# DELEGATE BOOKLET

# Understanding Assessment and Improving Delivery in International GCSE Chemistry

## Course code:4CH1
## Online modules 1 and 2

## About this event

**Course Title:** Understanding assessment and improving delivery in International GCSE Sciences: Online modules 1 and 2

**Course Code: 4CH1**

## Aims and Objectives of the event

These two online events are designed to support teachers who are preparing to deliver the new International GCSE Chemistry specification for assessment in May/June 2020.

During the training, throughout the two modules, you will:

- be introduced to the idea of assessment objectives: what are they and why they are used when writing examination papers
- analyse recent question papers and learn which types of questions match the different assessment objectives
- investigate different assessment objectives, considering how questions have been answered by looking at feedback from the previous exam series
- discuss strategies for teaching to try and make sure students can access questions targeting different assessment objectives
- review the support Pearson offers for the qualification
- network, discuss best practice and share ideas with other teachers

Each of these two modules can count as 2 hours of CPD

## This pack contains all you will need

**This should include all the materials needed for the training**

**Activity 1**
**Assigning AOs**

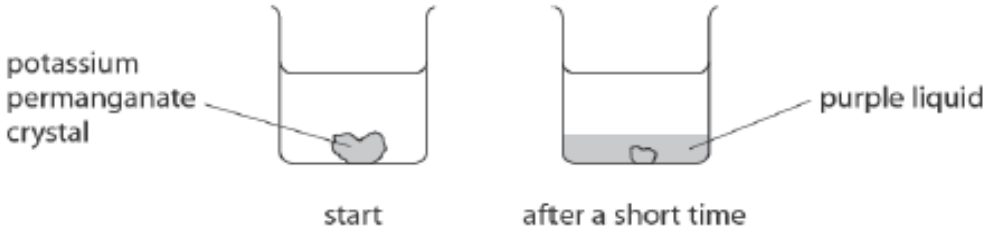
Your pack contains questions from May/June 2019 Papers 1C and 2C.

Read the questions and assign an AO to each question part.

# ACTIVITY 1 – Assigning AOs to questions

1 Potassium permanganate is a purple solid that is soluble in water.

A crystal of potassium permanganate is placed in a beaker containing water.




(a) After a short time, the crystal becomes smaller and the liquid at the bottom of the beaker becomes purple.

Which statement explains this observation?

(1)

☒ **A** the crystal condenses in the water

☒ **B** the crystal dissolves in the water

☒ **C** the crystal evaporates in the water

☒ **D** the crystal melts in the water

(b) The beaker is left until there is no further change in the appearance of the liquid.

(i) Which statement describes the final appearance of the liquid?

(1)

☒ **A** all of the liquid is purple

☒ **B** none of the liquid is purple

☒ **C** only the bottom half of the liquid is purple

☒ **D** only the top half of the liquid is purple

(ii) Which process causes this change in appearance?

(1)

☒ **A** condensation

☒ **B** crystallisation

☒ **C** diffusion

☒ **D** evaporation

6 The reactions of metals with water and with dilute sulfuric acid can be used to determine the order of reactivity of the metals.

The table shows the reactions of four metals, W, X, Y and Z, with water and with dilute sulfuric acid.

| Metal | Reaction with water | Reaction with dilute sulfuric acid |
|---|---|---|
| W | no reaction | no reaction |
| X | very slow reaction | reacts quickly |
| Y | no reaction | reacts slowly |
| Z | reacts quickly | reacts violently |

(a) What is the order of reactivity of these metals?

(1)

| | most reactive → | | | least reactive |
|---|---|---|---|---|
| ☐ A | W | X | Y | Z |
| ☐ B | Z | X | Y | W |
| ☐ C | W | Y | X | Z |
| ☐ D | Z | Y | X | W |

3 A student does these two tests on a solution made from a white solid.

- flame test
- add acidified silver nitrate solution

The table shows his results.

| Test | Result |
|---|---|
| flame test | red flame |
| add acidified silver nitrate solution | cream precipitate |

(a) Give the formula of the ion that produces the red flame.

(1)

.....

(b) Name the cream precipitate.

(1)

.....

(c) Identify the white solid.

(1)

.....

(d) The student uses a clean metal wire in the flame test.

(i) State why the wire should be clean when used in the flame test.

(1)

.....

.....

(ii) The table lists properties of some metals.

Add ticks (✓) to the table to show the two properties needed in a metal wire used in a flame test.

(2)

| Property | |
|---|---|
| good conductor of electricity | |
| high density | |
| high melting point | |
| unreactive | |

**2** The table gives some information about the halogens, chlorine, bromine and iodine.

| Halogen | Physical state at room temperature | Colour |
|---|---|---|
| chlorine | gas | pale green |
| bromine | | red-brown |
| iodine | solid | |

(a) Complete the table.

**(2)**

(b) Chlorine has two isotopes of mass numbers 35 and 37

The relative percentage of each isotope in a sample of chlorine is

chlorine-35 77.78% chlorine-37 22.22%

Calculate the relative atomic mass of this sample of chlorine.

Give your answer to one decimal place.

**(3)**

relative atomic mass = .....

(c) A student is given an aqueous solution of chlorine and an aqueous solution of potassium bromide.

Explain how he can use these two solutions to compare the reactivity of chlorine with the reactivity of bromine.

**(4)**

**Activity 2**

**Assigning Command words to AOs**

Your pack contains a list of command words used in International GCSE question papers.

