Please check the examination details below before entering your candidate information

| Candidate surname | Other names |
|---|---|

Centre Number | Candidate Number

# Pearson Edexcel Level 1/Level 2 GCSE (9–1)

## Friday 13 June 2025

Morning (Time: 1 hour 45 minutes)

Paper reference **1CH0/2F**

# Chemistry

## PAPER 2

**Foundation Tier**

**You must have:**
Calculator, ruler, Periodic Table (enclosed)

Total Marks

## Instructions

- Use **black** ink or ball-point pen.
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- Answer **all** questions.
- Answer the questions in the spaces provided – *there may be more space than you need.*
- Calculators may be used.
- Any diagrams may NOT be accurately drawn, unless otherwise indicated.
- You must **show all your working out** with **your answer clearly identified** at the **end of your solution**.

## Information

- The total mark for this paper is 100.
- The marks for **each** question are shown in brackets – *use this as a guide as to how much time to spend on each question.*
- In questions marked with an **asterisk** (*), marks will be awarded for your ability to structure your answer logically, showing how the points that you make are related or follow on from each other where appropriate.

## Advice

- Read each question carefully before you start to answer it.
- Try to answer every question.
- Check your answers if you have time at the end.

*Turn over* ▶

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**Answer ALL questions. Write your answers in the spaces provided.**

**Some questions must be answered with a cross in a box ☒. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.**

**1** The elements in group 7 of the periodic table are called the halogens.

(a) Give the symbol of the element astatine.

Use the periodic table to help you.

**(1)**

.....

(b) (i) What is the colour of chlorine gas at room temperature?

**(1)**

☒ **A** yellow-green

☒ **B** red-brown

☒ **C** purple

☒ **D** black

(ii) Damp blue litmus paper can be used to test for chlorine gas.

Use words from the box to complete the sentences.

**(2)**

| | | | | |
|---|---|---|---|---|
| blue | orange | red | white | yellow |

When damp blue litmus paper is added to chlorine gas there are **two** colour changes.

The damp blue litmus paper changes from blue to ..... .

The colour of the litmus paper then changes to ..... .

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(c) Figure 1 shows the atomic number and boiling point of some of the halogens.

| halogen | atomic number | boiling point in °C |
|---|---|---|
| fluorine | 9 | –188 |
| chlorine | 17 | –35 |
| bromine | 35 | 59 |
| iodine | 53 | |

**Figure 1**

(i) Describe the trend in the boiling points of the first three halogens in Figure 1.

**(2)**

.....

.....

(ii) Using the information in Figure 1, predict the boiling point of iodine.

Write your prediction on the answer line below.

**(1)**

boiling point of iodine = ..... °C

**(Total for Question 1 = 7 marks)**

**2** (a) Flame tests can be used to identify some metal ions.

Draw **one** straight line from each flame colour to the metal ion that produces that flame colour.

**(3)**

| **flame colour** | **metal ion** |
|---|---|
| lilac | calcium, $Ca^{2+}$ |
| | copper, $Cu^{2+}$ |
| orange-red | lithium, $Li^{+}$ |
| | potassium, $K^{+}$ |
| red | sodium, $Na^{+}$ |

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(b) When potassium hydroxide solution is added to copper chloride solution, a precipitate of copper hydroxide and a solution of potassium chloride are formed.

(i) Write the word equation for this reaction.

**(2)**

.....  .....

→

.....  .....

(ii) Copper hydroxide contains copper ions, $Cu^{2+}$.

What colour is copper hydroxide?

**(1)**

☒ **A** yellow

☒ **B** red-brown

☒ **C** green

☒ **D** blue

(iii) The formula of potassium chloride is KCl.

Give the number of ions in the formula KCl.

**(1)**

.....

**(Total for Question 2 = 7 marks)**

**3** A student investigates the temperature change when 10 g of solid magnesium chloride is dissolved in 100 $cm^3$ of water.

Figure 2 shows the apparatus the student uses.

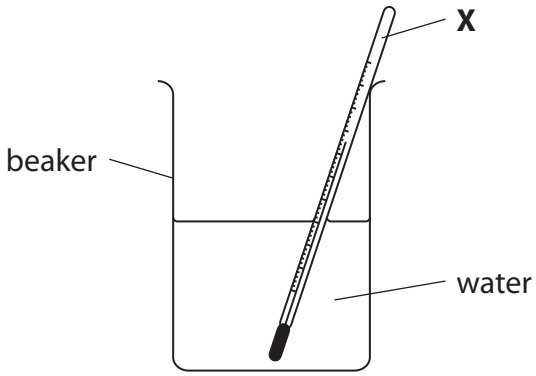



**Figure 2**

(a) Name the piece of apparatus labelled **X** in Figure 2.

