Write your name here

Surname	Other names

Pearson Edexcel
Level 1/Level 2 GCSE (9 - 1)

Centre Number

Candidate Number

Chemistry

Paper 2

Foundation Tier

Wednesday 13 June 2018 – Morning
Time: 1 hour 45 minutes

Paper Reference
1CH0/2F

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.
- A periodic table is printed on the back cover of this 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 ▶

1/1/1/1/1/1/1/1/

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 Students are investigating exothermic and endothermic reactions.
They are finding the temperature change in 50 cm^3 water when a solid dissolves in it.
The apparatus is shown in Figure 1.

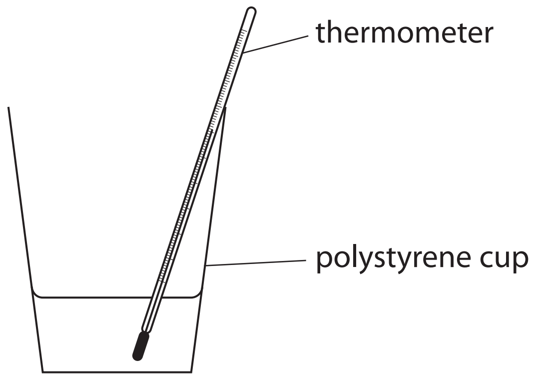


Figure 1

(a) The steps needed to carry out this experiment are **P**, **Q**, **R**, **S** and **T**.
They are shown below.

They are not in the correct order.

P pour the 50 cm^3 water into the polystyrene cup
Q add the solid to the water and stir
R measure 50 cm^3 water using a beaker
S measure the initial temperature of the water
T measure the final temperature of the solution when all the solid has dissolved

Write the steps in the correct order, from left to right.

(2)

(b) The dissolving of this solid in water is an exothermic change.
The experiment is repeated a number of times.
Compared with the initial temperature of the water, the final temperature of the solution is

(1)

☒ **A** always higher

☒ **B** always lower

☒ **C** sometimes higher and sometimes lower

☒ **D** always unchanged

(c) State how step **R** could be changed to measure the volume of water more accurately.

(1)

....

(d) Figure 2 shows a cold pack.

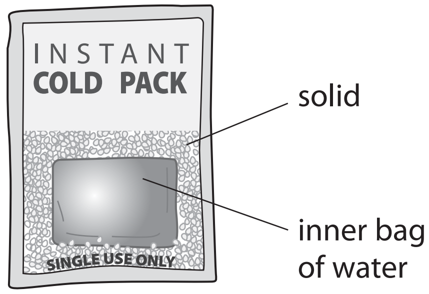


Figure 2

When the pack is squeezed hard the inner bag bursts.
Then the pack goes cold.

(i) Explain why the pack goes cold.

(2)

....

....

....

(ii) Give the reason why the pack can be used only once.

(1)

....

....

....

(Total for Question 1 = 7 marks)

BLANK PAGE

2 Figure 3 shows two tests carried out on a white solid and the results of the tests.

	test	results
test 1	flame test carried out	a yellow flame
test 2	dilute hydrochloric acid added gas given off passed into limewater	effervescence occurs the limewater goes milky

Figure 3

(a) Which ion is shown to be present by the result of test 1?

(1)

☒ **A** lithium

☒ **B** sodium

☒ **C** potassium

☒ **D** calcium

(b) (i) State the name of the gas given off in test 2.

(1)

....

(ii) State the name of the ion shown to be present in the white solid by the result of test 2.

(1)

....

(c) A flame photometer can be used to measure the concentration of potassium ions in a solution.

Figure 4 shows the photometer readings for three different concentrations of potassium ions in solutions.