- Draw a table with 3 columns: one for each AO.
- Place the command words into the columns, to show which command words can commonly be used to assess that AO

The following table lists the command words used in the external assessments.

| Command word | Definition |
|---|---|
| Add/Label | Requires the addition or labelling of a stimulus material given in the question, for example labelling a diagram or adding units to a table. |
| Calculate | Obtain a numerical answer, showing relevant working. |
| Comment on | Requires the synthesis of a number of variables from data/information to form a judgement. |
| Complete | Requires the completion of a table/diagram. |
| Deduce | Draw/reach conclusion(s) from the information provided. |
| Describe | To give an account of something. Statements in the response need to be developed, as they are often linked but **do not** need to include a justification or reason. |
| Determine | The answer must have an element that is quantitative from the stimulus provided, or must show how the answer can be reached quantitatively. To gain maximum marks, there must be a quantitative element to the answer. |
| Design | Plan or invent a procedure from existing principles/ideas. |
| Discuss | • Identify the issue/situation/problem/argument that is being assessed within the question.<br>• Explore all aspects of an issue/situation/problem/argument.<br>• Investigate the issue/situation etc. by reasoning or argument. |
| Draw | Produce a diagram either using a ruler or freehand. |
| Estimate | Find an approximate value, number or quantity from a diagram/given data or through a calculation. |
| Evaluate | Review information (e.g. data, methods) then bring it together to form a conclusion, drawing on evidence including strengths, weaknesses, alternative actions, relevant data or information. Come to a supported judgement of a subject's quality and relate it to its context. |
| Explain | An explanation requires a justification/exemplification of a point. The answer must contain some element of reasoning/justification – this can include mathematical explanations. |
| Give/State/Name | All of these command words are really synonyms. They generally all require recall of one or more pieces of information. |
| Give a reason/reasons | When a statement has been made and the requirement is only to give the reason(s) why. |
| Identify | Usually requires some key information to be selected from a given stimulus/resource. |

| Command word | Definition |
|---|---|
| Justify | Give evidence to support (either the statement given in the question or an earlier answer). |
| Plot | Produce a graph by marking points accurately on a grid from data that is provided and then draw a line of best fit through these points. A suitable scale and appropriately labelled axes must be included if these are not provided in the question. |
| Predict | Give an expected result. |
| Show that | Verify the statement given in the question. |
| Sketch | Produce a freehand drawing. For a graph, this would need a line and labelled axes with important features indicated. The axes are not scaled. |
| State what is meant by | When the meaning of a term is expected but there are different ways for how these can be described. |
| Suggest | Use your knowledge to propose a solution to a problem in a novel context. |
| **Verb preceding a command word** | |
| Analyse the data/graph to explain | Examine the data/graph in detail to provide an explanation. |
| **Multiple choice questions** | |
| What, Why | Direct command words used for multiple-choice questions. |

**Activity 3**
**AO2 in exams**

Your pack contains questions from May/June 2019 Papers 1C and 2C, with mark schemes and student answers.

- Mark the questions using the scheme provided.

# ACTIVITY 3a – AO2 in Exams

## Paper 2C, Q2(b)

(b) Chlorine has two isotopes of mass numbers 35 and 37

The relative percentage of each isotope in a sample of chlorine is

chlorine-35 77.78% chlorine-37 22.22%

Calculate the relative atomic mass of this sample of chlorine.

Give your answer to one decimal place.

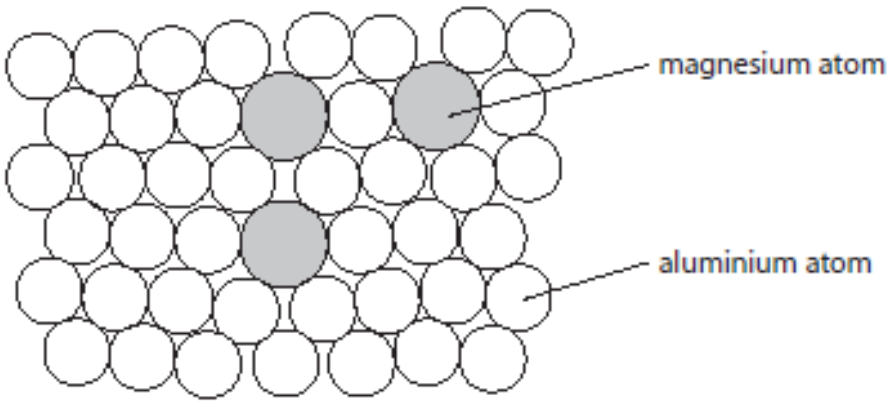
(3)

| | | | |
|---|---|---|---|
| (b) | **M1** (35 × 77.78) + (37 × 22.22)<br>**OR** 3544.44<br><br>**M2** 3544.44 ÷ 100 **OR** 35.4444 OR **M1** ÷ 100<br><br>**M3** 35.4 | (35 × 0.7778) + (37 × 0.2222)<br>**OR**<br>35.4444/35.444/35.44 with no working scores 2<br><br>35.4 with no working scores 3<br><br>M3 can be ECF from an incorrect M2 | 3 |

# Paper 2C, Q4(c)(ii)

(c) Magnalium is an alloy of aluminium and magnesium.

The diagram shows how the atoms are arranged in this alloy.



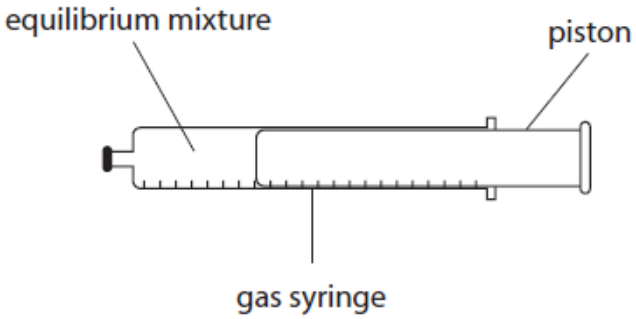

(ii) Explain why magnalium is harder than aluminium.

(3)

| Question number | Answer | Additional guidance | Marks |
|---|---|---|---|
| 4 (c) (ii) | An explanation that links together the following three points: | | |
| | **M1** the regular arrangement of atoms is distorted/disrupted OWTTE | **ALLOW** lattice/layers/rows of atoms are disrupted/distorted<br>**ALLOW** lattice/layers/rows of atoms less regular | 3 |
| | **M2** because magnesium atoms are larger than aluminium atoms | **ALLOW** magnesium and aluminium atoms are of different sizes | |
| | **M3** and therefore it is more difficult for the layers to slide over one another | **ALLOW** layers cannot (as easily) slide over one another<br>**IGNORE** references to strength of metallic bonds | |

# Paper 2C, Q7(b)(i)

(b) Some $N_2O_4$ and some $NO_2$ are put into a sealed gas syringe and allowed to form an equilibrium mixture.