**(1)**

.....

(b) The student carries out the following steps

**step 1** measure the initial temperature of the water in the beaker

**step 2** add the magnesium chloride

**step 3** stir the mixture

**step 4** record the new temperature.

(i) State why the mixture is stirred in step 3.

**(1)**

.....

.....

(ii) State **two** ways the apparatus could be changed to reduce the heat energy lost during the investigation.

**(2)**

1 .....

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2 .....

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(iii) The student carries out the experiment three times.

Figure 3 shows the results.

| initial temperature of water in °C | temperature of mixture after stirring in °C | temperature change in °C |
|---|---|---|
| 20.0 | 33.5 | +13.5 |
| 20.0 | 32.8 | +12.8 |
| 20.0 | 33.9 | +13.9 |

**Figure 3**

Calculate the mean temperature change for this investigation.

**(2)**

.....

.....

mean temperature change = ..... °C

(iv) Explain, using the information in Figure 3, the type of reaction that occurs when magnesium chloride dissolves in water.

**(2)**

.....

.....

.....

.....

**(Total for Question 3 = 8 marks)**

**4** Figure 4 shows the structure of molecules of three compounds, **A**, **B** and **C**.

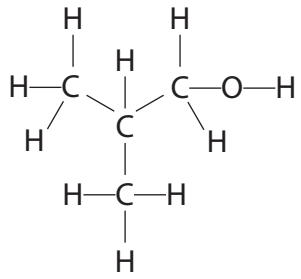
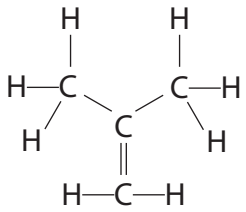
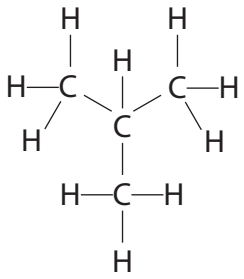
| compound A | compound B | compound C |
|---|---|---|
|  |  |  |

**Figure 4**

(a) (i) Explain which compound, **A**, **B** or **C**, is an alkene.

**(2)**

.....

.....

(ii) What is the empirical formula of compound **B**?

**(1)**

- ☒ **A** $CH_3C(CH_2)CH_3$
- ☒ **B** $C_4H_8$
- ☒ **C** $CH_4$
- ☒ **D** $CH_2$

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(b) The test to distinguish between compounds **B** and **C** involves shaking separate samples of each compound with an orange solution.

The label on the orange solution is shown in Figure 5.




**Figure 5**

(i) State the meaning of the hazard symbol shown.

**(1)**

.....

(ii) Name the orange solution used to distinguish between compounds **B** and **C**.

**(1)**

.....

(iii) What is the final appearance of the mixture when compound **B** is shaken with a few drops of the orange solution?

**(1)**

☒ **A** colourless

☒ **B** green

☒ **C** purple

☒ **D** red

(c) The molecular formula of compound **A** is $C_4H_{10}O$.

A sample of compound **A** undergoes complete combustion to form carbon dioxide and water.

$$C_4H_{10}O + 6O_2 \rightarrow 4CO_2 + 5H_2O$$

(i) Explain why this reaction is an oxidation reaction.

**(2)**

.....

.....

.....

.....

(ii) Calculate the mass of water formed from the complete combustion of 74 g of compound **A**, $C_4H_{10}O$.

$$C_4H_{10}O + 6O_2 \rightarrow 4CO_2 + 5H_2O$$

(relative formula masses: $C_4H_{10}O = 74$, $H_2O = 18$)

**(2)**

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mass of water formed = ..... g

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

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**5** (a) Which gas made up the greatest proportion of the Earth's **early** atmosphere?

**(1)**

- ☒ **A** oxygen
- ☒ **B** nitrogen
- ☒ **C** carbon dioxide
- ☒ **D** argon

(b) Figure 6 shows the composition by volume of the Earth's atmosphere **today**.