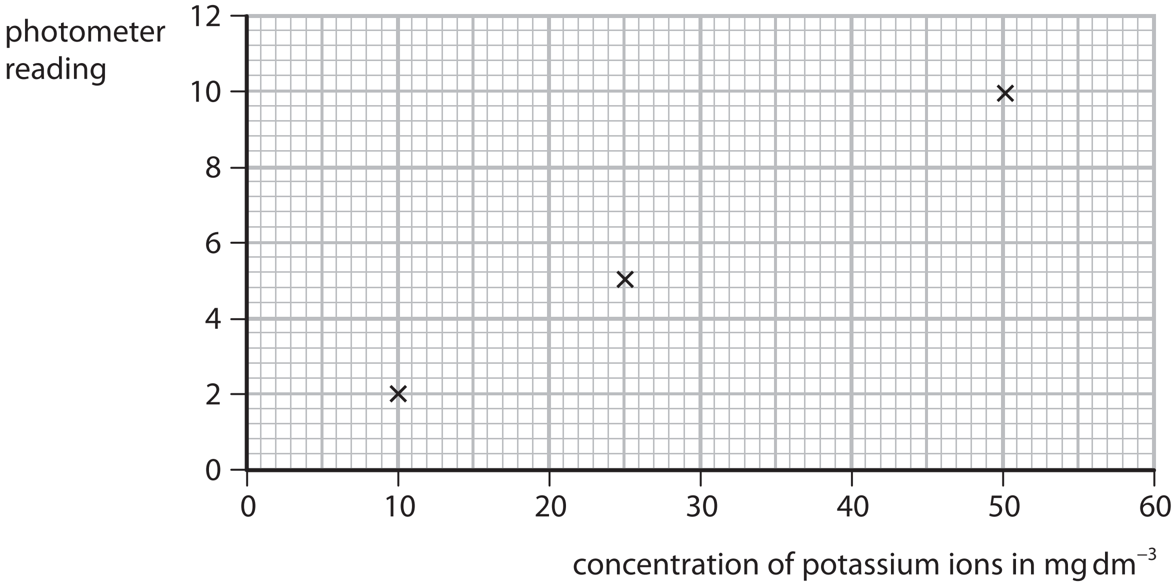


Figure 4

(i) A solution containing a concentration of potassium ions of 35 $mg\,dm^{-3}$ is placed in the photometer.
The photometer reading is 7.0.

Plot this point on the graph and then draw the straight line of best fit.

(2)

(ii) Another solution of potassium ions gives a photometer reading of 9.0.

Use the graph to find the concentration of potassium ions in this solution.

(1)

concentration = ... $mg\,dm^{-3}$

(Total for Question 2 = 6 marks)

DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA

3 Hydrogen peroxide decomposes to form water and oxygen.

The rate of this reaction can be found by measuring the volume of oxygen formed after different time intervals.

Hydrogen peroxide solution is placed in a conical flask.
The apparatus is set up as shown in Figure 5.

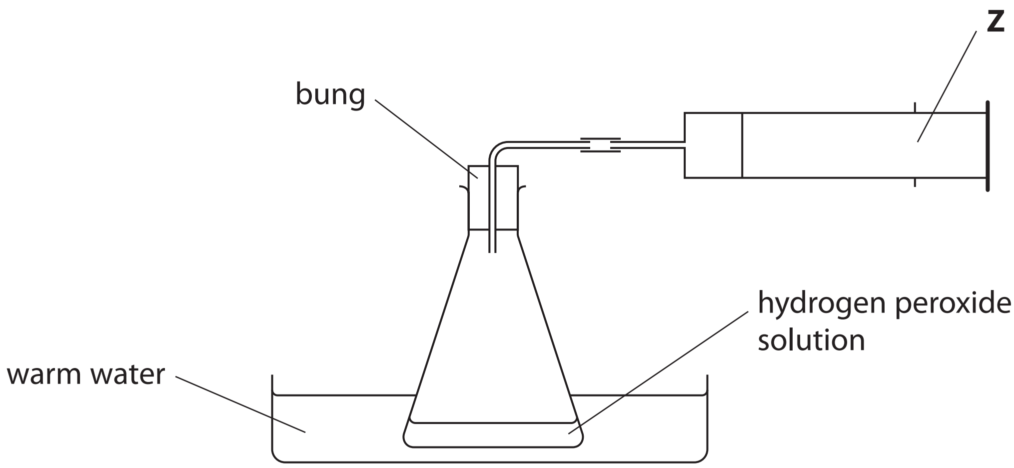


Figure 5

(a) State the name of the piece of apparatus labelled **Z** in Figure 5.

(1)

....

....

(b) At the end of the reaction the bung is removed from the conical flask.
A glowing splint is put into the gas in the flask.

State what you would **see**.

(1)

....

