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)

Time 1 hour 45 minutes

Paper reference **1CH0/1F**

Chemistry

PAPER 1

Foundation Tier

You must have:
Calculator, ruler

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.
- There is a periodic table on the back cover of the paper.

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 ▶

P69484A

Q:1/1/1/1/1/1/

P 6 9 4 8 4 A 0 1 3 2

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) Figure 1 shows a bag of NPK fertiliser.

Figure 1

N, P and K are the symbols of three elements that are essential for plant growth.

N is the symbol for nitrogen.

Name the other two elements, P and K, that are essential for plant growth.

You may want to refer to the periodic table.

(2)

P .....

K .....

(b) Many fertilisers are produced using ammonia.

Ammonia is produced on an industrial scale from the reaction of nitrogen with hydrogen.

The equation for the reaction is

$$\text{nitrogen} + \text{hydrogen} \rightleftharpoons \text{ammonia}$$

(i) State the name of this industrial process.

(1)

.....

(ii) State the meaning of the ⇌ symbol in the equation.

(1)

.....

(iii) Figure 2 shows the electronic configurations for an atom of nitrogen and an atom of hydrogen.

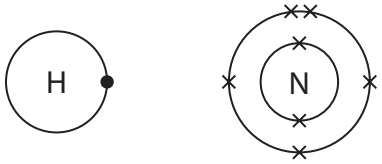
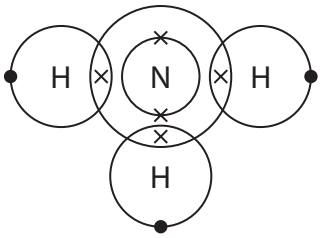


Figure 2

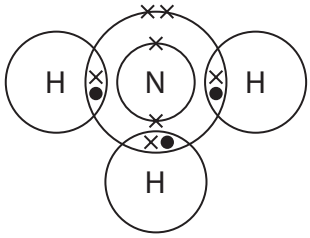
Which dot and cross diagram for ammonia, NH_3, is correct?

(1)

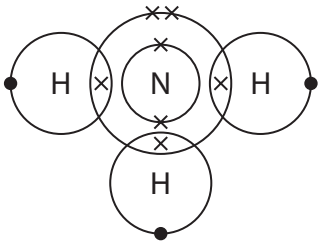
☒ **A**



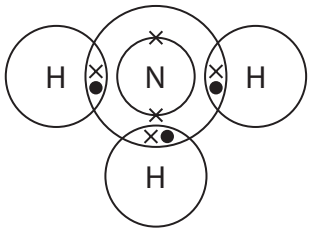
☒ **B**



☒ **C**



☒ **D**



(c) Ammonia reacts with nitric acid to produce ammonium nitrate.

Write the word equation for this reaction.

(2)

..... + ... → .....

(Total for Question 1 = 7 marks)

2 Figure 3 shows a metal spoon and two test tubes being heated in a water bath.

One test tube contains a piece of chocolate, the other some liquid egg white.

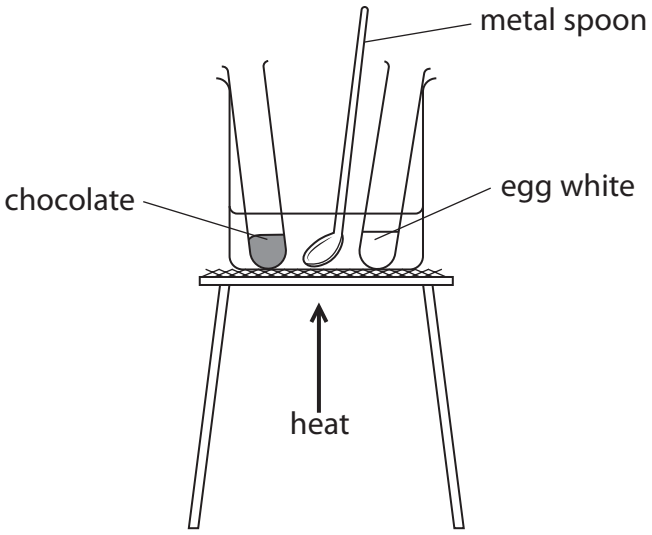


Figure 3

After heating, the spoon, the chocolate and the egg white are allowed to cool to room temperature.

