Please check the examination details below before entering your candidate information

Candidate surname	Other names

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

Centre Number	Candidate Number

Time 1 hour 45 minutes

Paper reference **1CH0/2F**

Chemistry
PAPER 2
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.
- Good luck with your examination.

Turn over ▶

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1/1/1/1/1/

P 6 7 0 6 9 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 mug made of clay ceramic.

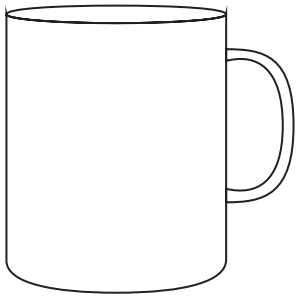

Figure 1

Which property of clay ceramic makes it suitable for use as a mug?

(1)

☒ **A** is brittle

☒ **B** is not transparent

☒ **C** does not conduct electricity

☒ **D** does not dissolve in water

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(b) Figure 2 shows the properties of some materials.

material	property			
	brittle	conducts electricity	conducts heat	transparent
clay ceramic	yes	no	no	no
glass	yes	no	no	yes
metal	no	yes	yes	no
polymer	no	no	no	no

Figure 2

Figure 3 shows an electrical cable.
The electrical cable is made of metal wire coated with another material.
The metal wire inside the electrical cable conducts electricity.

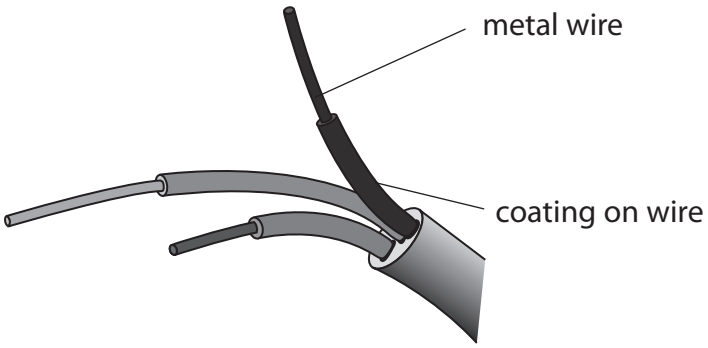

Figure 3

(i) Name a material from Figure 2 that would be suitable for coating the metal wire.

(1)

polymer

(ii) Which type of particle moves through the metal wire to allow it to conduct electricity?

(1)

- ☒ **A** atoms
- ☒ **B** electrons
- ☒ **C** neutrons
- ☒ **D** protons

(c) There are some concerns that nanoparticles may cause harm if they enter the human body.

(i) Suggest one way that nanoparticles can enter the human body.

(1)

breathed in / absorbed by the skin / consumed within food and drink /medication

(ii) Suggest one possible risk if nanoparticles enter the human body.

(1)

catalyse (harmful) reactions / build up and form blockages

(iii) The surface area of a nanoparticle of gold is 150 nm^2.
The volume of a nanoparticle of gold is 125 nm^3.

$$\text{ratio} = \frac{\text{surface area}}{\text{volume}}$$

Calculate the surface area to volume ratio of this nanoparticle of gold.

(1)

1.2 :1

surface area to volume ratio = ... : 1

(Total for Question 1 = 6 marks)

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2 Magnesium reacts with dilute sulfuric acid to form magnesium sulfate and hydrogen gas.

A student wants to find out the effect of temperature on the rate of this reaction.

The student used the following method.

step 1 pour 25 cm^3 of dilute sulfuric acid into a conical flask

step 2 warm the acid until its temperature is 30 °C

step 3 add a piece of magnesium to the acid

step 4 start a stopwatch

step 5 wait until the reaction has finished

step 6 stop the stopwatch

step 7 repeat steps 1–6 but at 50 °C.

(a) The student kept the volume of sulfuric acid the same when they repeated the method at 50 °C.

State two other variables that should be kept the same.

(2)

1 concentration of acid (1)

2 {size / shape / surface area / length} area of magnesium ribbon (1)

(b) Which piece of equipment can be used to find the volume of 25 cm^3 of sulfuric acid?

(1)

☒ **A** balance

☒ **B** measuring cylinder

☒ **C** ruler

☒ **D** thermometer

(c) State how the student will know that the reaction has finished.

(1)

magnesium has gone / no more bubbles

(d) The reaction at 50 °C was faster than the reaction at 30 °C.

Give **one** reason, in terms of particles, why the reaction at 50 °C was faster than the reaction at 30 °C.

(1)

(particles) have more energy / (particles) collide more frequently / more successful collisions

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(e) At 50 °C, 15.0 cm^3 of gas was produced during the first 60 seconds of the reaction.

Calculate the average rate of reaction, in $cm^3\ s^{-1}$, for the first 60 seconds of the reaction.

