Write your name here

Surname	Other names

Pearson Edexcel International GCSE (9 - 1)

Centre Number	Candidate Number

Chemistry

Paper 1

Sample Assessment Materials for first teaching September 2017	Paper Reference
Time: 2 hours	**4CH1/1C** **4SD0/1C**

You must have:	Total Marks
Calculator, ruler	

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.
- 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 ☒.

Information

- The total mark for this paper is 110.
- The marks for **each** question are shown in brackets
  – *use this as a guide as to how much time to spend on each question.*

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

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
[223] **Fr** francium 87	[226] **Ra** radium 88	[227] **Ac*** actinium 89	[261] **Rf** rutherfordium 104	[262] **Db** dubnium 105	[266] **Sg** seaborgium 106	[264] **Bh** bohrium 107	[277] **Hs** hassium 108	[268] **Mt** meitnerium 109	[271] **Ds** darmstadtium 110	[272] **Rg** roentgenium 111	Elements with atomic numbers 112-116 have been reported but not fully authenticated						

Key

relative atomic mass
atomic symbol
name
atomic (proton) number

**** The lanthanoids (atomic numbers 58-71) and the actinoids (atomic numbers 90-103) have been omitted.***

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

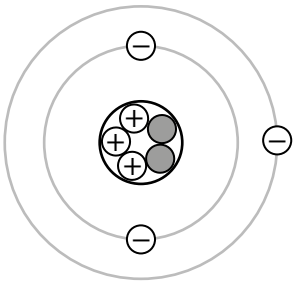
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Answer ALL questions. Write your answers in the spaces provided.

1 The diagram shows the structure of an atom.



(a) Name the central part of an atom.

(1)

.....

(b) Name the positively charged particles in an atom.

(1)

.....

(c) State how the diagram shows that this atom is neutral.

(1)

.....

.....

(d) Give the mass number of this atom.

(1)

.....

(e) Give the name of the element containing this atom.
Use the Periodic Table to help you.

(1)

.....

(Total for Question 1 = 5 marks)

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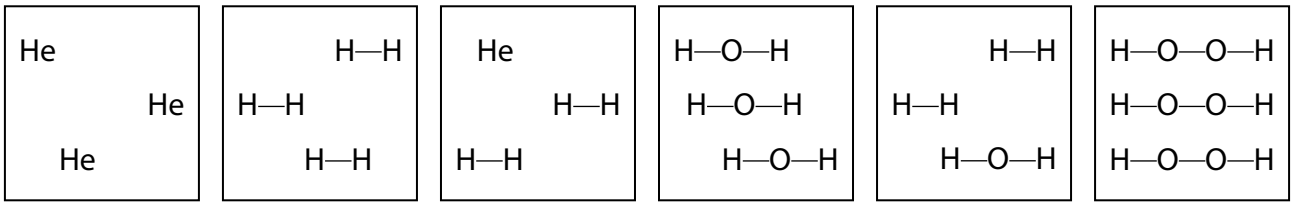
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2 Substances can be classified as elements, compounds or mixtures.

(a) Each of the boxes in the diagram represents either an element, a compound or a mixture.



box 1 box 2 box 3 box 4 box 5 box 6

(i) Explain which **two** boxes represent an element.

(2)

.....

.....

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.....

(ii) Explain which **two** boxes represent a mixture.

(2)

.....

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(b) The list gives the names of some methods used in the separation of mixtures:

- chromatography
- crystallisation
- distillation
- filtration

Use names from the list to choose a suitable method for each separation.

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

(i) Separating water from sodium chloride solution.

(1)

.....

(ii) Separating the blue dye from a mixture of blue and red dyes.

(1)

.....

(iii) Separating potassium nitrate from potassium nitrate solution.

(1)

.....

(Total for Question 2 = 7 marks)

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3 Ammonium chloride decomposes in a reversible reaction. The equation for this reaction is

$$NH_4Cl(s) \rightleftharpoons NH_3(g) + HCl(g)$$

(a) State how the equation shows that the reaction is reversible.

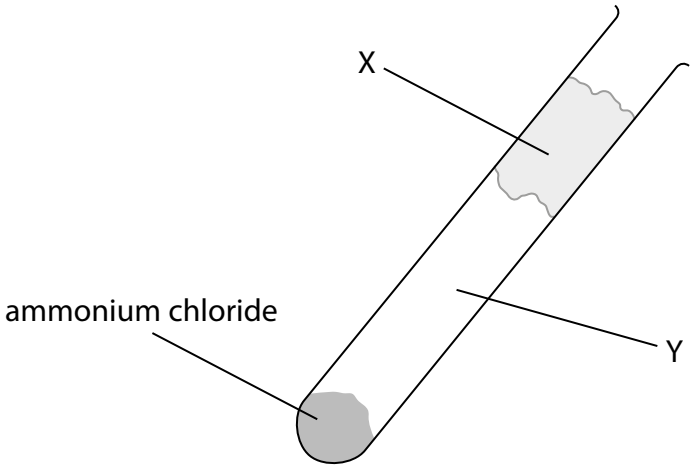
(1)

.....