....

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

(c) A solid catalyst can be used for this reaction.

(i) The experiment is repeated under identical conditions but with the catalyst added.

(1)

In the experiment **with** the catalyst added

☒ **A** the rate of reaction is the same as when no catalyst is present

☒ **B** water and oxygen are the only products of the reaction

☒ **C** some of the catalyst is used up

☒ **D** the volume of oxygen produced when all the hydrogen peroxide is decomposed is larger than when no catalyst is present

(ii) At the end of the experiment with the catalyst added, the mass of the catalyst remaining is found.

The method used to find the mass of the catalyst remaining is
filter the mixture of products and catalyst
determine the mass of the filter paper and solid catalyst
subtract the mass of a filter paper from the mass of filter paper and solid catalyst.

This method would not give the accurate mass of catalyst remaining.

Which of the following needs to be done to give a more accurate mass?

(1)

☒ **A** dry the filter paper and catalyst before finding their mass

☒ **B** scrape the catalyst off the filter paper and find the mass of the catalyst

☒ **C** find the mass of the filtrate and not the filter paper and catalyst

☒ **D** repeat the experiment

(iii) A given mass of catalyst is more effective if it has a large surface area.

State how you could increase the surface area of some lumps of solid catalyst.

(1)

....

(d) The experiment is repeated three times

once using a more dilute solution of hydrogen peroxide
once using a lower temperature
once using a larger flask

In each case, all other conditions are kept the same.

Circle the word that shows the change in the rate of decomposition in each case.

(2)

	change in rate		
hydrogen peroxide solution is more dilute	faster	slower	unchanged
the temperature used is lower	faster	slower	unchanged
the reaction is carried out in a larger flask	faster	slower	unchanged

(e) Complete the balanced equation for the reaction and fill in the two missing state symbols.

(2)

$$\ldots\ldots H_2O_2(aq) \rightarrow 2H_2O(\ldots\ldots) + O_2(\ldots\ldots)$$

(Total for Question 3 = 9 marks)

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

BLANK PAGE

4 (a) Nanoparticles are found in some sunscreens.

(i) An atom has a radius of about 0.1 nm.

A nanoparticle might have a radius of about

(1)

- ☒ **A** 0.01 nm
- ☒ **B** 0.1 nm
- ☒ **C** 50 nm
- ☒ **D** 1 cm

(ii) A useful property of nanoparticles in sunscreens is that they

(1)

- ☒ **A** have a low surface area to volume ratio
- ☒ **B** are toxic
- ☒ **C** are white
- ☒ **D** prevent harmful UV radiation reaching the skin

(iii) A nanoparticle has a surface area of 38 400 nm^2 and a volume of 51 200 nm^3.

Calculate the surface area to volume ratio.

(2)

....

....

....

....

surface area to volume ratio = 1.00 : ....

DO NOT WRITE IN THIS AREA DO NOT WRITE IN THIS AREA DO NOT WRITE IN THIS AREA

(b) The molecules of three organic substances **A**, **B** and **C** are shown in Figure 6.

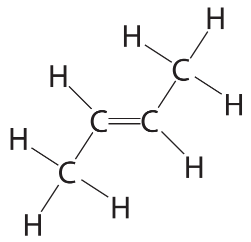
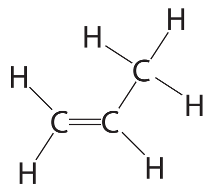
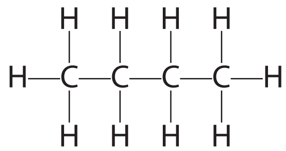
substance A	substance B	substance C
		

Figure 6

(i) A small volume of bromine water is added to each of the substances **A**, **B** and **C** and the mixtures shaken.
Explain why **A** and **B** decolourise bromine water but **C** does not.

(3)

....

....

....

....

(ii) Ethane, C_2H_6, is a hydrocarbon.

Draw a molecule of ethane showing all covalent bonds.

(2)

(iii) State why ethane is described as a **hydrocarbon**.

(2)

....

....

(Total for Question 4 = 11 marks)

5 Crude oil is found in the Earth's crust.

(a) Which of the statements about crude oil is correct?