This equilibrium mixture is brown.

(i) The pressure of the gas in the syringe is increased by pushing in the piston. The mixture is then allowed to reach a new equilibrium at the same temperature as before.

Explain why the new equilibrium mixture contains less $NO_2$ than the original equilibrium mixture.

**(2)**

| | | | |
|---|---|---|---|
| (b) (i) | An explanation that links together the following two points:<br><br>**M1** (the position of) equilibrium has moved to the left | **ALLOW** (position of) equilibrium has shifted in backwards direction<br><br>**ALLOW** (position of) equilibrium has shifted towards the $N_2O_4$ /reactants (side)<br><br>**ALLOW** increasing pressure shifts (position of) equilibrium in direction that produces fewer moles (of gas)<br><br>**IGNORE** references to Le Chatelier's Principle eg increasing pressure favours the side that has fewer moles of gas / increasing pressure favours the backwards reaction | 2 |
| | **M2** because there are fewer moles/molecules (of gas) on the left | **ALLOW** particles<br>**REJECT** atoms<br><br>**ALLOW** because there are fewer moles of $N_2O_4$ (than $NO_2$)<br>**ALLOW** because there are fewer moles of reactant (than product)<br><br>**ACCEPT** reverse argument | |

# Paper 2C, Q8(b)

(b) (i) Calculate the amount, in moles, of chlorine gas produced.
Assume one mole of chlorine gas occupies 24 000 $cm^3$.

**(2)**

amount of chlorine = ..... mol

(ii) Determine the amount, in moles, of NaClO in 4.00 $cm^3$ of bleach.

**(1)**

amount of NaClO = ..... mol

(iii) Calculate the concentration, in mol/$dm^3$, of the bleach solution.

**(2)**

concentration = ..... mol/$dm^3$

| | | | |
|---|---|---|---|
| (b) (i) | **M1** 60 ÷ 24 000<br>**M2** 0.0025 (mol) | 0.0025 with no working scores 2 marks<br>**REJECT** 0.003 for **M2** | 2 |
| (ii) | 0.0025 **OR** answer to **M2** from (i) | | 1 |
| (iii) | **M1** (0.0025 ÷ 4.00) × 1000<br>**M2** 0.625 (mol/$dm^3$) | Mark CSQ on (b)(ii)<br>**ACCEPT** any number of sig fig except 1 (unless ECF answer is exactly 1 sig fig<br>correct answer with no working throughout (b) scores 2 marks | 2 |

# ACTIVITY 3b – AO2 in Exams – Student Answers

## Paper 2C, Q2(b)

### Student 1

(b) Chlorine has two isotopes of mass numbers 35 and 37

The relative percentage of each isotope in a sample of chlorine is

chlorine-35 77.78% chlorine-37 22.22%

Calculate the relative atomic mass of this sample of chlorine.

Give your answer to one decimal place.

$(35 \times 77.78) + (37 \times 22.22)$ (3)

$= 3544.44$

relative atomic mass = 3544.4

### Student 2

(b) Chlorine has two isotopes of mass numbers 35 and 37

The relative percentage of each isotope in a sample of chlorine is

chlorine-35 77.78% chlorine-37 22.22%

Calculate the relative atomic mass of this sample of chlorine.

Give your answer to one decimal place.

$\left(\frac{77.78}{100} \times 35\right) + \left(\frac{22.22}{100} \times 37\right) = 35.4444$ (3)

relative atomic mass = 35

### Student 3

(b) Chlorine has two isotopes of mass numbers 35 and 37

The relative percentage of each isotope in a sample of chlorine is

chlorine-35 77.78% chlorine-37 22.22%

Calculate the relative atomic mass of this sample of chlorine.

Give your answer to one decimal place.

$(77.85 \times 35) + (22.22 \times 37)$ (3)

$= 3546$

$\div 100 = 35.4689$

relative atomic mass = 35.5

## Paper 2C, Q4c(ii)

### Student 1

(ii) Explain why magnalium is harder than aluminium.

**(3)**

In Magnalium the structure is less uniform as magnesium atoms disrupt ~~the~~ the uniformity of the aluminium atoms. This means the atoms can slide over each other less easily, this means the metal is harder and less soft/malleable.

### Student 2

(ii) Explain why magnalium is harder than aluminium.

**(3)**

Magnalium contains the different sized atoms of Mg and Al, therefore this distorts the layers. This means the layers are unable to slide over each other meaning that ~~they~~ Magnalium is hard and not malleable. Aluminium has the same sized atoms so layers can slide over each other, ~~not~~ making it softer, and malleable.

**(Total for Question 4 = 7 marks)**

### Student 3

(ii) Explain why magnalium is harder than aluminium.

**(3)**

Magnalium is harder than aluminium as its ~~the~~ atoms have different shapes which break up the ~~perfect~~ perfect lattice and make it harder for the layers to slide over each other as they are not uniform in shape making them harder.

## Paper 2C, Q7b(i)

### Student 1

The backwards reaction increases as the pressure in the gas syringe increases. This is because the backwards reaction produces fewer moles of gas which take up less space. So, less ~~moles of~~ $NO_2$ is produced as a result but more $N_2O_4$ is and the position of equilibrium moves to the left.

### Student 2

Increasing the pressure, favours the reaction that produces the least amount of moles. $2NO_2$ has more moles than $N_2O_4$, therefore more $N_2O_4$ is produced and less $NO_2$ is produced.

### Student 3

When the pressure increases, it favours the gas with less moles, so the equilibrium shifts to the left and creates more of the reactants - $N_2O_4$ - and less of the products - $2NO_2$.

