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 **1CH0/2H**

Chemistry

PAPER 2

Higher 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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Pearson

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 (a) A student carries out a flame test on a salt.
The student observes a yellow flame.

Which ion is in the salt?

(1)

☒ **A** Ca^{2+}

☒ **B** Cu^{2+}

☒ **C** Na^{+}

☒ **D** Li^{+}

(b) A molecule of a yellow substance is shown in Figure 1.

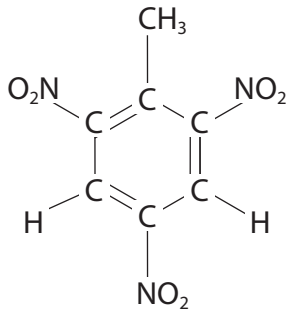

Figure 1

(i) What is the formula of this molecule?

(1)

☒ **A** $C_6H_5(NO_2)_3$

☒ **B** $C_6H_2(CH_3)(3NO_2)$

☒ **C** $C_7H_5N_3O_6$

☒ **D** $C_7H_6N_3O_6$

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(ii) A bottle of this substance is labelled with the hazard symbol in Figure 2.

Figure 2

State the danger associated with the contents of this bottle.

(1)

.....

(c) Yellow bananas emit ethene gas, C_2H_4.

Draw one molecule of ethene, showing all covalent bonds.

(2)

(d) Gold has a yellow colour.

A gold nanosphere has a surface area of 305 nm^2.
The surface area to volume ratio is 1 : 4.60.

Calculate the volume, in nm^3, of the gold nanosphere.

(1)

.....

.....

volume = ... nm^3

(Total for Question 1 = 6 marks)

2 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 3.
The student measures the time taken for the cross to become visible.
The experiment is repeated at different temperatures.

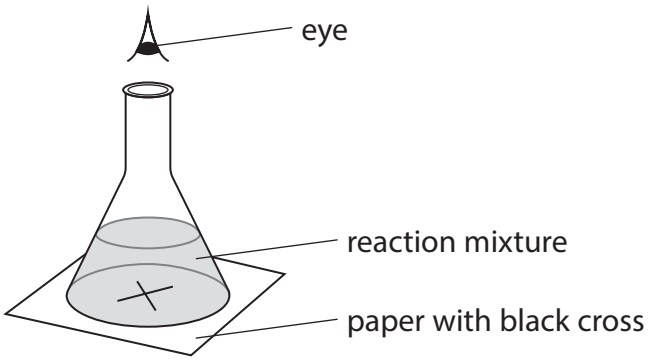

Figure 3

Figure 4 shows the results.

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

Figure 4

(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**.

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

(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)

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(Total for Question 2 = 9 marks)

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3 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.

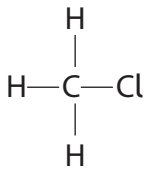
(1)

.....

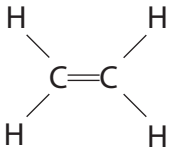
(ii) Which structure represents a molecule of a hydrocarbon?

(1)

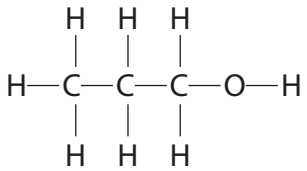
☒ **A**



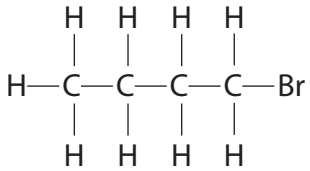
☒ **B**



☒ **C**



☒ **D**



(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 = ...

(Total for Question 3 = 7 marks)

4 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 5 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 5

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

Explain, using Figure 5, **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)

.....

.....

.....

.....

(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)

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mass of water = ... g

(d) Some crisps contain malic acid.

The structure of one molecule of malic acid is shown in Figure 6.