(1)

☒ **A** crude oil is a finite resource

☒ **B** crude oil is a mixture of the elements hydrogen and carbon

☒ **C** all of the molecules in crude oil contain rings of carbon atoms

☒ **D** crude oil is used in cars as a fuel

(b) The substances ethane, C_2H_6, octane, C_8H_{18}, and pentadecane, $C_{15}H_{32}$, are all found in crude oil.

These substances

(1)

☒ **A** have the same formula

☒ **B** have the same boiling point

☒ **C** are in the same homologous series

☒ **D** form different products when completely combusted in air

(c) (i) Use a word from the box to complete each of the sentences about the fractional distillation of crude oil.

condensed	heated	melted	solidified	stirred

Each word may be used once, more than once, or not at all.

(2)

The separation of crude oil into fractions occurs in a fractional distillation column.

Before crude oil is passed into the column it is ....

During the distillation, vapour rises up the column until it is cold enough for the vapour to form a liquid. The vapour has been ....

(ii) Complete this sentence by underlining the correct answer in the box.

(1)

Compared with the fraction from the top of the column,

the fraction from the bottom of the column

has more carbon atoms per molecule.
has a lower viscosity.
is easier to ignite.

(d) When crude oil is separated into fractions, the amount of each fraction obtained rarely matches the demand for that fraction.

Figure 7 shows the relative amounts of four of the fractions obtained from a crude oil and the relative demand for each of these fractions.

fraction	relative amount obtained from the crude oil	relative demand
gases	5	5
petrol	10	25
kerosene	20	25
fuel oil	45	5

Figure 7

State the fraction for which the relative amount obtained exceeds the relative demand.

(1)

....

(e) In January 2015 the United Kingdom produced 850 000 barrels of crude oil per day. 45% of this crude oil was fuel oil.

Calculate the number of barrels of fuel oil present in the 850 000 barrels of crude oil.

Give your answer to two significant figures.

(3)

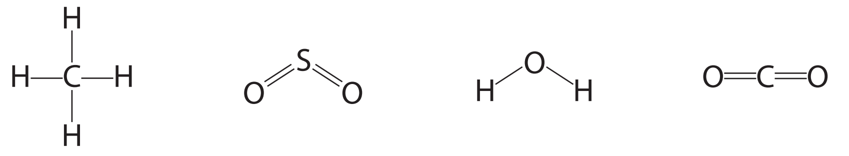
....

....

.... barrels

(Total for Question 5 = 9 marks)

6 Figure 8 shows one molecule of each of four different substances, **A**, **B**, **C** and **D**.



substance A substance B substance C substance D

Figure 8

(a) State the formula of a molecule of substance **B**.

(1)

....

(b) (i) Substance **C** can be formed by burning an element in oxygen.

Write the word equation for this reaction.

(1)

....

(ii) Consider substances **A**, **B**, and **D**.

Give the letters of the two substances that can be formed by burning an element in oxygen.

(1)

....

(c) The amount of oxygen in the atmosphere has increased since the Earth's early atmosphere was formed.

Explain what has caused this change.

(2)

....

....

....

(d) Carbon dioxide is present in the Earth's atmosphere.

Some processes increase the amount of carbon dioxide in the atmosphere, other processes decrease it.

Draw one straight line from each change in the amount of carbon dioxide in the atmosphere to the process causing the change.

(2)

change in the amount of carbon dioxide in the atmosphere	**process causing the change**
	carbon dioxide absorbing the Sun's energy
increase	carbon dioxide dissolving in oceans
	volcanic emissions
decrease	using argon in light bulbs
	burning hydrogen

(e) Figure 9 shows a graph of the amount of carbon dioxide in the Earth's atmosphere from 1985 to 2005.