(2)

$\frac{15.0}{60.0}$ (1)

= 0.25 (1) (cm3 s-1)

average rate of reaction = 0.25 $cm^3\ s^{-1}$

(Total for Question 2 = 7 marks)

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3 This question is about the noble gases.

(a) (i) State, in terms of outer shell electrons, why the noble gases are unreactive.

(1)

(outer shell is) full/ complete

(ii) Figure 4 shows an airship, filled with helium, floating above the ground.

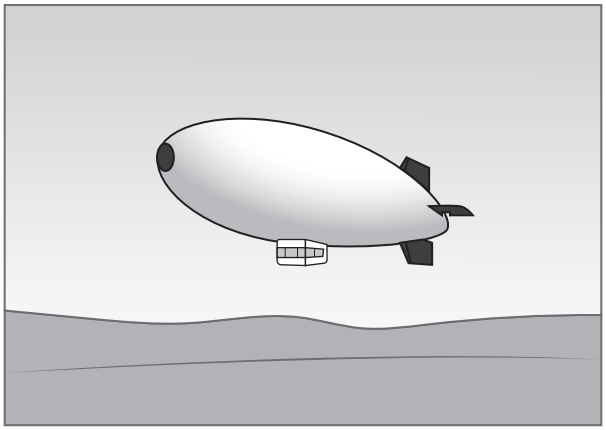

Figure 4

Helium, hydrogen and krypton are gases.
Figure 5 shows the reactivity and density, at room temperature and pressure, of helium, hydrogen and krypton.

gas	reactivity	density in g cm^{-3}
helium	unreactive	0.00018
hydrogen	very reactive	0.00009
krypton	unreactive	0.00380

Figure 5

The density of air is 0.001225 g cm^{-3}.

Helium is used in airships.

Explain why hydrogen and why krypton are **not** used in airships.

(3)

hydrogen is flammable / could ignite (1)

- krypton is more dense than air (1)
- (so krypton) air ship would not float (1)

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(b) Mendeleev produced one of the earliest periodic tables.

State why he could **not** include any of the noble gases in his periodic table.

(1)

had yet to be discovered / unknown / did not know about them

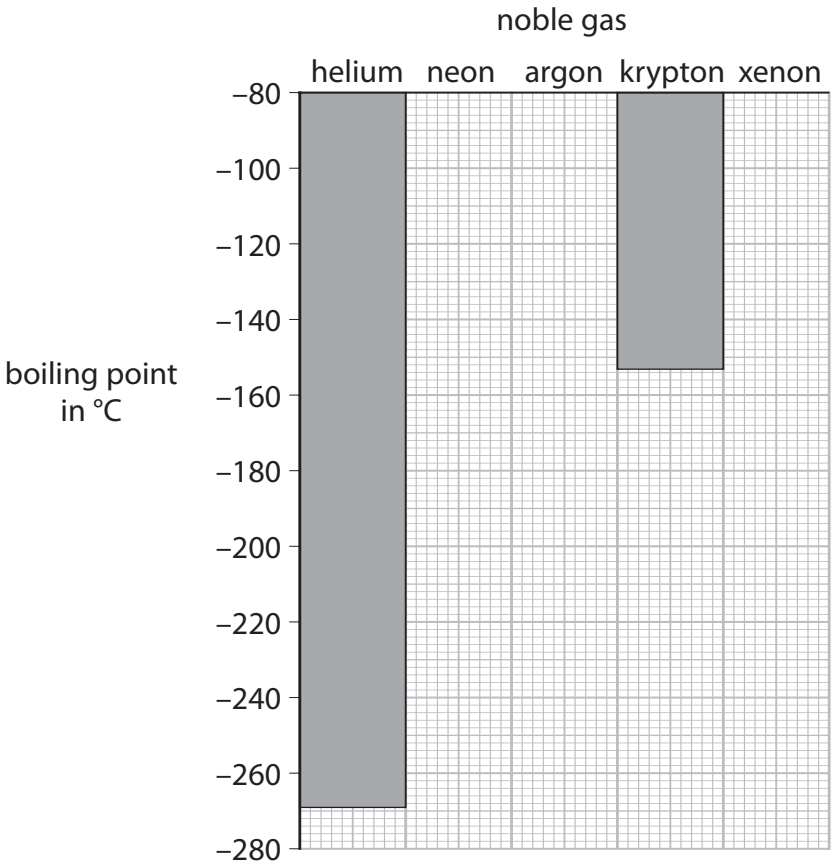
(c) Figure 6 shows the boiling points of some of the noble gases.

noble gas	boiling point in °C
helium	–269
neon	–246
argon	–186
krypton	–153
xenon	

Figure 6

(i) Complete the bar chart to show the boiling points of neon and argon.

(2)



neon bar correct (1)

argon bar correct (1)

(ii) Predict the boiling point of xenon.