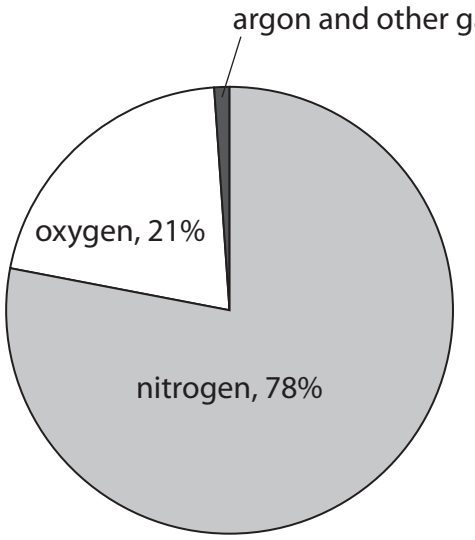



**Figure 6**

(i) Give the name of the gas in Earth's atmosphere today that makes up the largest proportion.

**(1)**

.....

(ii) Using the information in Figure 6, calculate the percentage of argon and other gases in the Earth's atmosphere today.

**(1)**

.....

percentage of argon and other gases = .....

(c) The percentage of oxygen in air can be measured using the apparatus shown in Figure 7.

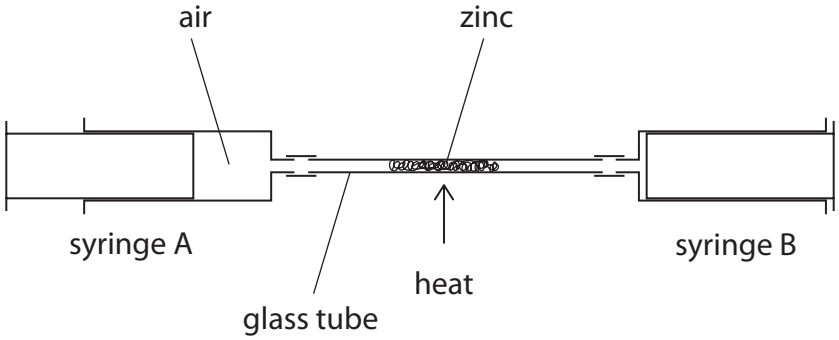



**Figure 7**

The oxygen in the air reacts with the heated zinc.

(i) Explain **one** change that would be seen during the reaction.

**(2)**

.....

.....

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.....

(ii) Name the product formed when the zinc reacts with oxygen in this experiment.

**(1)**

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(d) (i) Figure 8 shows the electron configuration of an argon atom.

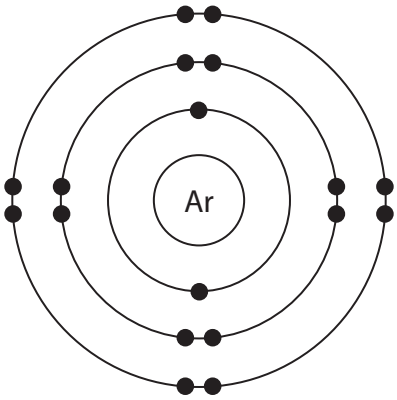



**Figure 8**

State why argon is unreactive.

**(1)**

.....

.....

(ii) Argon makes up 0.93% of the Earth's atmosphere today.

$$\% \text{ gas} = \frac{\text{volume of a gas present in air}}{\text{total volume of air}} \times 100$$

Calculate the volume of argon, in $cm^3$, in 4000 $cm^3$ of air.

**(2)**

.....

.....

.....

volume of argon = ..... $cm^3$

**(Total for Question 5 = 9 marks)**

**6** Lithium is an alkali metal.

(a) (i) State which group of the periodic table contains the alkali metals.

**(1)**

.....

(ii) Which of the following is a property of lithium?

**(1)**

☒ **A** hard

☒ **B** high density

☒ **C** high melting point

☒ **D** malleable

(b) A teacher adds a small piece of lithium to water containing universal indicator.

The universal indicator changes colour.

(i) State the colour change shown by the universal indicator.

**(1)**

from ..... to .....

(ii) Place ticks (✓) in boxes next to **two** observations that are made when lithium reacts with water.

**(2)**

| observations | (✓) |
|---|---|
| a green precipitate forms | |
| effervescence is seen | |
| the lithium sinks in the water | |
| the lithium gets smaller and disappears | |
| the temperature of the solution decreases | |

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(iii) When lithium is added to water, lithium hydroxide and a gas are produced.