Figure 4 shows the state of the three different substances before heating, when hot and after cooling.

substance	before heating	when hot	after cooling
metal spoon	solid	solid	solid
chocolate	solid	liquid	solid
egg white	liquid	solid	solid

Figure 4

(a) Describe the differences in the arrangement and movement of the particles in a solid and in a liquid.

(2)

difference in arrangement of particles

difference in movement of particles

(b) What name is given to the process when the chocolate changes from a solid to a liquid?

(1)

- ☒ **A** condensing
- ☒ **B** evaporating
- ☒ **C** freezing
- ☒ **D** melting

(c) Give a reason why the metal spoon has not changed state during the experiment.

(1)

(d) Explain how we know the change to the egg white is a chemical change rather than a physical change.

(2)

(Total for Question 2 = 6 marks)

3 Potable water is water that is suitable for drinking.

(a) River water can be treated to make it potable.
Chlorination, filtration and sedimentation are three of the processes involved in making the river water potable.

(i) Which row of the table shows these three processes in the order in which they are carried out?

(1)

		first	second	third
☒	**A**	chlorination	sedimentation	filtration
☒	**B**	chlorination	filtration	sedimentation
☒	**C**	sedimentation	filtration	chlorination
☒	**D**	sedimentation	chlorination	filtration

(ii) State the reason why chlorine is added during the water treatment.

(1)

.....

.....

(iii) Describe how sedimentation is carried out.

(2)

.....

.....

.....

.....

(iv) Figure 5 shows the results of an analysis of a sample of potable water.

ion	concentration in mg dm^{-3}
chloride	60.70
fluoride	0.24
nitrate	24.90
sulfate	71.40
copper	0.05
magnesium	9.10

Figure 5

Using this information, explain why this sample of potable water is not the same as pure water.

(2)

.....

.....

.....

.....

(b) A student wanted to distil a sample of potable water.
Figure 6 shows apparatus the student used.

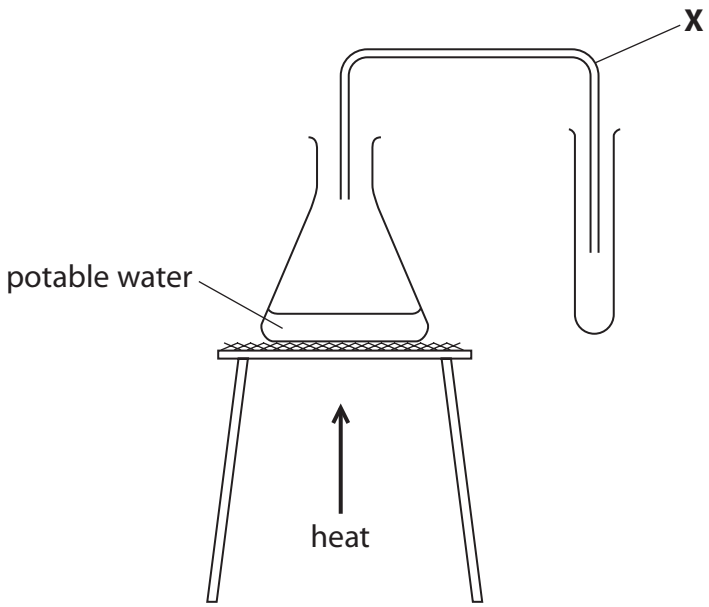


Figure 6

(i) Name the piece of equipment labelled **X** in Figure 6.

(1)

.....

(ii) The student made an error when setting up the equipment in Figure 6.
This error meant no water could be collected in the test tube.

Explain what the student needs to do so water can be collected.

(2)

.....

.....

.....

.....

(Total for Question 3 = 9 marks)

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4 A student wanted to find the volume of dilute hydrochloric acid that would react with 25.0 cm^3 of lithium hydroxide solution.

They used the equipment in Figure 7 to carry out a rough titration and then a further two accurate titrations.