(1)

allow any value from -152 to -90

boiling point of xenon = ... °C

(Total for Question 3 = 8 marks)

4 A student carried out some tests on copper sulfate.

(a) A flame test was carried out on some copper sulfate crystals.

The student used the following method.

step 1 dip a wire in hydrochloric acid, then hold the wire in a roaring Bunsen burner flame

step 2 dip the wire in hydrochloric acid again, then dip the wire in the copper sulfate crystals

step 3 hold the wire with the copper sulfate in the roaring Bunsen burner flame.

(i) State why in step 1 the wire is dipped in hydrochloric acid and held in a roaring Bunsen burner flame.

(1)

to clean the wire / to prevent contamination of sample

(ii) State why in step 2 the wire is dipped in hydrochloric acid again before dipping it in the copper sulfate crystals.

(1)

so that the solid vaporises more easily / so that the solid sticks onto thewire

(iii) What colour should be seen when the flame test is carried out on copper sulfate?

(1)

☒ **A** blue-green

☒ **B** lilac

☒ **C** orange-red

☒ **D** yellow

(b) A solution of the copper sulfate was tested in a flame photometer.

(i) Give an advantage of using a flame photometer, rather than a flame test, to test for copper ions.

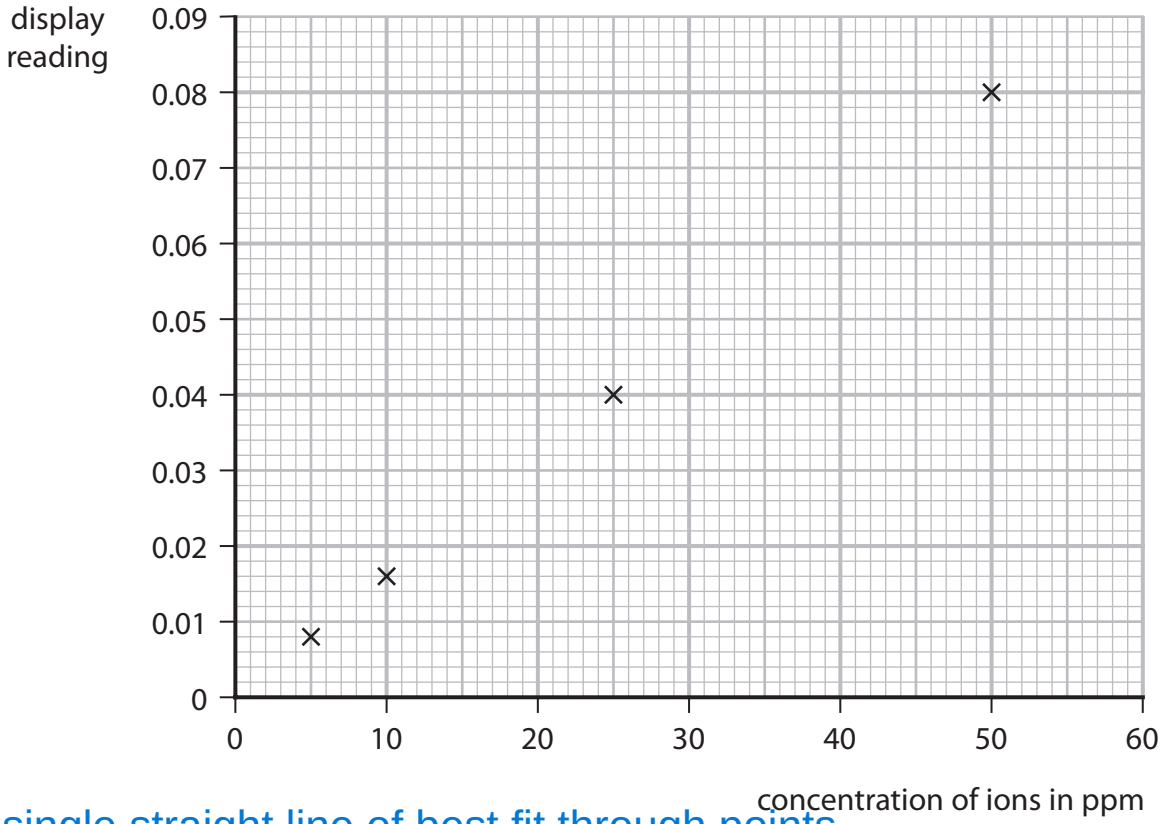
(1)

more {accurate / sensitive / reliable}

(ii) Figure 7 shows some values obtained when producing a calibration graph for copper ions in a flame photometer.

Draw a line of best fit through the points.

(1)



single straight line of best fit through points

Figure 7

(iii) A solution containing copper ions gave a display reading of 0.030.

Use the calibration graph in Figure 7 to find the concentration of copper ions in this solution.

value consistent with candidate's line of best fit **(1)**

concentration of copper ions = ... ppm

(c) The student tested an unknown solution for sulfate ions by

1. adding a few drops of dilute sulfuric acid to the unknown solution
2. then adding a few drops of barium chloride solution.