What is the name of the gas produced in this reaction?

**(1)**

- ☒ **A** carbon dioxide
- ☒ **B** chlorine
- ☒ **C** hydrogen
- ☒ **D** oxygen

(iv) Lithium hydroxide contains lithium ions, $Li^+$.

Describe how a lithium atom becomes a lithium ion.

**(2)**

(v) Calculate the percentage by mass of hydrogen in lithium hydroxide, LiOH.

$$\% \text{ by mass of element} = \frac{\text{relative atomic mass of element}}{\text{relative formula mass of compound}} \times 100$$

(relative atomic masses: Li = 7, O = 16, H = 1.0)

**(3)**

percentage by mass of hydrogen = .....

**(Total for Question 6 = 11 marks)**

**7** (a) A student heats a known volume of water by burning propanol.

The student investigates the mass of propanol needed to increase the temperature of the water by 50 °C.

Figure 9 shows the apparatus the student uses.

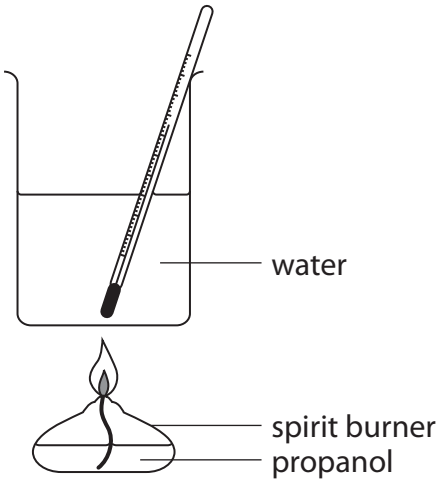



**Figure 9**

(i) The student carries out the investigation using the following six steps.

The steps are **not** shown in the correct order.

**step P** find the final mass of the spirit burner containing propanol

**step Q** measure the initial temperature of the water

**step R** put 100 $cm^3$ water into the beaker

**step S** find the initial mass of the spirit burner containing propanol

**step T** when the temperature of the water has increased by 50 °C extinguish the flame

**step U** place the spirit burner under the beaker of water and light the spirit burner

Write the steps in the correct order.

The first two steps have been completed for you.

**(2)**

| | | | | | |
|---|---|---|---|---|---|
| **R** | **Q** | | | | |

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(ii) State what should be used to find the mass of the spirit burner.

**(1)**

.....

(iii) The student finds that 1.40 g of propanol is needed to increase the temperature of the water by 50 °C.

Calculate the mass of propanol needed to increase the temperature of the water by 1 °C.

**(1)**

.....

.....

mass of propanol = ..... g

(b) Alcohols can be oxidised to produce carboxylic acids.

Propanol can be oxidised to propanoic acid.

Complete Figure 10 by giving the names of the missing compounds.

**(2)**

| name of alcohol | name of carboxylic acid produced |
|---|---|
| ethanol | ..... |
| propanol | propanoic acid |
| ..... | butanoic acid |

**Figure 10**

*(c) Compound **J** is a carboxylic acid and compound **K** is an alcohol.

Figure 11 gives some information about compounds **J** and **K**.

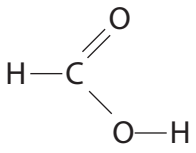
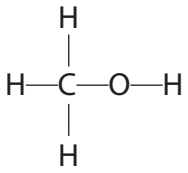
| compound | J | K |
|---|---|---|
| structure of one molecule |  |  |
| state at room temperature | liquid | liquid |
| pH of solution | 3 | 7 |

**Figure 11**

Describe, using Figure 11 and your own knowledge, the similarities and differences between compounds **J** and **K**.

Include information about

- the atoms in each molecule
- the structure and bonding
- the properties of each substance.

**(6)**

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**(Total for Question 7 = 12 marks)**

**8** When solutions **P** and **Q** are mixed together, a purple mixture forms.
This mixture slowly becomes colourless.

(a) A student pours 25 $cm^3$ of solution **P** into a conical flask and then adds 25 $cm^3$ of solution **Q**.

The student uses a beaker to measure out these volumes.

Name a piece of apparatus that could be used to measure these volumes more accurately.

**(1)**

.....