### Student 4

$NO_2$ has more moles on side 2 of the reaction. The equilibrium will shift to the left as if the reaction is trying to lower the pressure so there will be less $NO_2$ and more $N_2O_4$ $N_2O_4$ has less moles and therefore less pressure

# Paper 2C, Q8(b)

## Student 1

(b) (i) Calculate the amount, in moles, of chlorine gas produced.
Assume one mole of chlorine gas occupies 24 000 cm³. (2)

moles = volume / 24

24000 ÷ 60 = 24000 / 400

60 / 24000 = 1/400

1 mol = 24 dm³ or 24000 cm³ ) ×0.4

x = 60 cm³

amount of chlorine = 1/400 mol

(ii) Determine the amount, in moles, of NaClO in 4.00 cm³ of bleach. (1)

4.00 / 24000

1/400

amount of NaClO = ..... mol

(iii) Calculate the concentration, in mol/dm³, of the bleach solution. (2)

concentration = moles / volume

0.4 = 100

1 ÷ 400 / 4 ÷ 1000 = 0.625

concentration = 0.625 mol/dm³

## Student 2

(b) (i) Calculate the amount, in moles, of chlorine gas produced.
Assume one mole of chlorine gas occupies 24 000 cm³. (2)

Volume = moles × 24000

60 / 24000 = 0.0025 moles

amount of chlorine = 0.0025 mol

(ii) Determine the amount, in moles, of NaClO in 4.00 cm³ of bleach. (1)

23 + 35.5 + 16 = 74.5 ← RFM

4 / 74.5 = 0.05314... moles.

amount of NaClO = 0.05 mol

(iii) Calculate the concentration, in mol/dm³, of the bleach solution. (2)

4 cm³ = 0.004 dm³

0.05 / 0.004 = 12.5 mol/dm³

concentration = 12.5 mol/dm³

## Student 3

(b) (i) Calculate the amount, in moles, of chlorine gas produced.
Assume one mole of chlorine gas occupies 24 000 cm³. (2)

moles = mass ÷ MR

conc = moles ÷ vol

↳ 24 dm³

~~volume = moles × 24 (cm³ RTP)~~

~~moles = volume ÷ 24~~

~~= 24 000 ÷ 24~~

~~= 1000~~

60.0 cm³ = 0.060 dm³

mol = vol ÷ 24

= 60 ÷ 24

= 2.5

amount of chlorine = ~~1000~~ 2.5 mol

(ii) Determine the amount, in moles, of NaClO in 4.00 cm³ of bleach. (1)

4 ÷ 24 = 0.16666

amount of NaClO = 0.17 mol

(iii) Calculate the concentration, in mol/dm³, of the bleach solution. (2)

conc = mol ÷ volume

= 0.17 ÷ 4/1000

= 42.5

concentration = 42.5 mol/dm³

**Activity 4**
**AO2 exam preparation**

Your pack contains two questions from June 2019 Paper 2C.

- How are these two questions different?
- What advice would you give your students when trying to answer each question?

# ACTIVITY 4 – AO2 Exam Preparation

## Question 1

**6** Some cars in Brazil use ethanol, $C_2H_5OH$, as a fuel instead of petrol.

The ethanol is made by the fermentation of glucose which is obtained from sugar cane.

The sugar is extracted from the sugar cane and then dissolved in water to make a sugar solution.

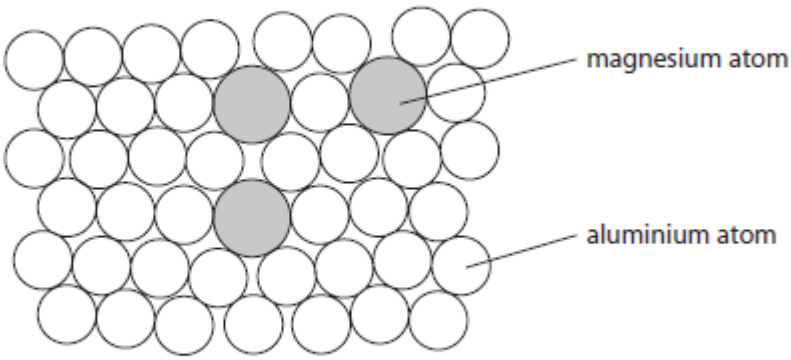
(iii) Explain why fermentation is done in the absence of air.

**(2)**

## Question 2

(c) Magnalium is an alloy of aluminium and magnesium.

The diagram shows how the atoms are arranged in this alloy.




(ii) Explain why magnalium is harder than aluminium.

**(3)**

| | | | |
|---|---|---|---|
| (iii) | An explanation using either of the following linked pairs:<br><br>**M1** oxygen in the air would react with ethanol<br><br>**M2** to form ethanoic acid<br><br>**OR**<br><br>**M1** the fermentation/reaction/respiration needs to be anaerobic<br><br>**M2** ethanol would not be formed /$CO_2$ and $H_2O$ would form | **ACCEPT** ethanol would be oxidised<br><br>**ALLOW** to form carboxylic acid<br>**ALLOW** to form vinegar | 2 |

| | | | |
|---|---|---|---|
| (ii) | An explanation that links together the following three points:<br><br>**M1** the regular arrangement of atoms is distorted/disrupted OWTTE<br><br>**M2** because magnesium atoms are larger than aluminium atoms<br><br>**M3** and therefore it is more difficult for the layers to slide over one another | <br><br>**ALLOW** lattice/layers/rows of atoms are disrupted/distorted<br>**ALLOW** lattice/layers/rows of atoms less regular<br><br>**ALLOW** magnesium and aluminium atoms are of different sizes<br><br>**ALLOW** layers cannot (as easily) slide over one another<br><br>**IGNORE** references to strength of metallic bonds | 3 |