A white precipitate was formed.

The student cannot conclude from this result that the unknown solution contains sulfate ions.

Explain what the student should change to obtain a valid result.

(2)

An explanation linking

use hydrochloric acid (rather than sulfuric acid) (1)

(as) sulfuric acid contains sulfate ions (1)

(d) Calculate the percentage by mass of copper in copper sulfate, $CuSO_4$.

(relative atomic masses: Cu = 63.5
relative formula mass of $CuSO_4$ = 159.5)

Give your answer to the nearest whole number.

(3)

$\frac{63.5}{159.5}$ (= 0.39811912) (1)

0.398 x 100 (= 39.811912) (1)

40 (1)

percentage by mass of copper = 40

(Total for Question 4 = 11 marks)

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5 Fluorine, chlorine, bromine and iodine are elements in group 7 of the periodic table.

(a) (i) State the name given to the group 7 elements.

(1)

halogens

(ii) Name one other element that is in group 7.
Use the periodic table on the back of this exam paper to help you.

(1)

astatine

(iii) Which element is liquid at room temperature and pressure?

(1)

- ☒ **A** fluorine
- ☒ **B** chlorine
- ☒ **C** bromine
- ☒ **D** iodine

(iv) Which element is dark-grey in colour at room temperature and pressure?

(1)

- ☒ **A** fluorine
- ☒ **B** chlorine
- ☒ **C** bromine
- ☒ **D** iodine

(b) Tin reacts with chlorine to form tin chloride.
A sample of tin chloride contains 1.19 g of tin and 1.42 g of chlorine.

Calculate the empirical formula of this tin chloride.

(relative atomic masses: Cl = 35.5, Sn = 119.0)

You must show your working.

(3)

$\frac{1.19}{119}$ and $\frac{1.42}{35.5}$ (1)

0.01 : 0.04 (1)

SnCl4. (1)

empirical formula of this tin chloride = SnCl4

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(c) Tin also reacts with fluorine.
The reaction between fluorine and tin is much more vigorous than the reaction between chlorine and tin.

Figure 8 shows the electronic configurations of fluorine and chlorine.

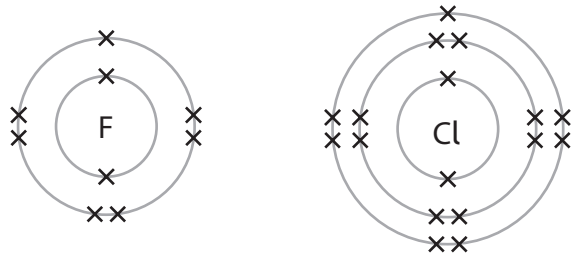

Figure 8

Explain, in terms of their electronic configurations, why fluorine reacts with tin more vigorously than chlorine reacts with tin.

(2)

fluorine has fewer electron shells (1)

(so) electron more easily attracted to nucleus (1)

(Total for Question 5 = 9 marks)

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6 Figure 9 shows a sample of hydrogen peroxide solution decomposing to form water and oxygen gas.

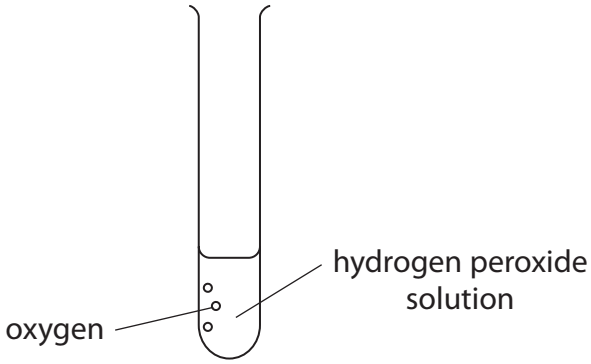

Figure 9

(a) (i) Write the word equation for hydrogen peroxide solution decomposing.

(1)

hydrogen peroxide → water + oxygen

(ii) In this reaction hydrogen peroxide is a solution, water is a liquid and oxygen is a gas.

Draw one straight line from each substance to its correct state symbol.

(2)

substance	**state symbol**
hydrogen peroxide solution	(aq)
liquid water	(g)
oxygen gas	(l)

(b) Describe the test to show the gas produced is oxygen.

(2)

A description to include
glowing splint (1)
relights (1)

(c) Figure 10 shows the electron arrangement for an atom of hydrogen and an atom of oxygen.