(b) The student investigates this reaction using the apparatus shown in Figure 12.
The student measures the time taken for the cross to become visible.
The experiment is repeated at different temperatures.

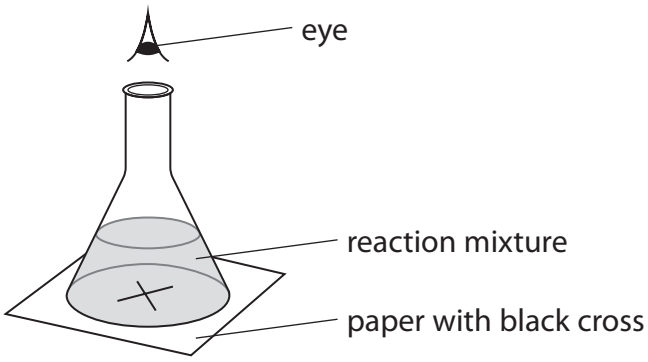



**Figure 12**

Figure 13 shows the results.

| temperature in °C | time in s |
|---|---|
| 20 | 45 |
| 40 | 19 |
| 60 | 10 |

**Figure 13**

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(i) The concentrations of the solutions are kept constant in each experiment.

State **one** other variable that should be kept constant.

**(1)**

.....

.....

(ii) State, and explain in terms of particles, how the time taken for the cross to become visible would change if a temperature of 80 °C was used.

**(3)**

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(c) The concentration of solution **Q** is 26.8 g $dm^{-3}$.

Calculate the mass of solid **Q** present in 25 $cm^3$ of solution **Q**.

$$\text{concentration } (\text{g dm}^{-3}) = \frac{\text{mass of solid (g)}}{\text{volume of solution (dm}^3\text{)}}$$

**(2)**

.....

.....

.....

.....

mass of solid **Q** = ..... g

(d) The student repeats the experiment at 20 °C, with the addition of a catalyst.

Explain how the addition of a catalyst will affect the rate of reaction.

**(2)**

.....

.....

.....

.....

(e) Hydrogen peroxide, $H_2O_2$, decomposes into oxygen and water.

A catalyst can be used to increase the rate of this reaction.

(i) Use a word or phrase from the box to complete the sentence about the mass of the catalyst in a reaction.

**(1)**

| | | |
|---|---|---|
| stays the same | increases | decreases |

During a reaction, the mass of a catalyst ..... .

(ii) Complete the balanced equation for this reaction and add the missing state symbol.

**(2)**

.....$H_2O_2(aq) \rightarrow 2H_2O($.....$) + O_2(g)$

**(Total for Question 8 = 12 marks)**

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**9** Crude oil is a mixture of hydrocarbons.

(a) (i) The majority of hydrocarbons in crude oil belong to one homologous series.

Give the name of this series.

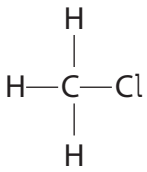
**(1)**

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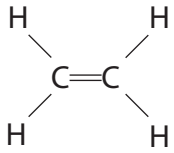
(ii) Which structure represents a molecule of a hydrocarbon?

**(1)**

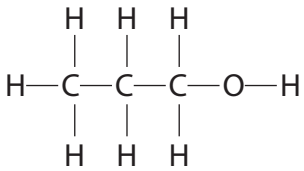
☒ **A**



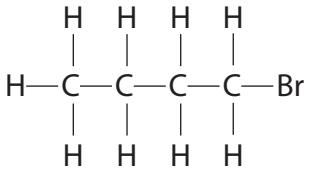
☒ **B**



☒ **C**



☒ **D**



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(b) When hydrocarbons undergo combustion, water is produced.

Draw a dot and cross diagram of a molecule of water.

**(2)**

(c) One compound in crude oil contains 0.96 g of carbon atoms combined with 0.32 g of hydrogen atoms.

Calculate the empirical formula of this compound.

(relative atomic masses: C = 12, H = 1.0)

**(3)**

empirical formula of this compound = .....

*(d) Crude oil is separated into useful products called fractions using fractional distillation.

Figure 14 shows a fractional distillation column and the fractions kerosene and fuel oil.