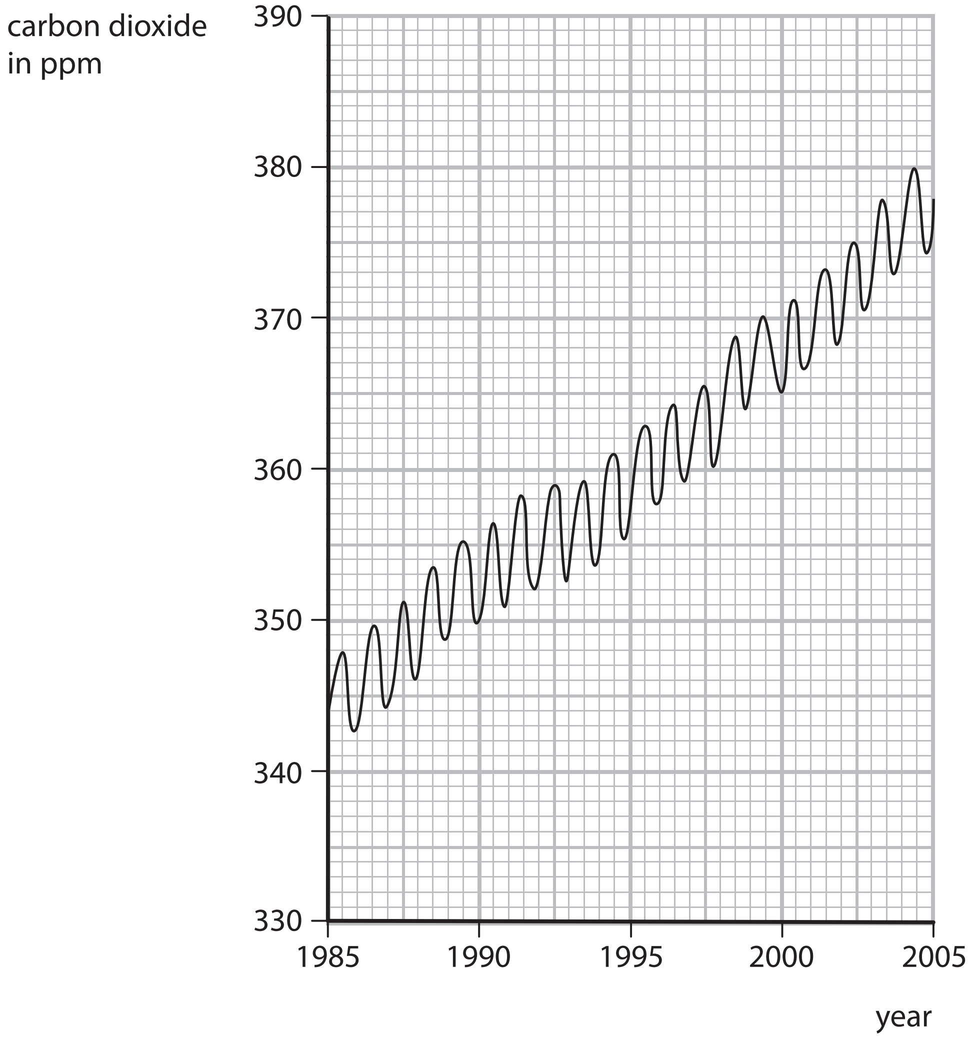


Figure 9

(i) Describe how the amount of carbon dioxide in the Earth's atmosphere varies within each year.

(1)

....

....

....

(ii) Describe the overall trend in the amount of carbon dioxide in the Earth's atmosphere from 1985 to 2005.

(1)

....

....

....

(iii) Calculate the change in the amount of carbon dioxide in the Earth's atmosphere from the beginning of 1990 to the beginning of 2000.

(2)

....

....

....

change in amount = ... ppm

(Total for Question 6 = 11 marks)

7 (a) Figure 10 shows information about a glass, a ceramic, a polymer and a metal.

	glass	**ceramic**	**polymer**	**metal**
flexibility	low	low	high	high
hardness	medium	medium	low	low
reaction with water	no reaction	no reaction	no reaction	very slow reaction
electrical conductivity	low	low	low	high
melting point	high	high	medium*	high

*polymers soften, rather than melt, when heated.

Figure 10

Figure 11 shows part of a household wire that connects a kettle to a plug.

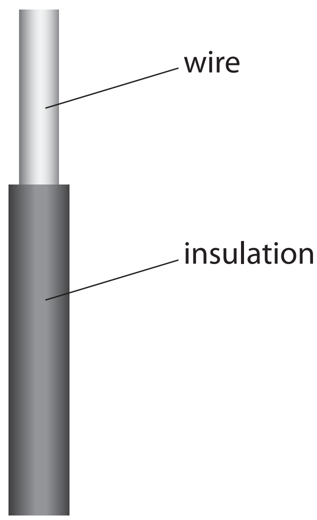


Figure 11

(i) Why is this wire made of metal?