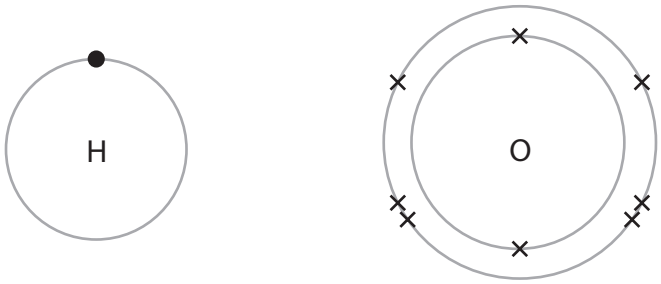

Figure 10

Complete the dot and cross diagram in Figure 11 for a molecule of water, H_2O.

Draw outer shell electrons only.

(2)

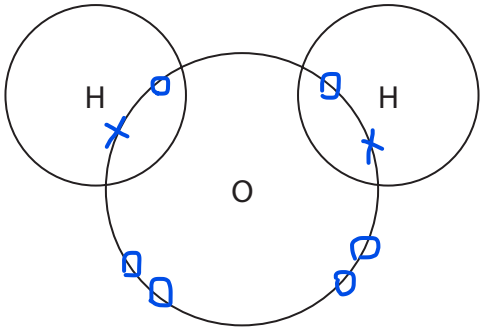

Figure 11

(d) Liver contains the enzyme catalase.

A piece of liver was added to another sample of hydrogen peroxide solution.

Figure 12 shows the results.

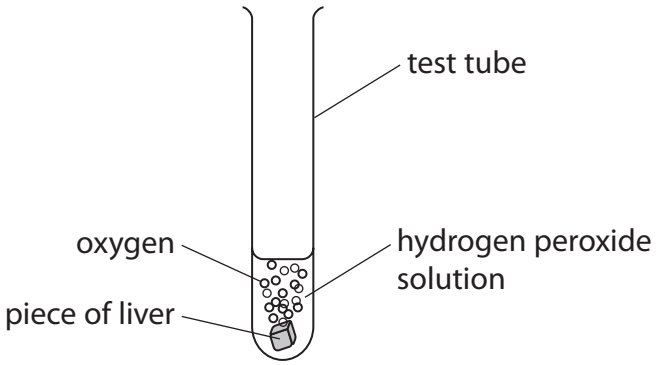

Figure 12

Figure 13 shows a graph of the volume of oxygen produced from the hydrogen peroxide with and without liver.

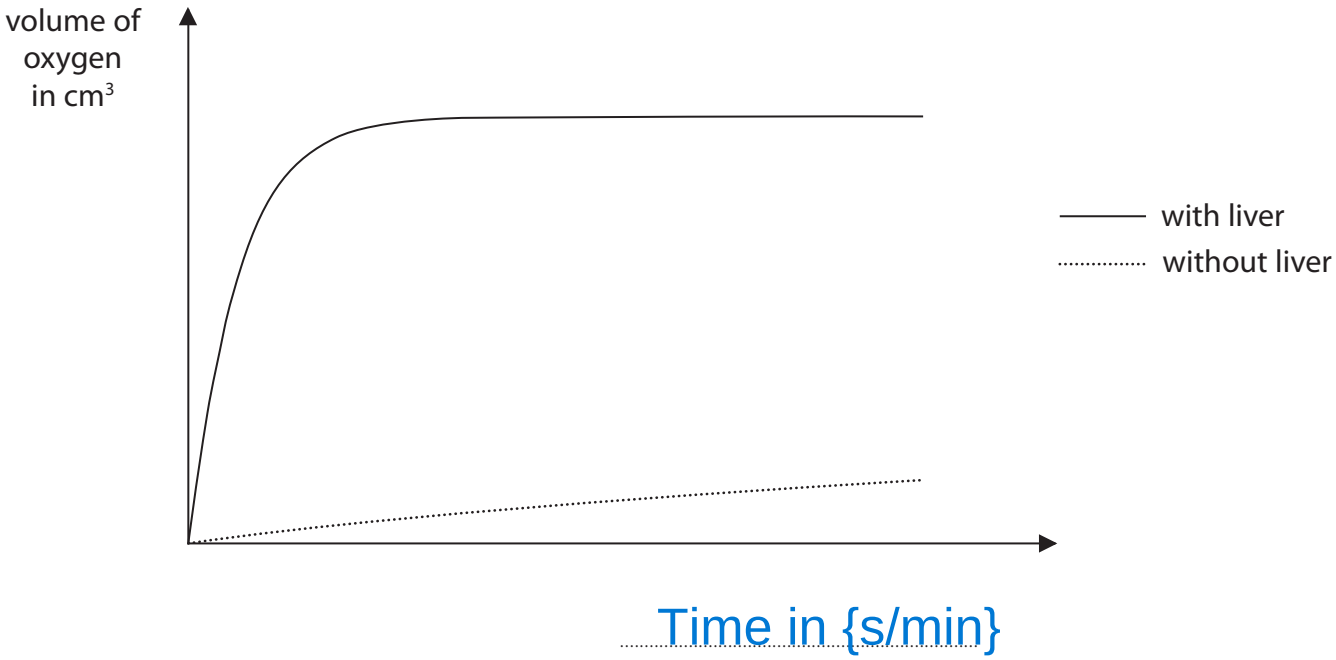

Figure 13

(i) Complete the missing label on the axis of the graph.