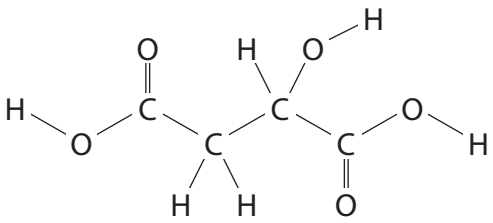

Figure 6

(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 4 = 11 marks)

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5 Group 1 elements are known as the alkali metals.

(a) Which row gives two physical properties of the alkali metals?

(1)

		hardness	melting point
☒	**A**	hard	low
☒	**B**	hard	high
☒	**C**	soft	low
☒	**D**	soft	high

(b) The alkali metals react with water.

(i) A teacher adds a small piece of potassium to water.

Give **two** observations that would be seen.

(2)

(ii) The reaction of lithium with water is much less vigorous than the reaction of potassium with water.

Explain why, in terms of their electronic configurations.

(3)

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(iii) When sodium reacts with water, a solution of sodium hydroxide is formed.

When the solution is left in air, the hydroxide ions react with carbon dioxide, forming carbonate ions, CO_3^{2-}, and one other product.

Complete the ionic equation for this reaction.

(2)

..... OH^- + ... $\rightarrow$ CO_3^{2-} + ...

(c) The relative atomic mass of caesium is 132.905.

Calculate the average mass of one atom of caesium.

(Avogadro constant = 6.02×10^{23})

(2)

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mass = ... g

(Total for Question 5 = 10 marks)

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6 This question is about the noble gas xenon.

(a) Xenon is unreactive.

Explain, in terms of its electronic configuration, why xenon is unreactive.

(2)

(b) Under extreme conditions, xenon can be made to react with fluorine to form xenon tetrafluoride, XeF_4.

(i) Write the balanced equation for this reaction.

(1)

(ii) Some information about xenon tetrafluoride is shown in Figure 7.

colour of solid	melting point in °C	conductor of electricity?
colourless	117	no

Figure 7

State and explain, with reasons, the type of structure and bonding in xenon tetrafluoride.

(3)

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(c) Under extreme conditions, xenon reacts with fluorine to form xenon hexafluoride.

The reaction is exothermic.
The energy change for the reaction is $-400\,kJ\,mol^{-1}$.

On Figure 8

- add a label to the y-axis
- draw the reaction profile for this reaction
- label the energy change and the activation energy for the reaction.

(3)

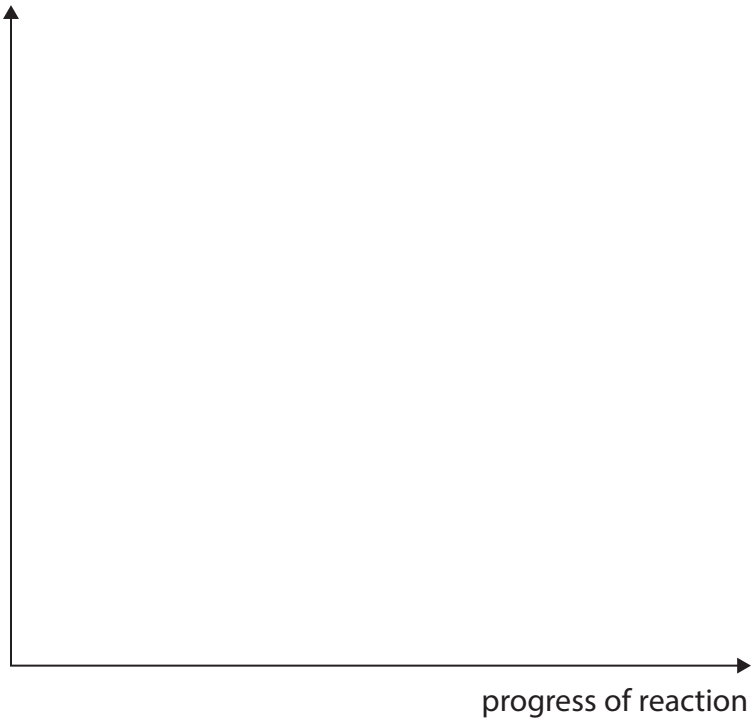

Figure 8

(Total for Question 6 = 9 marks)

7 This question is about carbon and some carbon compounds.

(a) Two forms of pure carbon are graphite and Buckminsterfullerene.