.....

(b) Some ammonium chloride is heated gently in a test tube.

The diagram shows the test tube after it has been heated gently for a short time.



(i) Identify solid **X** and the two gases formed in region **Y** of the test tube.

(2)

Solid **X** .....

Gases in region **Y** .....

.....

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(ii) Which change of state occurs in the test tube during heating?

(1)

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

(c) An experiment involving ammonium chloride can be used to show the process of diffusion.

The diagram shows the apparatus at the start of the experiment.



At the end of the experiment, a white solid forms in the test tube.

Explain which position, **A**, **B** or **C**, shows where the white solid forms.

(3)

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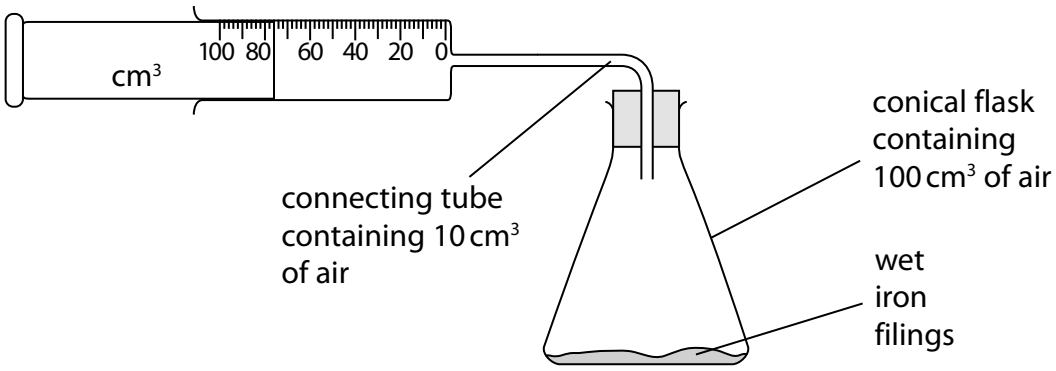
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(Total for Question 3 = 7 marks)

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4 The percentage by volume of oxygen in air can be found by using the rusting of iron.

A student sets up this apparatus to measure the volume of oxygen in a sample of air.

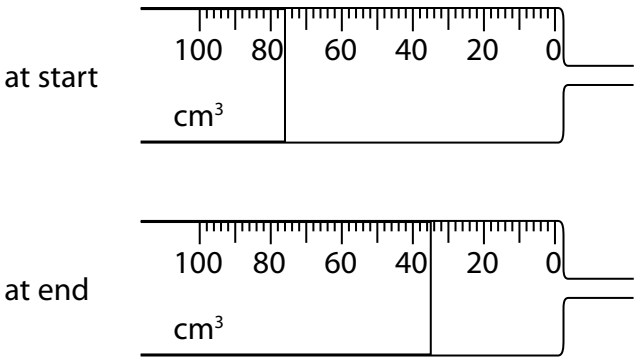


An excess of wet iron filings is used.

At the start of each experiment, the reading on the syringe is recorded and the apparatus is then left for a week so that the reaction is complete.

The reading on the syringe is then recorded again.

(a) The diagram shows the readings in one experiment.



Complete the table to show:

- the syringe reading at the end of this experiment
- the volume of oxygen used in the experiment.

(2)

syringe reading at start / cm^3	76
syringe reading at end / cm^3	
volume of oxygen used / cm^3	

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(b) The table shows the results recorded by a different student in her experiment.

volume of air in conical flask / cm^3	100
volume of air in connecting tube / cm^3	10
original volume of air in syringe / cm^3	80
final volume of air in syringe / cm^3	43

Calculate the percentage of oxygen in air using these results.

(3)

percentage of oxygen = ... %

(c) The table shows some possible causes of anomalous results in this experiment.

Use terms from the box to complete the table, showing possible causes and their effects on the volume of oxygen used in this experiment.

decreased	increased	no effect

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

(3)

Possible cause	Effect on volume of oxygen used
wet iron filings not in excess	
apparatus left for 1 hour instead of 1 week	
apparatus left in a warmer place for 1 week	

(Total for Question 4 = 8 marks)

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5 A metal is added to copper(II) sulfate solution.

A displacement reaction only occurs if the metal added is more reactive than copper.

metal + copper(II) sulfate → metal sulfate + copper

Displacement reactions are exothermic. The more reactive the metal added, the greater the temperature rise.

A student uses the following method in an experiment to compare the reactivities of different metals:

- pour some copper(II) sulfate solution into a boiling tube and record its temperature using a thermometer
- add some metal to the tube and stir with the thermometer
- record the maximum temperature of the contents of the tube.

He repeats the method using the same amount, in moles, of different metals.

(a) To make the experiment valid, he starts with the copper(II) sulfate solution and the added metal at the same temperature.

State **two** other variables that must be controlled if the experiment is to be valid.

(2)

1 .....

.....

2 .....

.....

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(b) Another student uses the same method three times for each of the metals **E**, **F**, **G** and **H**. The table shows her results for these metals.