(1)

(ii) Describe what the graph shows about the difference in decomposition of hydrogen peroxide with and without liver.

(2)

A description to include

reaction is faster with liver (1)

more {gas/oxygen} produced with liver (1)

(iii) Describe how the apparatus in Figure 12 could be modified to find the volume of gas produced when the liver is added to the hydrogen peroxide.

(2)

A description to include

bung and delivery tube (1)

connected to {a gas syringe / upturned burette / upturned measuring cylinder} (1)

(Total for Question 6 = 12 marks)

7 This question is about alcohols.

(a) (i) Figure 14 shows an incomplete diagram of the structure of a molecule of propanol, $CH_3CH_2CH_2OH$.

Complete the structure of the molecule of propanol in Figure 14.

(2)

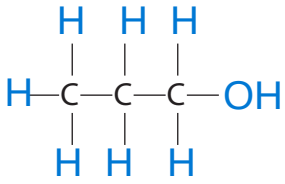

Figure 14

(ii) Propanol can be converted into propanoic acid.

What happens to propanol in this reaction?

(1)

☒ **A** it is dehydrated

☒ **B** it is neutralised

☒ **C** it is oxidised

☒ **D** it is polymerised

(b) A student used an alcohol burner to find the mass of different alcohols needed to raise the temperature of 100 cm^3 of water by 20 °C.

Figure 15 shows their results.

alcohol	initial mass of alcohol burner and alcohol in g	final mass of alcohol burner and alcohol in g	mass of alcohol used in g
ethanol	122.51	122.02	0.49
propanol	168.55	168.13	0.42
butanol	152.62	152.23	
pentanol	67.22	66.86	0.36

Figure 15

(i) Calculate the mass of butanol used.

(1)

0.39 with or without working scores 1 mark
152.62 – 152.23 (= 0.39) (1)

mass of butanol = 0.39 g

*(ii) Figure 16 shows equipment that can be used to obtain the results shown in Figure 15.

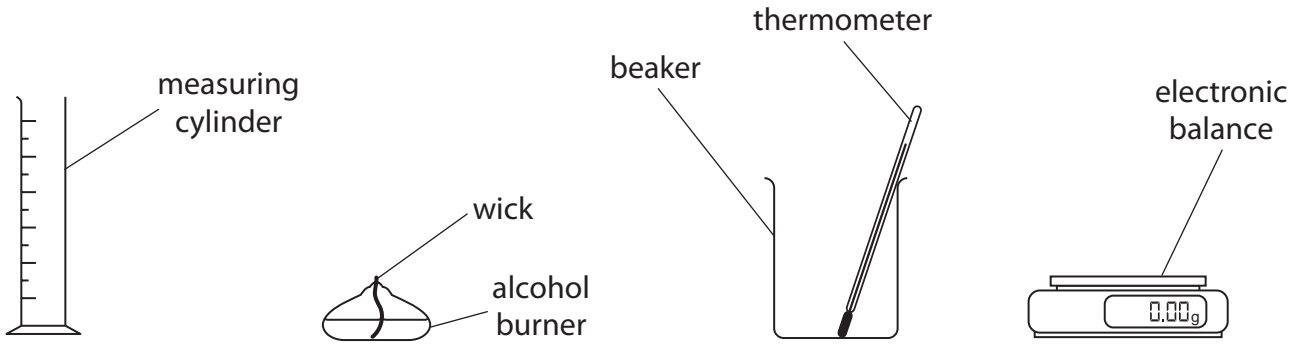

Figure 16

Describe an experiment, using the equipment in Figure 16, that could be used to obtain results like those shown in Figure 15.

(6)

measure 100 cm3 of water into a beaker.
- place the beaker above the burner
- place draft shields around the equipment
- weigh the (alcohol) burner containing the alcohol
- record this mass and the name of the alcohol.
- place a thermometer in the water
- record the initial temperature of the water
- place a lid on beaker
- light the wick.

• heat the water so the temperature rises by 20oC.

• extinguish the flame.
• re-weigh the (alcohol) burner
• subtract final mass from initial mass of burner and alcohol/ calculate the mass of alcohol used.

• repeat with the next alcohol

• using same volume of water
• keep the height of the beaker the same

(iii) The results show that 0.36 g of pentanol was needed to raise the temperature of the water by 20 °C.

Calculate the mass of pentanol needed to raise the temperature of water by 1 °C.

Give your answer to 2 decimal places.

Show your working.