(i) Explain why graphite is used as a lubricant.

(2)

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.....

.....

(ii) Calculate the mass, in kg, of five moles of Buckminsterfullerene, C_{60}.

(relative atomic mass: C = 12)

(2)

.....

.....

.....

mass = ... kg

(b) A molecule in an homologous series has the formula $C_9H_{21}N$.

What is the formula of the next molecule in this homologous series?

(1)

☒ **A** $C_{10}H_{21}N$

☒ **B** $C_{10}H_{23}N$

☒ **C** $C_{10}H_{21}N_2$

☒ **D** $C_{10}H_{23}N_2$

(c) A Bunsen burner burns methane gas, CH_4.

A student investigates the time taken to heat up a beaker of water using this Bunsen burner.

Figure 9 shows the apparatus used.

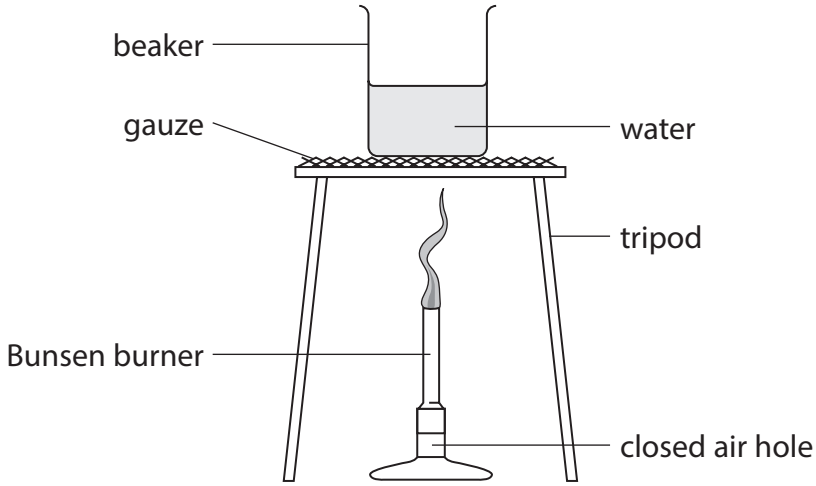

Figure 9

The student sees that a large amount of carbon forms as a black solid on the underside of the gauze.

The teacher said that the investigation would be improved if no carbon forms.

Explain what the student should do to stop carbon forming on the underside of the gauze.

(2)

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*(d) Natural processes and human activities change the amount of carbon dioxide in the atmosphere.

Figure 10 shows the concentration of carbon dioxide in the atmosphere measured in one location and the mean global temperature from 1960 to 2000.

