Pearson Edexcel

Additional Assessment Materials Summer 2021

Pearson Edexcel GCSE in Chemistry (1CH0) Higher

Resource Set Topic E: Acids, bases and salts – including preparation of salts

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- Additional Assessment Materials have come from past papers both published (those materials available publicly) and unpublished (those currently under padlock to our centres) presented in a different format to allow teachers to adapt them for use with candidate.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

2 (a) Salts of metals can be prepared by reacting the metal with an acid to produce the salt and hydrogen.

(i) Describe the test to show the gas is hydrogen.

(2)

Lighted splint goes off with a pop sound.

(c) Excess solid nickel carbonate is added to dilute sulfuric acid in a beaker.

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

Nickel sulfate is formed in solution.

Describe how a sample of pure, dry nickel sulfate crystals can be obtained from the mixture of nickel sulfate solution and excess solid nickel carbonate in the beaker.

(3)

The solution can be heated until the crystallisation point. The crystals are then cleaned with distilled water and dried within filter paper.

(d) The hydrogen ion concentration in a solution is decreased by a factor of 10.

State how the pH of this solution changes.

(1)

increase

9 (a) **X** and **Y** are solutions of two different acids.
The concentration of acid in each solution, in mol dm^{-3}, is the same.
Solution **X** has a pH of 3.40 and solution **Y** has a pH of 4.40.

(i) State what could be used to measure these pH values of 3.40 and 4.40.

(1)

pH meter

(ii) What is the concentration of hydrogen ions in solution **X** compared with that in solution **Y**?

(1)

- ☒ **A** ten times lower
- ☒ **B** lower by a factor of 3.30/4.40
- ☒ **C** higher by a factor of 4.40/3.30
- ☒ **D** ten times higher

(b) An experiment is planned to record the change in pH as a powdered base is added to 50 cm^3 dilute hydrochloric acid.

The method suggested is

step 1 add dilute hydrochloric acid up to the 50 cm^3 mark on a beaker

step 2 add one spatula of the base and stir

step 3 measure the pH of the mixture

step 4 repeat steps 2 and 3 until the pH stops changing.

(i) State how you could change the method so that the amounts of dilute hydrochloric acid and of the base can be measured more accurately.

(2)

dilute hydrochloric acid use a pipette

base dissolve the base in water to give a solution with a specific concentration, titrate the volume required for the pH to stop changing.

(ii) During the experiment the pH changes from 2 to 10.
If phenolphthalein indicator is added at the beginning of the experiment, a colour change occurs as the base is added.

State the colour change that occurs.

(1)

colour at start colourless

colour at end pink

(iii) Explain, in terms of the particles present, why the pH increases during the experiment.

(2)

OH^- from the base reacts with H^+ from the acid to form H_2O.

There are less H^+ available in the mixture so pH increases.

*(c) Some properties of four solids, **A**, **B**, **C** and **D**, are shown in Figure 6.

The solids, in no particular order, are copper carbonate, copper oxide, magnesium metal and sodium hydroxide.

CuO Mg NaOH $CuCO_3$

	A	B	C	D
colour of solid	black	silver	white	green
observation when solid is added to water	black solid remains	a few bubbles appear on surface of solid	solid dissolves and forms colourless solution	green solid remains
pH of mixture of solid added to water	7	8	13	7
observation when solid is added to dilute sulfuric acid	on warming, solid disappears to form blue solution	effervescence solid disappears to form colourless solution	solid disappears to form colourless solution	effervescence solid disappears to form blue solution

Figure 6

Identify the solids **A**, **B**, **C** and **D**, explaining how the information in Figure 6 supports the identification of each solid.

(6)

Solid A is copper oxide. Copper oxide is a black solid which is insoluble water. It dissolves in dilute sulfuric acid upon warming to give a blue solution due to the Cu^{2+} ions present.

Solid B is magnesium. It reacts with dilute sulfuric acid to form magnesium sulfate, which is colourless and soluble, and hydrogen gas.

Solid C is NaOH as it aqueous NaOH is colourless and have a high pH. NaOH and H_2SO_4 react in a neutralisation reaction to give Na_2SO_4 and H_2O, which is colourless.

Solid D is $CuCO_3$ as it is a green solid which is insoluble in water. When added to H_2SO_4, effervescence is observed as CO_2 is given off, and the solution turns blue due to the Cu^{2+} ions.

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)

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

(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

(b) Figure 4 shows a conical flask containing dilute sulfuric acid.
Copper carbonate is added to the acid in the flask.
The copper carbonate is added one spatula measure at a time until the reaction has finished.

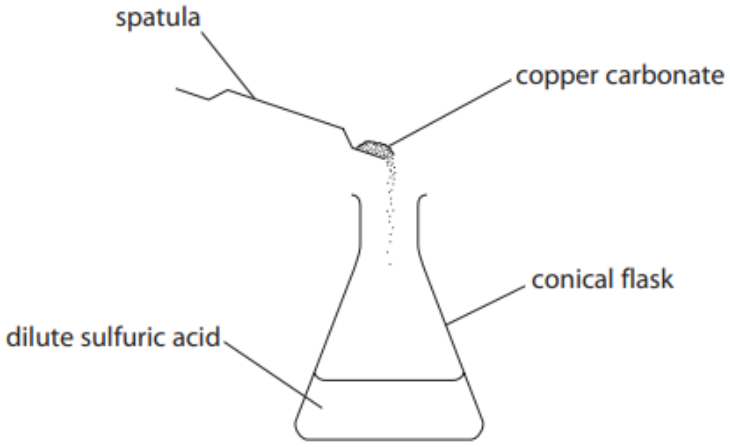

Figure 4

State **two** observations that would show the reaction has finished.

(2)

1 copper carbonate stops dissolving

2 no effervescence observed

9 (a) Dilute hydrochloric acid is a strong acid.

(i) Explain why dilute hydrochloric acid is described as a strong acid.

(2)

Dilute hydrochloric acid completely dissociate in water to give H^+.

(ii) 1 cm^3 of hydrochloric acid of pH 2 is made up to a volume of 10 cm^3 with distilled water.

State the pH of the new solution.

(1)

pH = 3

(b) Magnesium oxide reacts with dilute hydrochloric acid to produce magnesium chloride solution and water.

$$MgO(s) + 2HCl(aq) \rightarrow MgCl_2(aq) + H_2O(l)$$

Write the ionic equation for this reaction.

(3)

$\frac{1}{2} O_2 + 2H^+ + 2e^- \rightarrow H_2O(l)$

(c) In an experiment magnesium hydroxide powder is added in 0.1 g portions to 25 cm^3 of dilute hydrochloric acid until the magnesium hydroxide is just in excess.

Universal indicator paper can be used to test the pH of the solution after each addition of magnesium hydroxide.

(i) Give the name of an alternative piece of equipment that can be used to measure pH.

(1)

pH meter

(ii) State and explain how the pH changes as the magnesium hydroxide is added to the dilute hydrochloric acid.

(4)

$H^+ + OH^- \rightarrow H_2O$

As more magnesium hydroxide is added, more OH^- is available to react with H^+ forming H_2O. The H^+ concentration becomes lower so pH increases.

TOTAL FOR PAPER IS 35 MARKS