(2)

$\frac{0.36}{20} = (0.018)\ (1)$

0.02 (1)

mass of pentanol = 0.02 g

(Total for Question 7 = 12 marks)

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8 (a) The concentration of a solution can be calculated using the equation

$$\text{concentration of solution} = \frac{\text{mass of solid}}{\text{volume of solution}}$$

A student dissolved 9.25 g of ammonium chloride in water and made up the solution to a volume of 200 cm^3.

Use the equation to calculate the concentration of this solution in g dm^{-3}.

(2)

$\frac{9.25}{200}$ = (0.04625) (1)

0.04625 x 1000 = 46.25 (1)

concentration = 46.25 g dm^{-3}

(b) Dissolving ammonium chloride in water is an endothermic process.
Figure 17 shows part of the reaction profile for this process.

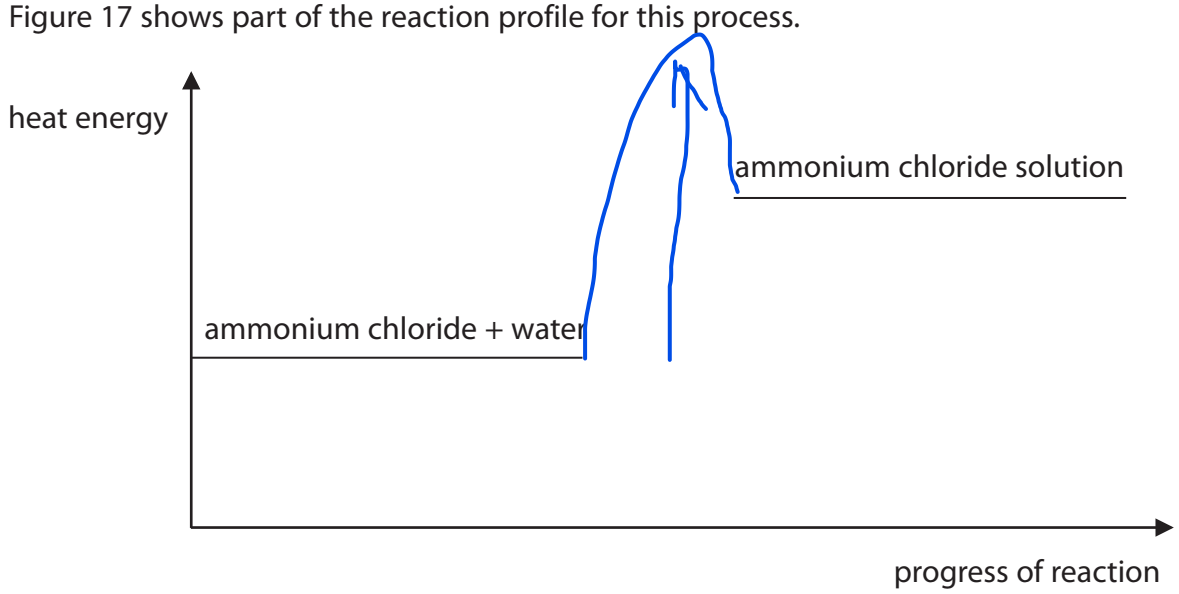

Figure 17

(i) Explain how Figure 17 shows that dissolving ammonium chloride in water is an endothermic process.

(2)

an explanation linking two of:

• {ammonium chloride solution/product} has more energy than {ammonium chloride solid and water/reactant} / ORA (1)

• heat (energy) has increased / energy change is positive (1)

• (therefore) heat energy has been {absorbed/taken in} (1)

(ii) Complete the reaction profile in Figure 17 and label the activation energy.

(2)

(c) A student used the equipment in Figure 18 to investigate whether electricity can pass through solid ammonium chloride and through ammonium chloride solution.

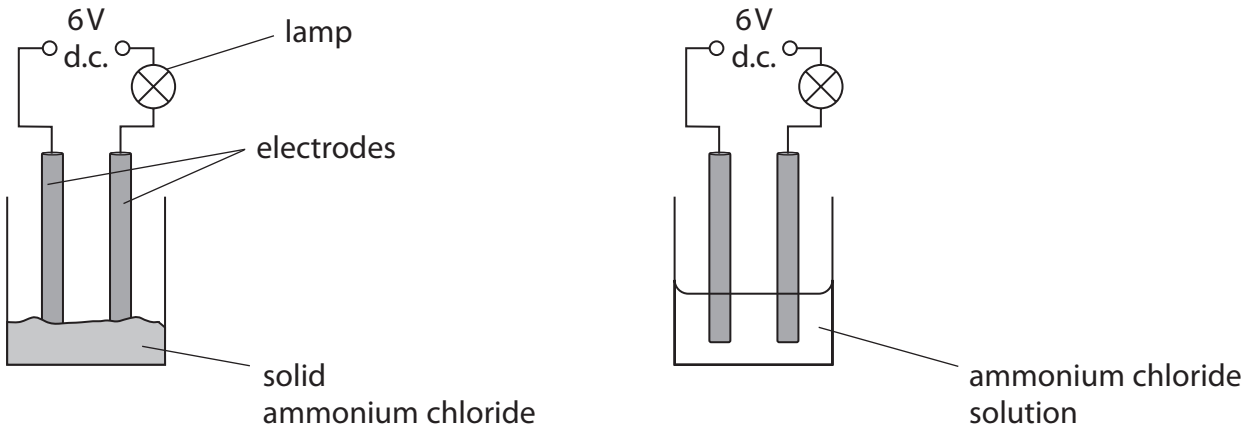

Figure 18

If an electrical current flows in the circuit, the lamp will light up.

