Additional Assessment Materials
Summer 2021

Pearson Edexcel GCSE in Chemistry (1CH0)
Higher

Resource Set Topic N: Qualitative analysis, bulk and surface properties of matter

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- Additional Assessment Materials have come from past papers both published (those materials available publicly) and unpublished (those currently under padlock to our centres) presented in a different format to allow teachers to adapt them for use with candidate.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

8 Qualitative tests are used to identify ions in compounds.

(a) Solid **X** contains two ions.

The tests for these ions and their results are shown in Figure 10.

test	result
flame test on solid **X**	red-orange flame
dilute nitric acid is added to an aqueous solution of **X**, followed by silver nitrate solution	white precipitate forms

Figure 10

Use the information in Figure 10 to name the cation and the anion in solid **X**.

(2)

name of cation calcium ions

name of anion chloride ions

(b) Another solid, **Y**, also contains two ions.

A test was carried out on solid **Y**.

A few drops of sodium hydroxide solution were added to a solution of solid **Y**.
A white precipitate formed.

(i) Give the reason why this test does not identify the cation in solid **Y**.

(1)

Both aluminium and calcium ions will form white precipitate in NaOH.

(ii) Give the reason why this test does not identify the anion in solid **Y**.

(1)

Sodium hydroxide solution is not used to test for anions.

(c) Instrumental methods are often used for analysis.

Give a reason why instrumental analysis may be better than other methods of analysis.

(1)

It is more accurate

(d) Iron(II) sulfate solution reacts with sodium hydroxide solution to form a pale green precipitate of iron(II) hydroxide, $Fe(OH)_2$.

(i) Write the ionic equation for this reaction.

(3)

$Fe^{2+} + 2OH^- \rightarrow Fe(OH)_2$

(ii) The green iron(II) hydroxide precipitate gradually turns brown when exposed to air.

Explain this observation.

(2)

The Fe^{2+} reacts with oxygen in air and form Fe_2O_3. Fe^{2+} is oxidised to Fe^{3+}.

5 (a) Figure 4 shows information about a ceramic and a metal.

	ceramic	metal
flexibility	low	high
hardness	medium	low
reaction with water	no reaction	very slow reaction
density	medium	high

Figure 4

The ceramic, rather than the metal, is a more suitable material for washbasins.

Give a reason for this, using a property from Figure 4.

(1)

Ceramic does not react with water. Metals can react with water and rust.

1

(b) Nanoparticles are very small particles that have unusual properties.

(i) Particles less than 100 nanometres in size are classified as nanoparticles.

100 nanometres is

$1\ nm = 1 \times 10^{-9}\ m$

$100\ nm = 1 \times 10^{-7}\ nm$

(1)

- ☒ **A** 1×10^{-4} metres
- ☒ **B** 1×10^{-5} metres
- ☒ **C** 1×10^{-7} metres
- ☒ **D** 1×10^{-9} metres

(ii) Nanoparticles of titanium(IV) oxide are used in some sunscreens.

Describe a reason why nanoparticles of titanium(IV) oxide are used in some sunscreens.

(2)

Nanoparticles have a larger surface area to volume ratio so a smaller amount is needed.

(iii) Some people are concerned that there is a risk when sunscreens containing nanoparticles are used.

Explain a possible risk associated with using nanoparticles in sunscreens.

(2)

Nanoparticles can be inhaled and can cause health issues inside the body.

10 (a) A sample of potassium carbonate is contaminated with a small amount of sodium carbonate.
When a flame test is carried out on the sample, a bright yellow flame is seen.

Describe how you could show that potassium and sodium ions are present in this sample.

(2)

Potassium ions will give a lilac flame and sodium ions give a yellow flame.

(b) Hydrochloric acid reacts with a solution of sodium carbonate.

$$2HCl(aq) + Na_2CO_3(aq) \rightarrow 2NaCl(aq) + CO_2(g) + H_2O(l)$$

(3)

Write the ionic equation for this reaction.

$2H^+ + 2Cl^- + 2Na^+ + CO_3^{2-} \rightarrow 2Na^+ + 2Cl^- + CO_2 + H_2O$

$2H^+ + CO_3^{2-} \rightarrow CO_2 + H_2O$

*(c) A student tests solutions of three ionic substances, **K**, **L** and **M**.

The student carries out the same two tests on each of the three solutions.

Test 1 add dilute nitric acid and then silver nitrate solution.

Test 2 add a few drops of sodium hydroxide solution and warm the mixture.

Figure 7 shows the results of the tests and the student's conclusions about the identity of each substance.

ionic substance	test 1	test 2	student's conclusion
K	white precipitate	colourless solution	ammonium chloride
L	white precipitate	white precipitate	aluminium chloride
M	no precipitate	green precipitate	iron(II) sulfate

Figure 7

None of the student's conclusions are fully justified.

Explain which part of each conclusion is justified and what further work can be carried out to fully justify each conclusion.

(6)

In K, further test can be carried out to identify the cation. If ammonium ions are present, ammonia will be released when the solution is warmed. The presence of ammonia can be tested using damp red litmus paper, which turns blue if ammonia is present.

In L, excess NaOH can be added after test 2. If the white precipitate dissolves the cation present is aluminium. If it does not dissolve, the cation is calcium.

In both K and L, the results of test 1 justified that chloride ions are present.

In M, the result from test 2 shows that Fe^{2+} is present. The result

of test 1 shows that halide ions are absent but do not show that sulfate ions are present. To test for sulfate ions, dilute hydrochloric acid can be added to the sample, followed by dilute barium chloride solution. If sulfate ions are present, barium sulfate will form and an insoluble white precipitate will form.

1 (a) A chloride ion, a fluorine atom and a nanoparticle are all types of particle.

Which of the following shows the particles in order of size, starting from the smallest?

(1)

☒ **A** nanoparticle, fluorine atom, chloride ion

☐ **B** nanoparticle, chloride ion, fluorine atom

☐ **C** fluorine atom, nanoparticle, chloride ion

☐ **D** fluorine atom, chloride ion, nanoparticle

(b) A solution, **X**, is thought to contain chloride, bromide or iodide ions.

(i) The solution is tested to see whether it contains one of these ions.
In the test, a few drops of **two** different solutions are added to **X**.

Name the two solutions that are added in the test.

(2)

solution 1 dilute nitric acid

solution 2 dilute silver nitrate

(ii) The student carrying out the test records the following result.

A precipitate forms in the test tube. The precipitate is a cream/yellow colour.

Explain why the anion in **X** cannot be known for certain.

(2)

Bromide ions give a cream precipitate and iodide ions give a yellow precipitate. The colours are difficult to identify using naked eye.

(iii) The metal ions in **X** could be identified using a flame test.
There is a more sensitive and accurate instrumental method that can be used.

Give the name of an instrument that can be used to identify the metal ions in **X**.

(1)

Flame photometer.

TOTAL FOR PAPER IS 33 MARKS