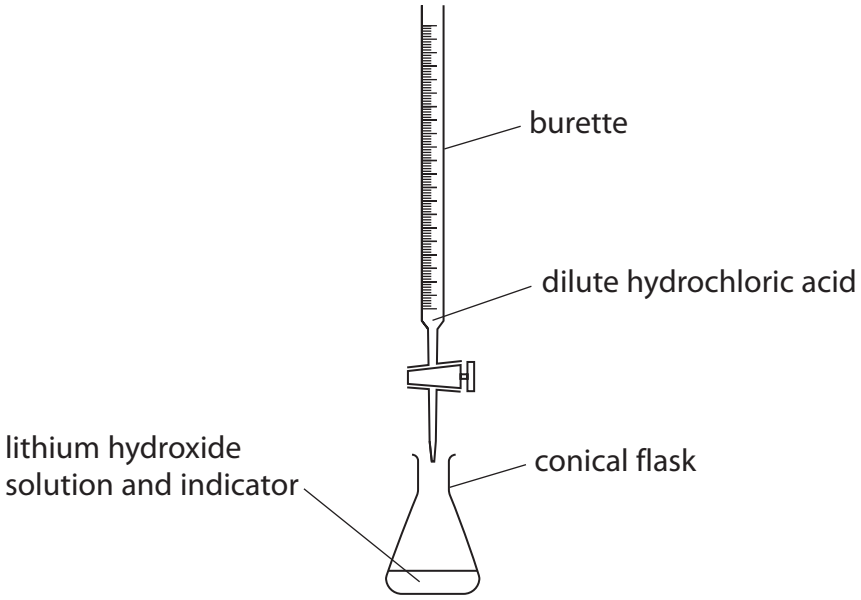

Figure 7

(a) Suggest why the student carried out a rough titration before the two accurate titrations.

(1)

.....

.....

(b) Figure 8 shows the results of the rough titration.

final reading on burette in cm^3	30.10
initial reading on burette in cm^3	2.50

Figure 8

What was the volume of acid added in the rough titration?

(1)

☒ **A** 2.50 cm^3

☒ **B** 27.60 cm^3

☒ **C** 30.10 cm^3

☒ **D** 32.60 cm^3

(c) Describe how the rough titration should be carried out once the dilute hydrochloric acid, lithium hydroxide solution and indicator are placed in the apparatus in Figure 7.

(4)

(d) Which is the name of an indicator that is suitable to use in this titration?

(1)

- ☒ **A** limewater
- ☒ **B** litmus paper
- ☒ **C** methyl orange
- ☒ **D** universal indicator

(e) During the titration the dilute hydrochloric acid, HCl, is reacting with the lithium hydroxide solution, LiOH.

Explain what type of reaction is taking place in the titration.

(3)

(Total for Question 4 = 10 marks)

5 (a) An atom of aluminium has an atomic mass of 27.

Aluminium has an atomic number of 13.

State the number of electrons, neutrons and protons in this atom.

(3)

number of electrons = ...

number of neutrons = ...

number of protons = ...

(b) Aluminium reacts with bromine to form aluminium bromide.
A sample of aluminium bromide contains 1.35 g of aluminium atoms and 12.00 g of bromine atoms.

Calculate the empirical formula of this sample of aluminium bromide.

(relative atomic masses: Al = 27.0, Br = 80.0)

(3)

.....

.....

.....

.....

.....

.....

empirical formula = ...

(c) Gallium is in the same group in the periodic table as aluminium and in the same period in the periodic table as bromine.

(i) State in which group and period of the periodic table gallium can be found.

You may want to refer to the periodic table.

(2)

group = ...

period = ...

(ii) Gallium had not been discovered when Mendeleev created his first periodic table.

Figure 9 shows some properties of gallium that Mendeleev predicted and some of the actual properties of gallium.

property	predicted property	actual property
relative atomic mass	about 68	70
density in g / cm^3	about 6.0	5.9
melting point	lower than 40 °C	29.8 °C
density of oxide in g / cm^3	about 5.5	5.9

Figure 9

Describe how Mendeleev predicted these properties of gallium.

(2)

.....

.....

.....

.....

(Total for Question 5 = 10 marks)

6 (a) 3.14 g of solid copper sulfate was dissolved in water and made up to 250 cm^3 of solution.

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

Calculate the concentration of this copper sulfate solution in g dm^{-3}.

(2)

.....

.....

.....

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

(b) Sodium hydroxide solution was added to a solution of copper sulfate.
A precipitate of copper hydroxide and a solution of sodium sulfate were formed.

(i) State what would be **seen** in the reaction.

(1)

.....

(ii) Complete the balanced equation for the reaction by adding a number in front of NaOH.