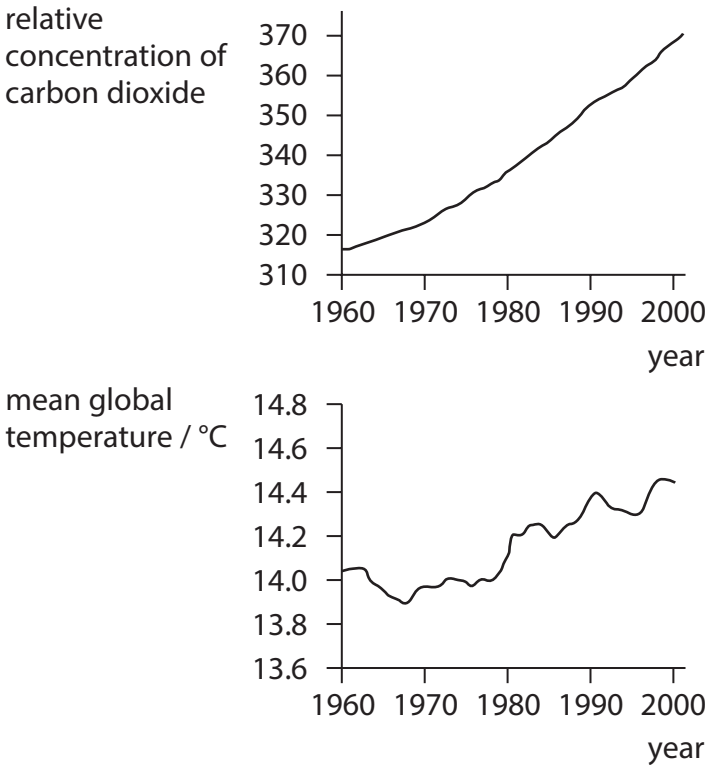

Figure 10

Evaluate whether the data in Figure 10 shows that the change in the amount of carbon dioxide is leading to climate change.

Your answer should include

- the natural processes that change the amount of carbon dioxide in the atmosphere
- the human activities that change the amount of carbon dioxide in the atmosphere
- how carbon dioxide contributes to the greenhouse effect and climate change.

(6)

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(Total for Question 7 = 13 marks)

8 This question is about molecules containing two atoms.

(a) In an experiment, hydrochloric acid is reacted with zinc.

The volume of gas produced is measured by collecting the gas in an upturned measuring cylinder over water.

Give a method of collecting and measuring the gas that would give a more accurate volume of gas.

(1)

(b) Iodine has an atomic number of 53 and a mass number of 127.

How many electrons are there in an iodine molecule, I_2?

(1)

- ☒ **A** 53
- ☒ **B** 106
- ☒ **C** 127
- ☒ **D** 180

(c) Iodine reacts with hydrogen to form hydrogen iodide, HI.

Explain whether or not a solution of hydrogen iodide in water conducts electricity.

(2)

(d) Chlorine gas is bubbled through a colourless solution of potassium bromide, KBr. The mixture turns orange.

(i) Give the name of the substance that causes the orange colour.

(1)

(ii) Write the balanced equation for this reaction.

(3)

(e) Hydrogen iodide reacts with oxygen to form water and iodine.

The equation for this reaction is

$$4HI + O_2 \rightarrow 2H_2O + 2I_2$$

Calculate the energy change for this reaction using the bond energies in Figure 11.

bond	bond energy in kJ mol^{-1}
H—I	299
O═O	495
H—O	464
I—I	151

Figure 11

Include a sign and unit in your answer.

(4)

energy change = ...

(Total for Question 8 = 12 marks)

9 (a) Figure 12 shows the calibration graph of a flame photometer for the concentration of calcium ions in a solution.