**Activity 5**
**AO3 in exams**

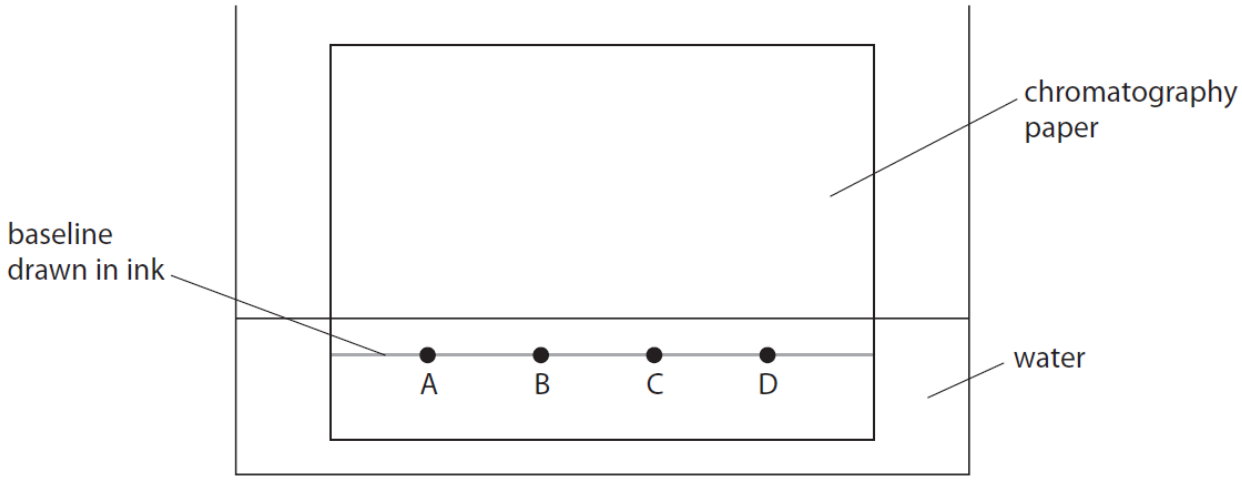
Your pack contains two questions from this May/June 2019 papers 1C and 2C, with mark schemes and student answers.

- Mark the questions using the scheme provided.
- Are students showing understanding of what they did in practical lessons?

# ACTIVITY 5a – AO3 in Exams

## Paper 1C, Q4(a)

**4** A student uses this apparatus to investigate the colours in four different inks, A, B, C and D.




(a) Explain two mistakes the student made when setting up his experiment.

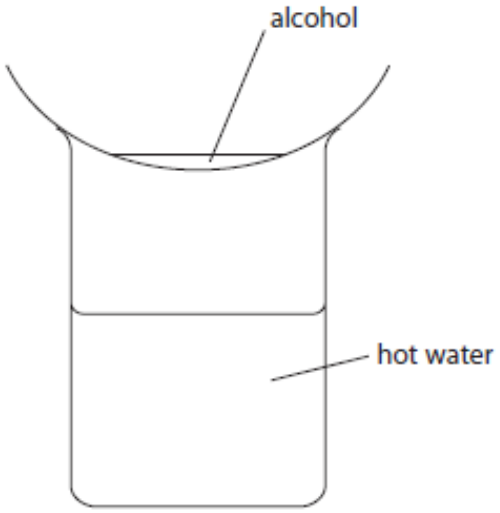
**(4)**

| Question number | Answer | Notes | Marks |
|---|---|---|---|
| 4 a | Explanations that link together the following two pairs of points:<br><br>**M1** baseline has been drawn in ink<br><br>**M2** and therefore it will interfere with /contaminate the results<br><br>**M3** the water level is above the ink spots<br><br>**M4** and therefore the inks will mix with the water | <br><br>**ACCEPT** not drawn in pencil<br><br>**ACCEPT** will produce other colours/will move up the paper/will get mixed up with the ink samples<br><br>**ALLOW** pencil will not interfere with the results/ pencil will not dissolve<br><br>**ACCEPT** too high/above the baseline<br><br>**ACCEPT** the spots are under water<br><br>**ACCEPT** the inks will dissolve in the water / the inks will wash off the paper | **4** |

# Paper 2C, Q3(c)(i), (ii) & (iii)

**3** Methanol, ethanol, propanol and butanol are alcohols. They are all liquids that evaporate easily when warmed.

A student uses this apparatus to compare the time taken for the four liquids to evaporate.




She uses this method.

- pour some methanol into an evaporating basin
- place the evaporating basin on top of a beaker containing hot water
- measure the time taken for the methanol to evaporate completely
- repeat the experiment with each of the other alcohols, using the same apparatus

(c) The table shows the results of experiments done by four students, A, B, C and D.

| Alcohol | Formula of alcohol | Time taken for liquid to evaporate in s | | | | |
|---|---|---|---|---|---|---|
| | | Student A | Student B | Student C | Student D | Mean time in s |
| methanol | $CH_3OH$ | 20 | 24 | 22 | 26 | 23 |
| ethanol | $C_2H_5OH$ | 32 | 34 | 35 | 30 | 33 |
| propanol | $C_3H_7OH$ | 45 | 47 | 50 | 48 | 48 |
| butanol | $C_4H_9OH$ | 64 | 63 | 90 | 60 | |

(i) Calculate the mean (average) time for butanol to evaporate.

(2)

(ii) Explain how the results show which alcohol evaporates most easily.

(2)

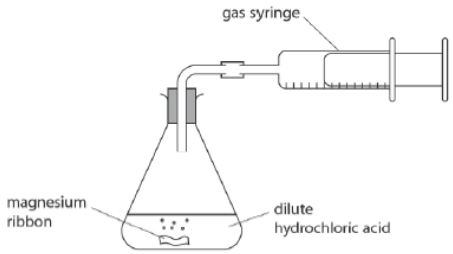
(iii) State the relationship between the number of carbon atoms in the molecule and how easily the alcohol evaporates.

(2)

| Question number | Answer | Additional guidance | Marks |
|---|---|---|---|
| 3 (c) (i) | **M1** (64 + 63 + 60) ÷3<br><br>**M2 =** 62 | <br><br>**ALLOW** 62.3<br><br>62/62.3 with no working scores 2<br><br>**ALLOW** 69/69.25/69.3 for 1 mark | 2 |
| (ii) | An explanation including the following two points:<br><br>**M1** methanol/$CH_3OH$ (evaporates most easily)<br><br>**M2** because the time taken is the shortest | <br><br><br><br>**ACCEPT** because has lowest (mean) time | 2 |
| (iii) | **M1** as the number of carbon atoms increases<br><br>**M2** the ease of evaporation decreases/the less easily the alcohol evaporates | <br><br>**ALLOW** the less volatile the alcohol<br><br>**IGNORE** the slower the alcohol evaporates<br>**IGNORE** references to time taken<br><br>**ALLOW** correct reverse argument | 2 |

# Paper 1C, Q13(a) & (b)

**13** A student uses this apparatus to investigate the rate of reaction between magnesium and an **excess** of dilute hydrochloric acid.