(1)

.....$NaOH + CuSO_4 \rightarrow Cu(OH)_2 + Na_2SO_4$

(iii) Describe how to obtain a pure, dry sample of the precipitate of copper hydroxide from the reaction mixture.

(3)

.....

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.....

(c) Figure 10 shows the equipment used to electrolyse a sample of sodium sulfate solution.

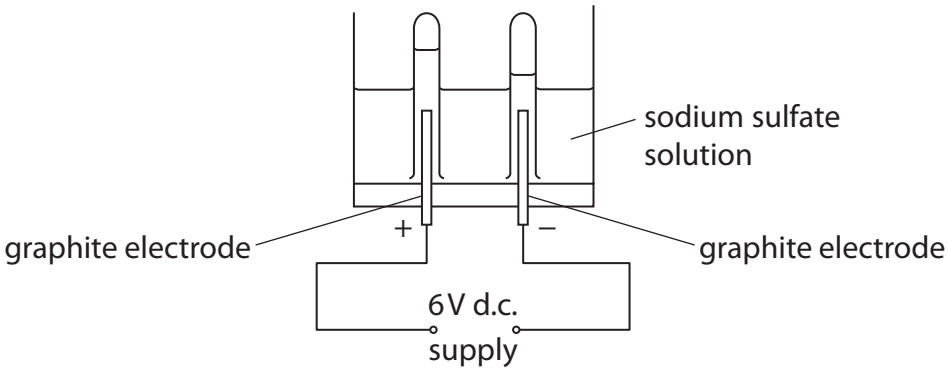


Figure 10

Graphite electrodes are used in the electrolysis of sodium sulfate solution. Graphite is used because it is inert and conducts electricity.

(i) Figure 11 shows the ions in the sodium sulfate solution.

Draw a circle around each of the ions in Figure 11 that are attracted to the negative graphite electrode during the electrolysis.

(1)

H^+	OH^-	Na^+	SO_4^{2-}

Figure 11

(ii) State why it is important that the electrodes are inert.

(1)

.....

.....

(iii) Explain, in terms of its structure, how graphite conducts electricity.

(2)

.....

.....

.....

(Total for Question 6 = 11 marks)

7 (a) When iron wool reacts with oxygen from the air, the iron corrodes and iron oxide is formed.

What happens to the iron in this reaction?

(1)

- ☒ **A** it is decomposed
- ☒ **B** it is neutralised
- ☒ **C** it is oxidised
- ☒ **D** it is reduced

(b) A piece of damp iron wool was placed in a measuring cylinder with 50 cm^3 of air, as shown in Figure 12.

Figure 13 shows the apparatus one week later.

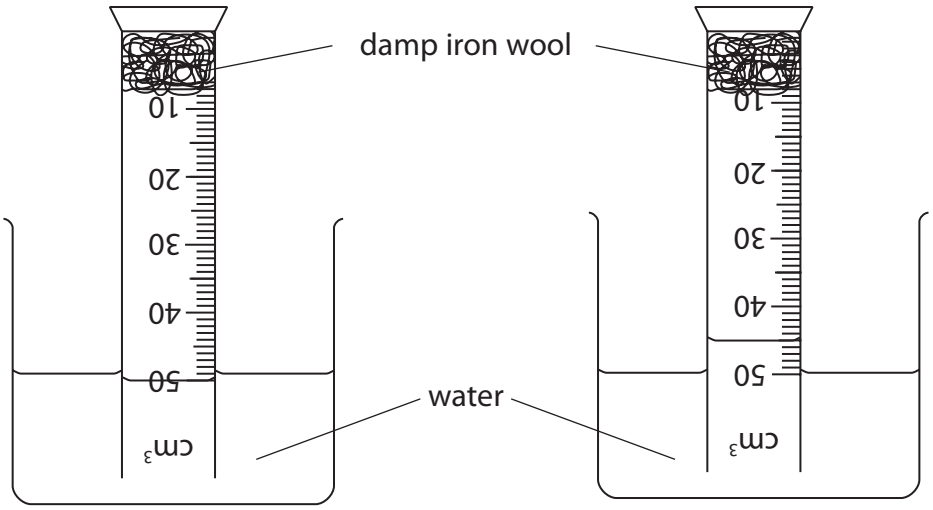


Figure 12 **Figure 13**

(i) Complete the table of results.