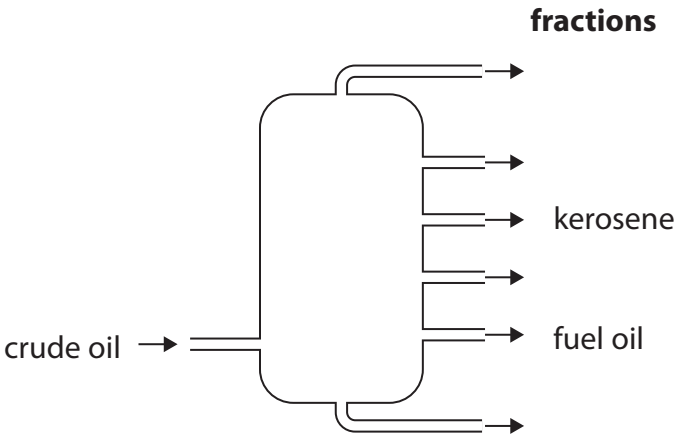



**Figure 14**

Kerosene and fuel oil have different uses depending on their properties.

Describe the properties and uses of kerosene and fuel oil.
Include in your answer

- the difference in boiling point
- the difference in viscosity
- the difference in ease of ignition
- their uses and how fuel oil can be converted into kerosene.

**(6)**

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**(Total for Question 9 = 13 marks)**

**10** Crisp packets are often made from poly(propene) coated with a thin layer of aluminium on the inside.

Poly(propene) is a polymer made from the monomer propene, $CH_2CHCH_3$.

(a) (i) What is the relative formula mass of propene?

(relative atomic masses: C = 12, H = 1)

**(1)**

☒ **A** 9

☒ **B** 39

☒ **C** 42

☒ **D** 75

(ii) Describe how monomer molecules combine to make polymers.

**(2)**

.....

.....

.....

.....

(b) Crisps go stale when exposed to the atmosphere.

In an experiment some crisp packets were made from aluminium, some from poly(propene) and some from poly(propene) coated with aluminium. These packets were tested.

Figure 15 shows the results.

| crisp packet material | relative porosity to water and oxygen | easily recycled? | relative mass | easily torn? |
|---|---|---|---|---|
| aluminium | low | yes | high | yes |
| poly(propene) | high | yes | low | no |
| poly(propene) coated with aluminium | low | no | low | no |

**Figure 15**

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Low porosity is an advantage of using poly(propene) coated with aluminium as it prevents the crisps from becoming damp.

Explain, using Figure 15, **one** other advantage of using poly(propene) coated with aluminium.

**(2)**

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.....

(c) The aluminium coating can be replaced by a very thin layer of material called a nanosheet.

The nanosheet is made from amino acids and is less than 100 nm thick.

(i) Explain why the nanosheet layer would be better than aluminium as a coating for crisp packets.

**(2)**

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.....

.....

(ii) Nanosheet layers can be made from amino acids.

An equation showing a reaction of an amino acid, $C_2H_5NO_2$, is

$$3C_2H_5NO_2 \rightarrow C_6H_{11}N_3O_4 + 2H_2O$$

Calculate the mass of water formed when 105 g of this amino acid reacts.

(relative formula masses: $C_2H_5NO_2 = 75$, $H_2O = 18$)

**(2)**

.....

.....

.....

.....

mass of water = ..... g

(d) Some crisps contain malic acid.

The structure of one molecule of malic acid is shown in Figure 16.

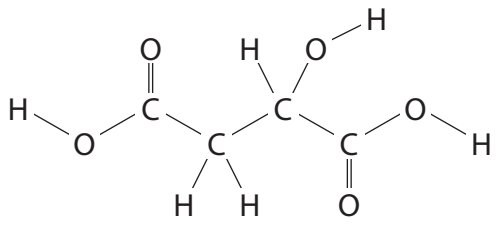



**Figure 16**

(i) Malic acid has two types of functional group.

One type is the –COOH functional group.

Give the name of this functional group.

**(1)**

.....

(ii) Name the other functional group.

**(1)**

.....