She uses this method.

- use a graduated beaker to pour 50 $cm^3$ of dilute hydrochloric acid of concentration 2.00 $mol/dm^3$ into the conical flask
- add a piece of magnesium ribbon of mass 0.086 g to the acid and put the bung into the neck of the flask
- measure the total volume of gas collected every ten seconds until the reaction stops

The table shows the student's results.

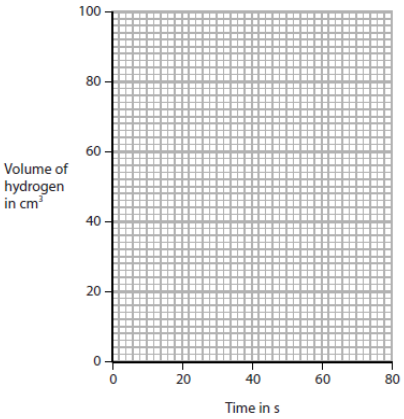
| Time in s | Volume of hydrogen in $cm^3$ |
|---|---|
| 0 | 0 |
| 10 | 29 |
| 20 | 52 |
| 30 | 67 |
| 40 | 76 |
| 50 | 81 |
| 60 | 84 |
| 70 | 84 |
| 80 | 84 |

(a) (i) Plot the student's results on the grid.

(1)

(ii) Draw a curve of best fit.

(1)




(b) (i) The student repeats the experiment using

- 0.043 g of magnesium ribbon
- 50 $cm^3$ of 2.00 $mol/dm^3$ hydrochloric acid

Draw, on the grid in part (a), the curve you would expect in this experiment.

Label this curve Y.

(2)

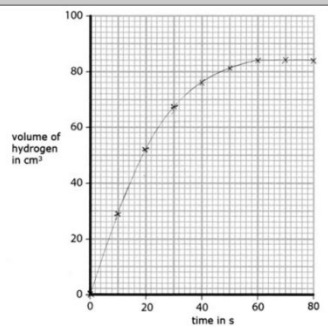
(ii) The student repeats the experiment again, using

- 0.086 g of magnesium ribbon
- 50 $cm^3$ of 2.00 $mol/dm^3$ hydrochloric acid
- a slightly higher temperature than the first experiment

Draw, on the grid in part (a), the curve you would expect in this experiment.

Label this curve Z.

(2)

| Question number | Answer | Notes | Marks |
|---|---|---|---|
| 13 a (i) |   | all points plotted correctly to + or – half a square | 1 |
| (ii) | | curve of best fit drawn for points plotted | 1 |

| Question number | Answer | Notes | Marks |
|---|---|---|---|
| 13 b i | **M1** curve Y starting at origin **and** below original curve<br><br>**M2** levelling off at 42 $cm^3$ to + or – half a square | | 2 |
| ii | **M1** curve Z starting at origin **and** above original curve<br><br>**M2** levelling off at 84 $cm^3$ to + or – half a square | **ACCEPT** curves unlabelled<br><br>If curves labelled incorrectly then deduct 1 mark | 2 |

# ACTIVITY 5b – AO3 in Exams – Student Answers

## Paper 1C, Q4(a)

### Student 1

1 The starting level of the four different inks dots is below the water meaning the ink will not mix. To be done correctly they should be 1-2 cm above the waterline

2 The student has drawn the baseline in ink meaning that it will mix with and contaminate the inks that they want to use (A, B, C, D). This line should be drawn in pencil.

### Student 2

1 The student uses ink as the baseline. This is wrong as the ink could smear the ~~chromatography~~ chromatography paper which could make the test invalid

2 The student submerges the four inks into the water. This will ruin the test as the inks will not travel up the paper properly. The student should have put the baseline and inks just above the water line.

### Student 3

1 The baseline should not be drawn in ink it should be drawn in pencil as it will interfere with the results.

2 There should be a cover on top of the apparatus.

# Paper 2C, Q3(c)

## Student 1 (c)(i)

(c) The table shows the results of experiments done by four students, A, B, C and D.

| Alcohol | Formula of alcohol | Time taken for liquid to evaporate in s | | | | |
|---|---|---|---|---|---|---|
| | | Student A | Student B | Student C | Student D | Mean time in s |
| methanol | $CH_3OH$ | 20 | 24 | 22 | 26 | 23 |
| ethanol | $C_2H_5OH$ | 32 | 34 | 35 | 30 | 33 |
| propanol | $C_3H_7OH$ | 45 | 47 | 50 | 48 | 48 |
| butanol | $C_4H_9OH$ | 64 | 63 | 90 | 60 | |

(i) Calculate the mean (average) time for butanol to evaporate.

$\frac{64+63+90+60}{4} = 69.23$

$\frac{63+64+60}{3} = 62.3$ (2)

Without anomaly

mean time = 69.25 s

## Student 2 (c)(i)

(c) The table shows the results of experiments done by four students, A, B, C and D.

| Alcohol | Formula of alcohol | Time taken for liquid to evaporate in s | | | | |
|---|---|---|---|---|---|---|
| | | Student A | Student B | Student C | Student D | Mean time in s |
| methanol | $CH_3OH$ | 20 | 24 | 22 | 26 | 23 |
| ethanol | $C_2H_5OH$ | 32 | 34 | 35 | 30 | 33 |
| propanol | $C_3H_7OH$ | 45 | 47 | 50 | 48 | 48 |
| butanol | $C_4H_9OH$ | 64 | 63 | 90 | 60 | |

(i) Calculate the mean (average) time for butanol to evaporate.

