



Additional Assessment Materials

Summer 2021

Pearson Edexcel GCE in Chemistry 9CH0

Resource Set 2 – Topic Group 6

Questions based on practical work taken
from any topic

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- Additional Assessment Materials have come from past papers both published (those materials available publicly) and unpublished (those currently under padlock to our centres) presented in a different format to allow teachers to adapt them for use with candidate.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

3 This question is about a titration experiment carried out by a group of students to determine the concentration of a solution of ethanoic acid using sodium hydroxide.

(a) A student weighed about 4.00 g of sodium hydroxide pellets and added them to a beaker containing 50 cm³ of deionised water.

The mixture was stirred with a glass rod to dissolve the pellets and to give a homogenous solution.

The solution was poured through a funnel into a 250.0 cm³ volumetric flask and deionised water was added up to the mark and then the flask was shaken.

(i) Describe how you would ensure that all the sodium hydroxide was transferred to the volumetric flask.

(2)

(ii) A student adds deionised water above the mark and shakes the flask.

State why the procedure has to be restarted rather than using a teat pipette to remove the excess water.

(1)

(b) Two students each cleaned a burette, then poured sodium hydroxide solution into their burettes.

(i) Student 1 used a funnel to pour sodium hydroxide solution into the burette.

Give **two** steps needed before the student takes the initial burette reading.

(2)

(ii) Student 2 cleaned the burette by rinsing it with deionised water immediately before filling it with the sodium hydroxide solution.

Give the effect, if any, on the value of the first titre. Justify your answer.

(1)

- (ii) Complete the table, with a tick (✓) or a cross (✗), to show whether or not the indicator would be suitable for use in this titration.

(1)

Indicator	pH range	Tick or Cross
Bromocresol purple	5.2 – 6.8	
Thymol blue	8.0 – 9.6	
Thymolphthalein	8.3 – 10.6	
Alizarin yellow R	10.1 – 13.0	

- (d) Each student used a pipette to measure 25.0 cm^3 of the ethanoic acid solution into four separate conical flasks and added an indicator.

The results of one student's titrations are shown in the table.

Titration number	1	2	3	4
Final burette reading / cm^3	13.00	25.50	37.90	50.00
Initial burette reading / cm^3	0.25	13.00	25.50	37.90
Titre / cm^3				
Concordant titres (✓)				

- (i) Complete the table.

(1)

- (ii) The low titre for titration **4** was queried by the teacher. The student had wanted to refill the burette and continue the titration but had been told the measurement uncertainty would increase if this was done.

Calculate the total percentage measurement uncertainty if the burette had been refilled to 0.00, and then a further 0.30 cm^3 had been added from the burette, to the conical flask.

The measurement uncertainty for each burette reading is $\pm 0.05 \text{ cm}^3$.

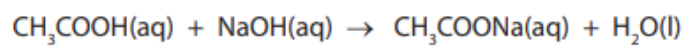
(1)

(e) The teacher carried out the experiment and obtained the following results.

Mass of sodium hydroxide used to make 250.0 cm³ solution = 3.80 g

Volume of ethanoic acid solution = 25.00 cm³

Mean titre of sodium hydroxide = 11.90 cm³



Calculate the concentration of the ethanoic acid solution in **g dm⁻³**.

Give your answer to an appropriate number of significant figures.

(5)

(Total for Question 3 = 18 marks)

(iii) The student corrected the errors.

While the mixture was heating under reflux, the student noticed a small amount of a brown vapour was formed.

Explain why the brown vapour forms.

(2)

(b) The distillate collected in Step 5 is a mixture consisting of two layers. There is an aqueous layer and a layer containing impure 1-bromobutane.

Data	
Densities:	
water	1.00 g cm ⁻³
butan-1-ol	0.81 g cm ⁻³
1-bromobutane	1.27 g cm ⁻³
Boiling temperature of 1-bromobutane = 102 °C	

The steps for the purification of the 1-bromobutane are summarised.

- Step 6** Transfer the mixture from Step 5 to a separating funnel and remove the aqueous layer.
- Step 7** Wash the impure 1-bromobutane with concentrated hydrochloric acid in the separating funnel. Remove the aqueous layer.
- Step 8** Add aqueous sodium hydrogencarbonate to the impure 1-bromobutane in the separating funnel.
- Step 9** Shake the mixture in the separating funnel and, from time to time, invert the funnel and open the tap.
- Step 10** Collect the 1-bromobutane layer from Step 9 in a small conical flask. Add anhydrous sodium sulfate and swirl the flask until the liquid becomes clear.
- Step 11** Decant the 1-bromobutane into a clean pear-shaped flask and redistil it. Measure the volume of 1-bromobutane produced.

1 This question is about some halogens and their compounds.

(a) The intermolecular attractions between halogen molecules are London forces.

(ii) The boiling temperatures of chlorine and bromine are shown in the table.

Halogen	Boiling temperature / °C
chlorine	-34
bromine	59

Explain why bromine has a higher boiling temperature than chlorine.

(2)

(b) A student carries out experiments to determine the order of reactivity of three halogens: bromine, chlorine and iodine.

The student is provided with aqueous solutions of the following five substances:

- bromine
- iodine
- potassium chloride
- potassium bromide
- potassium iodide.

The student has **no** access to chlorine gas or chlorine water.

The student uses cyclohexane, an organic solvent, to identify the halogen present at the end of each experiment.

The student carries out the **smallest** number of experiments required to determine the order of reactivity of the halogens.

Describe the experiments and the expected observations.

Include in your answer **ionic** equations for any reactions that occur.

State symbols are **not** required.

(5)