**(Total for Question 10 = 11 marks)**

**TOTAL FOR PAPER = 100 MARKS**

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# Pearson Edexcel Level 1/Level 2 GCSE (9–1)

## Friday 13 June 2025

Paper reference **1CH0/2F**

# Chemistry

**PAPER 2**

**Foundation Tier**

**Periodic Table Insert**

**Do not return this Insert with the question paper.**

*Turn over* ▶

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# The periodic table of the elements

| 1 | 2 | | | | | | | | | | | 3 | 4 | 5 | 6 | 7 | 0 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | 1<br>**H**<br>hydrogen<br>1 | | | | | | | | | | 4<br>**He**<br>helium<br>2 |
| 7<br>**Li**<br>lithium<br>3 | 9<br>**Be**<br>beryllium<br>4 | | | | | | | | | | | 11<br>**B**<br>boron<br>5 | 12<br>**C**<br>carbon<br>6 | 14<br>**N**<br>nitrogen<br>7 | 16<br>**O**<br>oxygen<br>8 | 19<br>**F**<br>fluorine<br>9 | 20<br>**Ne**<br>neon<br>10 |
| 23<br>**Na**<br>sodium<br>11 | 24<br>**Mg**<br>magnesium<br>12 | | | | | | | | | | | 27<br>**Al**<br>aluminium<br>13 | 28<br>**Si**<br>silicon<br>14 | 31<br>**P**<br>phosphorus<br>15 | 32<br>**S**<br>sulfur<br>16 | 35.5<br>**Cl**<br>chlorine<br>17 | 40<br>**Ar**<br>argon<br>18 |
| 39<br>**K**<br>potassium<br>19 | 40<br>**Ca**<br>calcium<br>20 | 45<br>**Sc**<br>scandium<br>21 | 48<br>**Ti**<br>titanium<br>22 | 51<br>**V**<br>vanadium<br>23 | 52<br>**Cr**<br>chromium<br>24 | 55<br>**Mn**<br>manganese<br>25 | 56<br>**Fe**<br>iron<br>26 | 59<br>**Co**<br>cobalt<br>27 | 59<br>**Ni**<br>nickel<br>28 | 63.5<br>**Cu**<br>copper<br>29 | 65<br>**Zn**<br>zinc<br>30 | 70<br>**Ga**<br>gallium<br>31 | 73<br>**Ge**<br>germanium<br>32 | 75<br>**As**<br>arsenic<br>33 | 79<br>**Se**<br>selenium<br>34 | 80<br>**Br**<br>bromine<br>35 | 84<br>**Kr**<br>krypton<br>36 |
| 85<br>**Rb**<br>rubidium<br>37 | 88<br>**Sr**<br>strontium<br>38 | 89<br>**Y**<br>yttrium<br>39 | 91<br>**Zr**<br>zirconium<br>40 | 93<br>**Nb**<br>niobium<br>41 | 96<br>**Mo**<br>molybdenum<br>42 | [98]<br>**Tc**<br>technetium<br>43 | 101<br>**Ru**<br>ruthenium<br>44 | 103<br>**Rh**<br>rhodium<br>45 | 106<br>**Pd**<br>palladium<br>46 | 108<br>**Ag**<br>silver<br>47 | 112<br>**Cd**<br>cadmium<br>48 | 115<br>**In**<br>indium<br>49 | 119<br>**Sn**<br>tin<br>50 | 122<br>**Sb**<br>antimony<br>51 | 128<br>**Te**<br>tellurium<br>52 | 127<br>**I**<br>iodine<br>53 | 131<br>**Xe**<br>xenon<br>54 |
| 133<br>**Cs**<br>caesium<br>55 | 137<br>**Ba**<br>barium<br>56 | 139<br>**La***<br>lanthanum<br>57 | 178<br>**Hf**<br>hafnium<br>72 | 181<br>**Ta**<br>tantalum<br>73 | 184<br>**W**<br>tungsten<br>74 | 186<br>**Re**<br>rhenium<br>75 | 190<br>**Os**<br>osmium<br>76 | 192<br>**Ir**<br>iridium<br>77 | 195<br>**Pt**<br>platinum<br>78 | 197<br>**Au**<br>gold<br>79 | 201<br>**Hg**<br>mercury<br>80 | 204<br>**Tl**<br>thallium<br>81 | 207<br>**Pb**<br>lead<br>82 | 209<br>**Bi**<br>bismuth<br>83 | [209]<br>**Po**<br>polonium<br>84 | [210]<br>**At**<br>astatine<br>85 | [222]<br>**Rn**<br>radon<br>86 |

**Key**

relative atomic mass
**atomic symbol**
name
atomic (proton) number

**** The elements with atomic numbers from 58 to 71 are omitted from this part of the periodic table.***

***The relative atomic masses of copper and chlorine have not been rounded to the nearest whole number.***



PMT