(2)

mean time = 62 s

## Student 3 (c)(i)

(c) The table shows the results of experiments done by four students, A, B, C and D.

| Alcohol | Formula of alcohol | Time taken for liquid to evaporate in s | | | | |
|---|---|---|---|---|---|---|
| | | Student A | Student B | Student C | Student D | Mean time in s |
| methanol | $CH_3OH$ | 20 | 24 | 22 | 26 | 23 |
| ethanol | $C_2H_5OH$ | 32 | 34 | 35 | 30 | 33 |
| propanol | $C_3H_7OH$ | 45 | 47 | 50 | 48 | 48 |
| butanol | $C_4H_9OH$ | 64 | 63 | 90 | 60 | |

(i) Calculate the mean (average) time for butanol to evaporate.

(2)

$\frac{64 + 63 + 90 + 60}{4} = 69.25$

$\frac{64 + 63 + 60}{3} = 62.3$. anomaly. 4. Remove the

mean time = 62.3 ~~69.25~~ s

## Student 1 (c)(ii)

Methanol evaporates most easily because it's mean time taken to evaporate is the ~~smallest~~ lowest out of all the alcohols.

## Student 2 (c)(ii)

The results show that methanol evaporates most easily

## Student 3 (c)(ii)

The results show that Methanol evaporates the easiest because it takes less time on average to evaporate compared to Butanol which takes the longest.

## Student 1 (c)(iii)

The fewer carbon atoms, the quicker the reaction. More carbon atoms makes evaporation slower.

**Student 2 (c)(iii)**

The more carbon atoms in a molecule, the longer it takes for the alcohol to evaporate. ~~A~~ ~~smell~~ A less number of carbon atoms, the ~~alcohol~~ alcohol evaporates more easily.

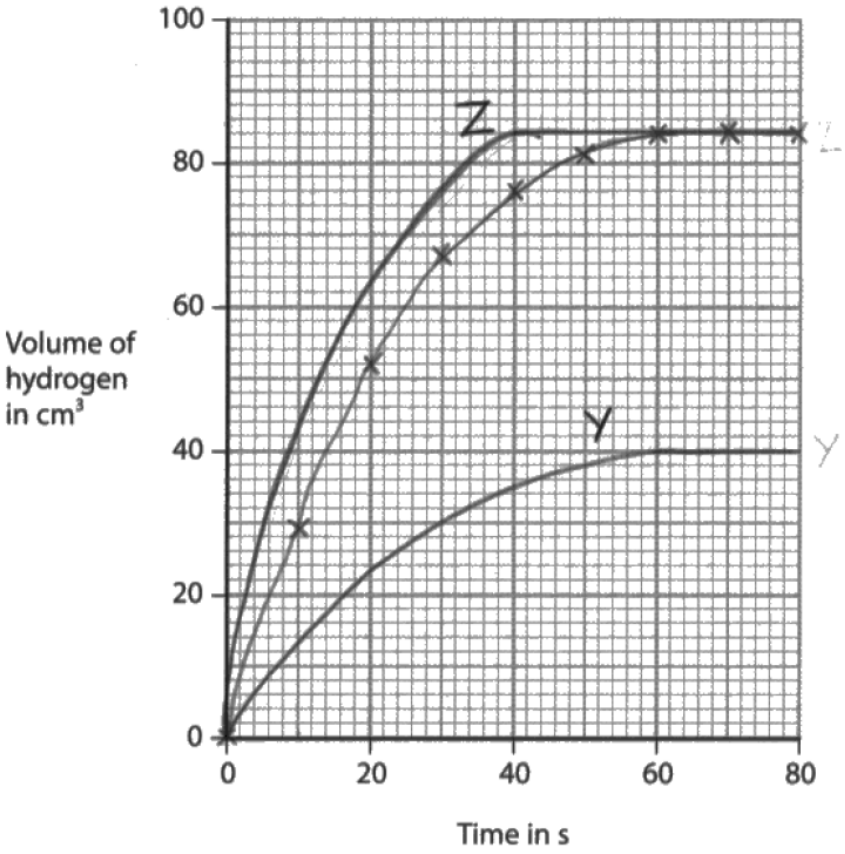
**Student 3 (c)(iii)**

The greater the number of carbon atoms in the molecule, the longer the alcohol takes to ~~evaporate~~ evaporate and so the less easily it evaporates. For example, methanol (which only has one carbon atom) takes an average of 23 seconds to evaporate compared to propanol (which has three carbon atoms) which takes an average of 48 seconds to completely evaporate.