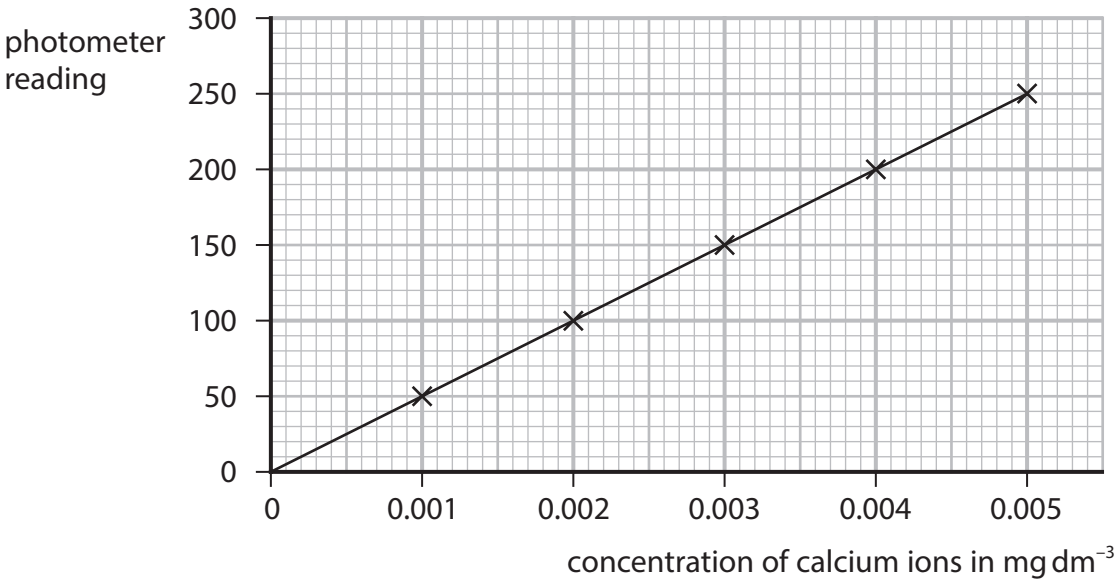

Figure 12

Use Figure 12 to find the concentration of calcium ions when the photometer reading is 175.

(1)

concentration = ... mg dm^{-3}

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(b) A flame photometer was used to measure the concentration of sodium ions in tap water and three types of bottled water.

The results are shown in Figure 13.

type of water	concentration of sodium ions in mg dm^{-3}
tap water	6.47
bottled water A	0.68
bottled water B	0.78
bottled water C	0.41

Figure 13

(i) Calculate the mean concentration of sodium ions in the three **bottled** waters.

(1)

.....

.....

mean concentration = ... mg dm^{-3}

(ii) Calculate the volume of **tap** water, in dm^3, that contains 3 moles of sodium ions.

(relative atomic mass: Na = 23)

(3)

.....

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.....

.....

volume = ... dm^3

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(c) A student is given two test tubes, one containing solid aluminium chloride and the other containing solid calcium chloride.

Describe the test the student should use to show which solid is in which test tube, giving the observation for each compound.

(4)

(d) Silver carbonate and silver bromide are both insoluble solids.

A student tests a solution to see if it contains bromide ions.
The student adds a few drops of silver nitrate solution.
A precipitate forms.

The student repeats the test but adds some dilute nitric acid before adding the silver nitrate solution.
The mixture fizzes and no precipitate forms.

Explain what conclusion the student can draw from these results.

(3)

(Total for Question 9 = 12 marks)

10 (a) Ethanol can be produced by the fermentation of carbohydrates.

(i) What conditions are necessary for fermentation?

(1)

☒ **A** hot temperature, iron catalyst

☒ **B** hot temperature, yeast

☒ **C** warm temperature, iron catalyst

☒ **D** warm temperature, yeast

(ii) A carbohydrate has the formula $C_{12}H_{24}O_{12}$.

Complete the equation for the fermentation of this carbohydrate to make ethanol and carbon dioxide only.

(2)

$C_{12}H_{24}O_{12} \rightarrow$ .....

.....

(b) Ethanol can be oxidised to make ethanoic acid.
One use of ethanoic acid is to make a monomer.

This monomer is polymerised to make the addition polymer PVA, used as a glue.

The structure of the monomer is shown in Figure 14.

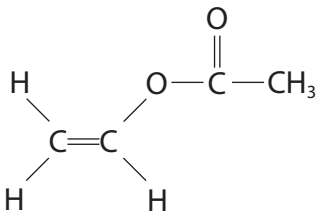

Figure 14

Draw a diagram to show the structure of the repeating unit of PVA.

(2)

*(c) Babies may wear bamboo nappies or disposable nappies.
Both types of nappy absorb liquid.

The bamboo in bamboo nappies comes from a fast growing plant.
A bamboo nappy can be washed and used again many times.
When a bamboo nappy is placed in landfill, it will rot away quickly.

Disposable nappies contain a polymer made using crude oil.
1 g of a typical polymer used in disposable nappies can absorb about 150 g water.
When a disposable nappy is placed in landfill, it may take over 400 years to decompose.

Discuss, using the information given, the advantages and disadvantages of bamboo nappies and disposable nappies.
Include in your answer a brief description of how a nappy could be tested to see how much water it will absorb.

(6)

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(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 1CH0/2H

Chemistry

PAPER 2

Higher Tier

Periodic Table Insert

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Turn over ▶

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Y:1/1/1/1/1/1/1/1/1/1/1/1/1/1/1

P 7 5 5 0 9 R R R A

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The periodic table of the elements

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