(1)

volume of gas in Figure 12 in cm^3	50
volume of gas in Figure 13 in cm^3	.....

(ii) Use these results to calculate the percentage decrease in the volume of gas in the measuring cylinder after one week.

(3)

.....

.....

.....

percentage decrease in volume of gas = ...

(iii) Not all of the oxygen in the air in the measuring cylinder has reacted with the iron.

Give a reason why.

(1)

.....

.....

*(c) Pure metals can be made more useful by converting them into alloys or by electroplating them.

Explain what alloying and electroplating are and how they can make metals more useful.

(6)

(Total for Question 7 = 12 marks)

8 Barium hydroxide reacts with dilute hydrochloric acid to form barium chloride and water.

(a) The equation for the reaction is

$$Ba(OH)_2(s) + 2HCl(aq) \rightarrow BaCl_2(aq) + 2H_2O(l)$$

Which row of the table shows the correct state of each of the substances in the equation for the reaction?

(1)

		barium hydroxide	hydrochloric acid	barium chloride	water
☒	**A**	solid	aqueous	aqueous	liquid
☒	**B**	solid	liquid	solid	aqueous
☒	**C**	aqueous	aqueous	solid	liquid
☒	**D**	aqueous	liquid	aqueous	aqueous

(b) A student wanted to investigate how the pH of the mixture changes as barium hydroxide is added to dilute hydrochloric acid.

They followed this method.

step 1 measure out 50.0 cm^3 of dilute hydrochloric acid into a beaker using a measuring cylinder

step 2 use a glass rod to place a drop of the acid onto a piece of universal indicator paper and record the pH

step 3 add 0.2 g of barium hydroxide to the acid in the beaker and stir

step 4 use the glass rod to place a drop of the mixture onto a new piece of universal indicator paper and record the pH again

step 5 repeat steps 3–4 until there is no further change in the pH.

(i) Name a piece of equipment which could be used to measure out 50.0 cm^3 of dilute hydrochloric acid more accurately than the measuring cylinder.

(1)

.....

(ii) Describe how the pH of the mixture is determined when a drop of it is placed on the universal indicator paper.

(2)

.....

.....

.....

.....

(iii) In the method, universal indicator paper is used to determine the pH.

Explain why litmus paper would not be a suitable indicator to use in this experiment.

(2)

.....

.....

.....

.....

(iv) Figure 14 shows the student's results.

mass of barium hydroxide in g	pH of mixture
0.0	1
0.2	1
0.4	1
0.6	1
0.8	2
1.0	7
1.2	12
1.4	13
1.6	13

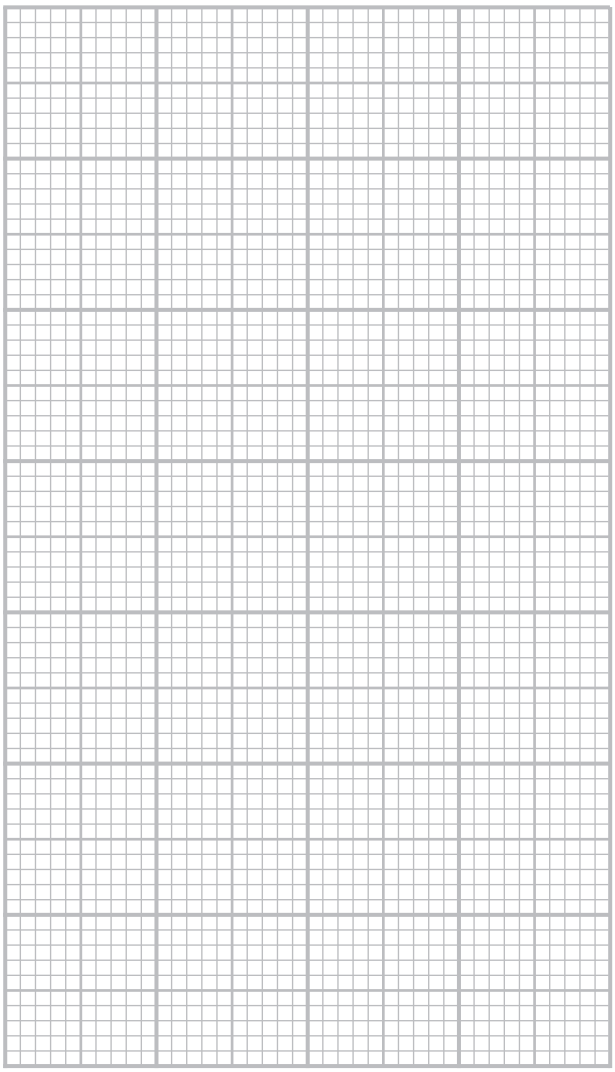
Figure 14

On the grid opposite:

- Add suitable scales to the vertical and horizontal axes.
- Plot a graph of the pH of the mixture against the mass of barium hydroxide.