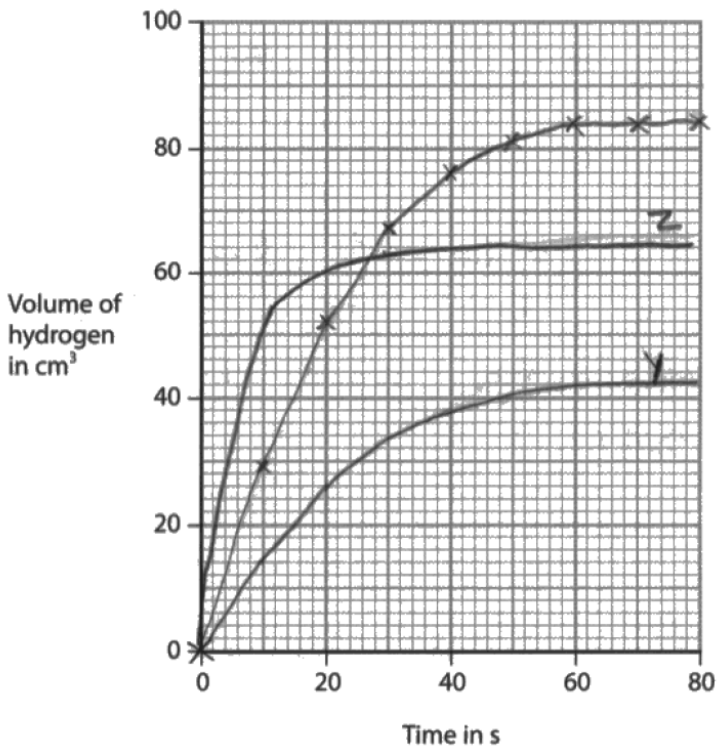
**(Total for Question 3 = 9 marks)**

# Paper 1C, Q12(a) & (b)

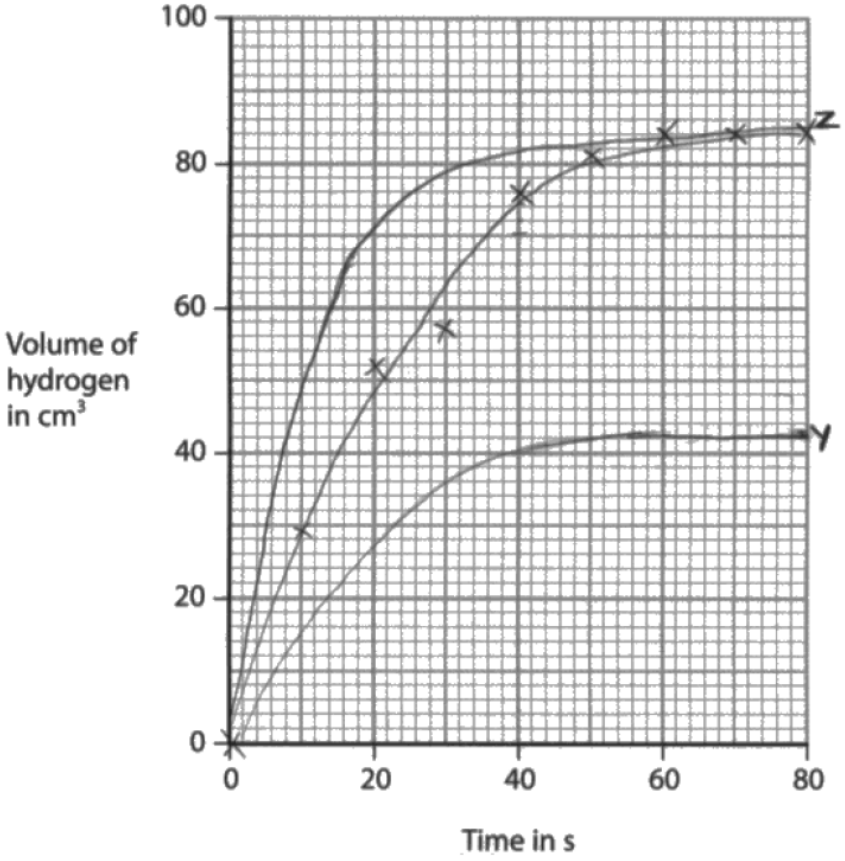
## Student 1



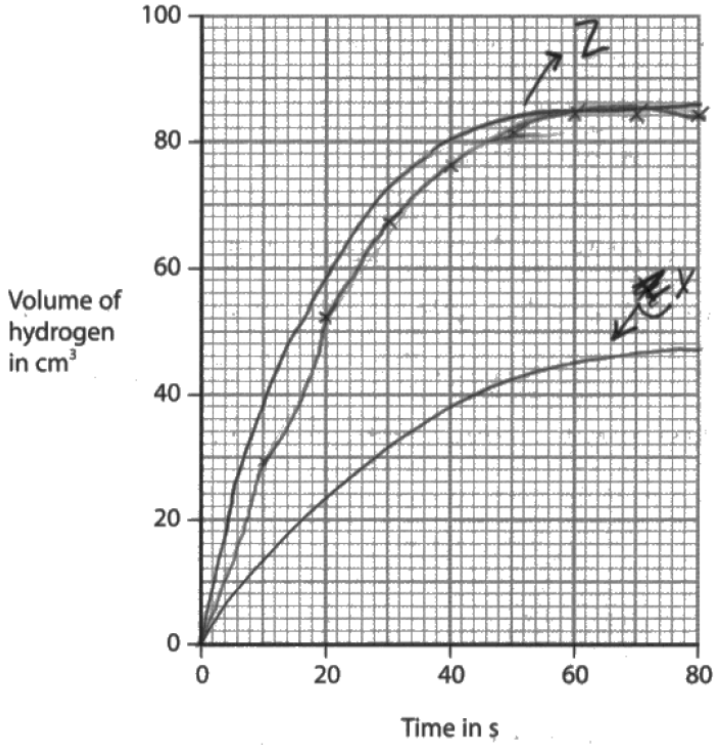

## Student 2



## Student 3




## Student 4



**Activity 6**
**Questions for practicals**

Your pack has a list of Core Practicals.

- Select one Core Practical from the list: it should ideally be one that your students actually do
- What questions would you ask your students as they do this practical?
- What homework would you set?

# ACTIVITY 6 – Core Practicals

## Chemistry

| | |
|---|---|
| **1.7C** | **Investigate solubility of a solid in water at a specific temperature** |
| 1.13 | investigate paper chromatography using inks/food colourings |
| 1.36 | know how to determine the formula of a metal oxide by combustion (e.g. magnesium oxide) or by reduction (e.g. copper(II) oxide) |
| **1.60C** | **Investigate the electrolysis of aqueous solutions** |
| 2.14 | determine the approximate percentage by volume of oxygen in air using a metal or a non-metal |
| 2.21 | investigate reactions between dilute hydrochloric and sulfuric acids and metals (e.g. magnesium, zinc and iron) |
| 2.42 | prepare a sample of pure, dry hydrated copper(II) sulfate crystals starting from copper(II) oxide |
| **2.43C** | **Prepare a sample of pure, dry lead(II) sulfate** |
| 3.8 | investigate temperature changes accompanying some of the following types of change: salts dissolving in water; neutralisation reactions; displacement reactions; combustion reactions. |
| 3.15 | investigate the effect of changing the surface area of marble chips and of changing the concentration of hydrochloric acid on the rate of reaction between marble chips and dilute hydrochloric acid |
| 3.16 | investigate the effect of different solids on the catalytic decomposition of hydrogen peroxide solution |
| **4.43C** | **Prepare a sample of an ester such as ethyl ethanoate** |

## PERSONAL LEARNING

**Things to do:**

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- 
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