Figure 19 shows the results of the investigation.

substance	lamp
solid ammonium chloride	did not light up
ammonium chloride solution	lit up brightly

Figure 19

Explain the results of the investigation.

(3)

An explanation linking

• ammonium chloride solution conducts electricity and solid ammonium chloride does not conduct electricity (1)

• ammonium chloride contains ions (1)

• in solution ions can move / in solid ions cannot move (1)

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(d) Ammonia gas is toxic.

(i) Which symbol should be placed on a container of a toxic gas?

(1)

☒ **A**

☒ **B**

☒ **C**

☒ **D**

(ii) Give **one** safety precaution that should be taken when working with toxic gases in the laboratory.

(1)

use a fume cupboard

(Total for Question 8 = 11 marks)

9 Diesel oil is a mixture of hydrocarbons that can be obtained from crude oil.

(a) State the name of the process used to separate diesel oil from crude oil.

(1)

fractional distillation / fractionation (1)

(b) Diesel oil contains alkanes.
These alkanes are part of an homologous series.

Which statement about compounds in this homologous series is true?

(1)

☒ **A** they have the same chemical formula

☒ **B** they have the same empirical formula

☒ **C** they have the same general formula

☒ **D** they have the same molecular formula

(c) When fuels such as diesel oil are burned, the high temperatures produced can cause nitrogen and oxygen in the air to form the pollutant nitrogen dioxide.

Complete the balanced equation for the reaction.

(2)

$N_2 + 2O_2 \rightarrow$ 2NO2 (2)

(d) Explain how the greenhouse effect is caused by the gases produced by the complete combustion of diesel oil.

(3)

{carbon dioxide / water} produced (1)

• (the gases) absorb heat radiated from earth (1)

re-radiate heat back into the atmosphere (1)

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*(e) Diesel oil can contain impurities of sulfur.
Burning diesel oil containing impurities of sulfur can result in acid rain.
Acid rain is harmful to the environment.

Explain how acid rain is formed and the harm it can do.

(6)

sulfur burns at the same time as the hydrocarbon
- sulfur reacts with oxygen
- sulfur dioxide gas is formed
- sulfur dioxide is an acidic gas
- sulfur dioxide dissolves in clouds
- to form sulfurous acid
- which is then oxidised to form sulfuric acid
- rain water becomes acidic
- acid rain damages buildings / statues
- damages plants/trees
- runs into rivers / waterways
- makes rivers/waterways acidic
- kills fish/insects/waterlife
- increases corrosion of metals

(Total for Question 9 = 13 marks)

10 This question is about polymers.

(a) (i) State a problem with **recycling** polymers.

(1)

need to sort polymers into different types

(ii) Describe a problem associated with the **disposal** of polymers.

(2)

A description to include
- polymers persist in landfill / landfill site fills up too quickly
- polymers degrade very slowly

or
- combustion produces gases
- which may be toxic

(b) Poly(chloroethene) is a polymer made from chloroethene.
A molecule of chloroethene is shown in Figure 20.

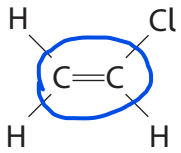


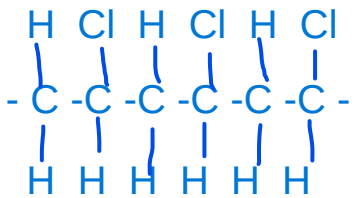
Figure 20

(i) On Figure 20, draw a circle around the functional group in this molecule.

(1)

(ii) Draw a section of a poly(chloroethene) molecule containing three repeating units, showing all bonds.

(3)



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(iii) What type of polymer is poly(chloroethene)?

(1)

addition (polymer)

(iv) Calculate the relative formula mass of a poly(chloroethene) molecule made from 2850 chloroethene molecules, C_2H_3Cl.

(relative atomic masses: H = 1.00, C = 12.0, Cl = 35.5)

Give your answer to three significant figures.

Show your working.

(3)

relative formula mass C2H3Cl = 62.5 (1)

2850 x 62.5 (1) (=178125)

178000 (to 3 sig figs) (1)

relative formula mass = ...

(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.