0.43

(i) Outline a procedure that you could use to obtain a sample of dry, solid potassium iodate(V) from the reaction mixture.

(3)

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(ii) Describe how you would show that iodide ions are present in an aqueous solution of potassium iodide.

(2)

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(d) Fluorine is an element in Group 7.

Group 7 includes the elements chlorine, bromine and iodine.

Some information about the melting and boiling temperatures of Group 7 elements is shown in the table.

Element	Melting temperature / K	Boiling temperature / K
chlorine	172	238
bromine	266	332
iodine	387	457

Which is the expected boiling temperature of fluorine, in kelvin, K?

(1)

- A 4
- B 85
- C 575
- D 610

(Total for Question 5 = 12 marks)

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4 This question is about redox chemistry.

(a) (i) Write an ionic half-equation for the reduction of chlorine molecules to chloride ions.

State symbols are not required.

(1)

(ii) Write an ionic half-equation for the oxidation of chlorine molecules to chlorate(I) ions in the presence of cold, aqueous hydroxide ions.

State symbols are not required.

(1)

(iii) Combine the two equations in (a)(i) and (ii) to give the ionic equation for the reaction of chlorine molecules with cold, aqueous hydroxide ions.

(1)

(iv) Use your answer to (a)(iii) to explain why the reaction is described as a **disproportionation** reaction.

(2)

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(b) A different ion containing chlorine is formed if the solution of aqueous hydroxide ions is hot.

Give the formula of the chlorine-containing ion **and** the oxidation number of chlorine in this ion.

(2)

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- (c) (i) Bromine can be extracted from seawater containing bromide ions using chlorine.

Write the ionic equation for this reaction. State symbols are not required.

(1)

- (ii) Identify **one** hazard associated with carrying out this reaction in a school laboratory and a safety precaution other than wearing a laboratory coat and eye protection.

(2)

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**(Total for Question 4 = 10 marks)**

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5 This question is about iron(II) salts.

(a) What is the percentage by mass of iron in anhydrous iron(II) sulfate,  $\text{FeSO}_4$ , to 3 significant figures?

(1)

A 21.3%

B 35.1%

C 36.7%

D 53.8%

(b) Describe a chemical test, and the expected result, to show that sulfate ions are present in a solution of iron(II) sulfate in water.

(2)

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(c) Mohr's salt is another compound containing iron(II) ions.

It has the formula  $(\text{NH}_4)_2\text{Fe}(\text{SO}_4)_2 \cdot 6\text{H}_2\text{O}$ .

What is the molar mass, in  $\text{g mol}^{-1}$ , of Mohr's salt?

(1)

A 392.0

B 312.0

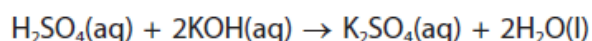
C 302.0

D 284.0

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**(Total for Question 5 = 4 marks)**

- 3 The reaction of sulfuric acid with potassium hydroxide is a neutralisation.  
The equation for this reaction is



A titration was carried out using the following method.

1. Potassium hydroxide solution of unknown concentration was placed in a burette and the initial reading was recorded.
2.  $25.0\text{ cm}^3$  of sulfuric acid solution, concentration  $0.0800\text{ mol dm}^{-3}$ , was transferred to a conical flask.
3. Three drops of phenolphthalein indicator were added to the sulfuric acid.
4. Potassium hydroxide was added from the burette until the solution just changed colour and then the burette reading was recorded.
5. Repeat titrations were carried out until concordant titres were obtained.

- (a) Select the most appropriate piece of apparatus to measure the  $25.0\text{ cm}^3$  of sulfuric acid.

(1)

- A burette
- B measuring cylinder
- C pipette
- D volumetric flask

- (b) What is the colour of the solution when neutralisation has just occurred?

(1)

- A colourless
- B orange
- C pale pink
- D red

(c) (i) Complete the table of results for titration number 1, using the diagrams to find the initial and final burette readings.

(2)



Initial reading



Final reading

Table of results

Titration number	Final reading / cm <sup>3</sup>	Initial reading / cm <sup>3</sup>	Titration volume / cm <sup>3</sup>
1			
2	28.05	1.10	26.95
3	37.65	10.20	27.45
4	32.05	5.00	27.05

(ii) The best value for the mean titre of this reaction is

(1)

- A 27.00 cm<sup>3</sup>
- B 27.15 cm<sup>3</sup>
- C 27.25 cm<sup>3</sup>
- D 27.30 cm<sup>3</sup>

(iii) Calculate the concentration, in  $\text{mol dm}^{-3}$ , of the potassium hydroxide solution, giving your answer to an appropriate number of significant figures.

(3)

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(Total for Question 3 = 8 marks)

**Total for Test = 40 marks**