(1)

☒ **A** the metal is hard

☒ **B** the metal reacts with water

☒ **C** the metal is an element

☒ **D** the metal conducts electricity

(ii) Which type of material would be most suitable for the insulation on this household wire?

(1)

- ☒ **A** the glass
- ☒ **B** the ceramic
- ☒ **C** the polymer
- ☒ **D** the metal

(b) Explain, using information from Figure 10, why the ceramic is a suitable material to make a cup that will contain a hot drink of tea or coffee.

(2)

....

....

....

(c) (i) The structure of a molecule of a polymer is shown in Figure 12.

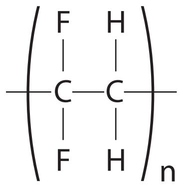
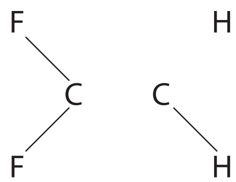


Figure 12

Complete the structure of a molecule of the monomer used to make this polymer by adding the missing covalent bonds.

(2)



*(ii) Poly(ethene) has many uses in everyday life.
Large amounts of poly(ethene) are manufactured from ethene produced by cracking fractions obtained from crude oil.

Poly(ethene) is used to make many objects.
After use it is necessary to dispose of the large amounts of poly(ethene) in these objects.

Explain some of the problems associated with the manufacture and disposal of poly(ethene).

(6)

(Total for Question 7 = 12 marks)

8 (a) A chlorine atom contains 17 electrons, 18 neutrons and 17 protons.

(i) State the mass number of this chlorine atom.

(1)

....

(ii) Give the electronic configuration of this chlorine atom.

(1)

....

(b) Describe what you would **see** if damp, blue litmus paper is placed into chlorine gas.

(2)

....

....

....

....

(c) Chlorine exists as diatomic molecules.

In a molecule, two chlorine atoms are joined by a covalent bond.

(i) Describe what is meant by a **covalent bond**.

(2)

....

....

....

(ii) Explain why chlorine is a gas, rather than a liquid, at room temperature.

(2)

....

....

....

....

(d) When the gas hydrogen chloride, HCl, is dissolved in water, a solution forms. Blue litmus paper dipped in this solution turns red.

State why the litmus paper turns red.

(1)

....

....

(e) (i) Figure 13 lists the halogens in the order in which they appear in group 7 of the periodic table.

The melting points of four of the halogens are given.

halogen	melting point in °C
fluorine	–220
chlorine	–101
bromine	–7
iodine	
astatine	302

Figure 13

Estimate the melting point of iodine.

(1)

.... °C

(ii) Bromine reacts with heated iron.

Give the name of one halogen that would react with iron more vigorously than bromine.

(1)

....

(Total for Question 8 = 11 marks)

DO NOT WRITE IN THIS AREA DO NOT WRITE IN THIS AREA DO NOT WRITE IN THIS AREA

9 Lithium, sodium and potassium are reactive metals in group 1 of the periodic table.

(a) Sodium metal tarnishes in air to form a layer of sodium oxide on its surface. 0.92 g of sodium combined with 0.32 g of oxygen in this oxide.

Calculate the empirical formula of this sodium oxide.
(relative atomic masses: O = 16, Na = 23)

You must show your working.

(3)

....

....

....

....

....

....

empirical formula of sodium oxide = ...

(b) Sodium reacts with water to form sodium hydroxide in solution and hydrogen.

Complete the balancing of the equation for this reaction and add the state symbols for each substance.

(3)

$$\ldots\ldots Na(\ldots\ldots) + 2H_2O(\ldots\ldots) \rightarrow \ldots\ldots NaOH(\ldots\ldots) + H_2(\ldots\ldots)$$

(c) In an experiment equal-sized pieces of lithium, sodium and potassium are added to separate samples of water.

(i) A flame is produced only with potassium because potassium

(1)

☒ **A** is the softest metal

☒ **B** has the lowest melting point

☒ **C** is the most reactive

☒ **D** is the only flammable metal

*(ii) A teacher demonstrated this experiment.