(3)

pH of
the mixture



mass of barium hydroxide in g

(c) Figure 15 shows a hazard symbol placed on a container of barium hydroxide.

Figure 15

(i) What is the meaning of the hazard symbol in Figure 15?

(1)

- ☒ **A** flammable
- ☒ **B** health hazard
- ☒ **C** oxidising
- ☒ **D** toxic

(ii) Barium hydroxide is also corrosive.

Give **one** precaution that the student should take when using barium hydroxide.

(1)

.....

.....

(Total for Question 8 = 11 marks)

9 Magnesium carbonate has the formula $MgCO_3$.

(a) Magnesium carbonate contains Mg^{2+} and CO_3^{2-} ions.

(i) The atomic number of magnesium is 12.

What is the electronic configuration of the Mg^{2+} ion?

(1)

☒ **A** 2

☒ **B** 2.8

☒ **C** 2.8.2

☒ **D** 2.8.4

(ii) Explain why solid magnesium carbonate cannot conduct electricity but solid magnesium can.

(3)

.....

.....

.....

.....

.....

.....

(b) Calculate the percentage by mass of magnesium in magnesium carbonate, $MgCO_3$.

(relative atomic masses: C = 12.0, O = 16.0, Mg = 24.0)

(3)

.....

.....

.....

.....

percentage by mass of magnesium = ...

*(c) A student has two separate test tubes containing sulfuric acid.

The student adds a spatula measure of magnesium carbonate, $MgCO_3$, to the first test tube and a piece of magnesium to the second test tube.

Explain what the student would see in each test tube and the tests that they should carry out to identify the gases produced.

Your answer should include word equations for the reactions that would take place.

(6)

(Total for Question 9 = 13 marks)

10 Sucrose is a carbohydrate.

When a solution of sucrose is fermented using yeast, ethanol is formed.

$$\text{sucrose} + \text{water} \rightarrow \text{ethanol} + \text{carbon dioxide}$$

(a) In one experiment, 100.00 g of sucrose was dissolved in water.

Yeast was added and the mixture allowed to ferment until no more bubbles of carbon dioxide were seen to be formed.

The ethanol was obtained from the mixture and its mass determined.

The results are shown in Figure 16.

	mass in g
mass of sucrose	100.00
mass of ethanol obtained from the reaction	8.07
theoretical mass of ethanol formed	53.80

Figure 16

The percentage yield is calculated using

$$\text{percentage yield} = \frac{\text{actual yield}}{\text{theoretical yield}} \times 100$$

(i) State the meanings of the terms **actual yield** and **theoretical yield**.

(2)

actual yield

.....

.....

theoretical yield

.....

.....

(ii) Use the information in Figure 16 to calculate the percentage yield of ethanol in this experiment.

(2)

.....

.....

.....

.....

percentage yield = ...

(iii) State **two** reasons why the actual yield of a reaction is usually less than the theoretical yield.

(2)

1 .....

.....

2 .....

.....

(b) The balanced equation for the fermentation of sucrose is

$$C_{12}H_{22}O_{11} + H_2O \rightarrow 4C_2H_5OH + 4CO_2$$

(i) Calculate the atom economy of this reaction to produce ethanol.

Give your answer to two significant figures.

(relative formula masses: $C_{12}H_{22}O_{11} = 342$, $H_2O = 18$, $C_2H_5OH = 46$, $CO_2 = 44$)

(3)

.....

.....

.....

atom economy = ...%

(ii) Explain the effect on the atom economy of this reaction if the carbon dioxide produced was used to make fizzy drinks.

(2)

.....

.....

.....

.....

(Total for Question 10 = 11 marks)

TOTAL FOR PAPER = 100 MARKS

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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.