The results are shown in Figure 14.

	lithium	**sodium**	**potassium**
position of metal in water	floats	floats	floats
movement of metal	slow	fast	very fast
effervescence / bubbling	slow	fast	very fast

Figure 14

Describe, in detail, how the teacher would demonstrate this experiment safely, showing how the results give the order of reactivity of the metals.

(6)

(Total for Question 9 = 13 marks)

10 Ethanol can be used as a liquid fuel.

A student investigates how much heat energy is released when a known mass of ethanol is burned.

The apparatus is set up as shown in Figure 15.

A known volume of water is placed in a metal can.
The temperature of the water is measured.
The ethanol is ignited and placed under the beaker so that the flame is touching the beaker.
The water is heated by the flame.
The flame is extinguished.
The final temperature of the water is measured.

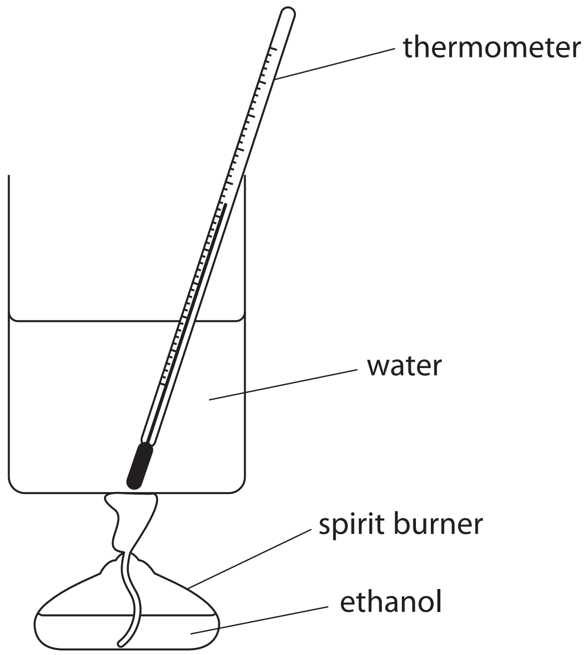


Figure 15

(a) The theoretical temperature rise for burning a given mass of ethanol is 82.4 °C.

In the experiment the actual temperature rise for burning this mass of ethanol was only 34.8 °C.
One reason why the temperature rise is less than expected is that the ethanol does not burn completely.

(i) Give a reason why, even if the ethanol burns completely, the actual temperature rise is much less than the theoretical value.

(1)

....

(ii) Explain how the method described above could be improved to give a temperature rise closer to the theoretical value.

(2)

....

....

....

....

(iii) The amount of heat energy used to raise the temperature of the water by 34.8 °C can be calculated using

heat energy = 210 × temperature rise

Calculate the amount of heat energy used.

(2)

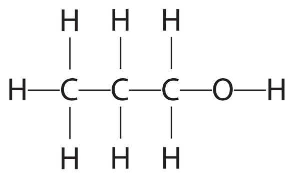
....

....

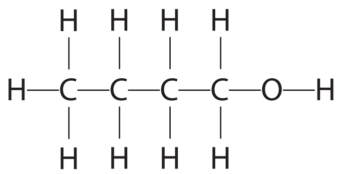
....

heat energy = ... (energy units)

(b) Propanol and butanol are both members of the same homologous series as ethanol.



propanol



butanol

Propanol and butanol can also be burned in the apparatus shown in Figure 15.

Give **three** reasons why ethanol, propanol and butanol are members of the same homologous series.

(3)

reason 1 ....

....

reason 2 ....

....

reason 3 ....

....

(c) Ethanol can oxidise when exposed to air to produce ethanoic acid and water. Propanol can also oxidise in a similar reaction when it is exposed to air.

(i) Write the word equation for the reaction when **propanol** oxidises when it is exposed to air.

(2)

....

....

(ii) What is the formula of the functional group in carboxylic acids?

(1)

☒ **A** –OH

☒ **B** $–CH_3$

☒ **C** –COOH

☒ **D** $–CO_2$

(Total for Question 10 = 11 marks)

TOTAL FOR PAPER = 100 MARKS

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

BLANK PAGE

BLANK PAGE

BLANK PAGE

The periodic table of the elements

Key

relative atomic mass
atomic symbol
name
atomic (proton) number

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

***** 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.