Metal	Temperature increase / °C			Mean temperature increase / °C
	1	2	3	
E	7.0	4.0	8.0	7.5
F	0.0	0.0	0.0	0.0
G	6.0	5.0	5.4	
H	5.5	11.0	12.0	

(i) The student calculates the mean temperature increase for metals **E** and **F**. She does not include anomalous values in her calculations.

Calculate the mean temperature increase for metals **G** and **H**, ignoring any anomalous values. Write your answers in the table.

(2)

(ii) Explain which metal is the most reactive.

(2)

.....

.....

(iii) Explain which metal is less reactive than copper.

(2)

.....

.....

(Total for Question 5 = 8 marks)

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6 This question is about the elements in Group 1 of the Periodic Table and their reactions with water.

(a) State why sodium and potassium are in Group 1 of the Periodic Table.

(1)

.....

.....

(b) A reaction occurs when a small piece of sodium is added to a large volume of water in a trough.

(i) Give **two** observations that you would make during this reaction.

(2)

1 .....

.....

2 .....

.....

(ii) After the reaction has finished, a few drops of universal indicator are added to the solution in the trough.

Explain the final colour of the universal indicator.

(2)

.....

.....

.....

(iii) What is the most likely pH value of the solution in the trough after the reaction is complete?

(1)

☒ **A** 2

☒ **B** 5

☒ **C** 8

☒ **D** 12

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(c) Give the name of a Group 1 metal that is less reactive than sodium.

(1)

.....

(d) A small piece of potassium is added to a large volume of water in a trough.

Give **one** observation that is made when potassium is added to water that is **not** made when sodium is added to water.

(1)

.....

.....

(e) Complete the equation for the reaction of rubidium with water.
State symbols are not required.

(1)

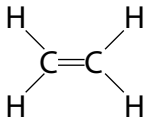
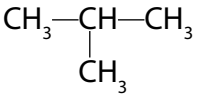
.....Rb + ...H_2O → .....RbOH + ...H_2

(Total for Question 6 = 9 marks)

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7 This question is about hydrocarbons.

(a) The table shows the formulae of some hydrocarbons.

A CH_4	**B** 	**C** $CH_3—CH_2—CH_3$
D 	**E** $CH_3CH{=}CH_2$	**F** $CH_3CH_2CH_2CH_3$

(i) Give the letters that represent hydrocarbons with the general formula C_nH_{2n}

(1)

.....

.....

(ii) State why **B** is the only hydrocarbon shown as a displayed formula.

(1)

.....

(iii) Explain which **two** letters represent isomers.

(3)

.....

.....

.....

.....

(iv) How many of the hydrocarbons are members of the homologous series of alkanes?

(1)

.....

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(b) Many hydrocarbons are used as fuels. There are problems associated with this use.

(i) Explain how the combustion of a hydrocarbon can lead to the formation of a poisonous gas.

(2)

(ii) State why this gas is poisonous to humans.

(1)

(c) Fuels used in cars often have sulfur compounds removed.

Explain how the combustion of these fuels in car engines still leads to the formation of acid rain.

(4)

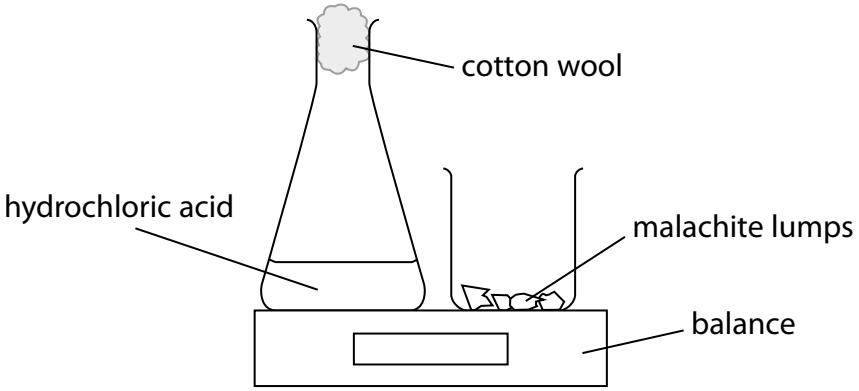
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8 The copper(II) carbonate in the mineral, malachite, reacts with hydrochloric acid according to this equation.

$$CuCO_3(s) + 2HCl(aq) \rightarrow CuCl_2(aq) + H_2O(g) + CO_2(g)$$

Some students investigate the effect of changing the concentration of acid on the rate of this reaction. The diagram shows the apparatus they use.



This is the method they use:

- set the balance to zero
- add an excess of malachite lumps to the conical flask and replace the cotton wool
- start a timer and record the balance reading after one minute.

The experiment is repeated using different concentrations of hydrochloric acid. The mass and number of malachite lumps are kept the same in each experiment.

(a) The table shows the results obtained in one series of experiments.

concentration of hydrochloric acid / mol/dm^3	0.6	0.8	1.0	1.6	1.8	2.0
balance reading / g	−0.20	−0.27	−0.44	−0.54	−0.60	−0.67

State why the balance readings have negative values.

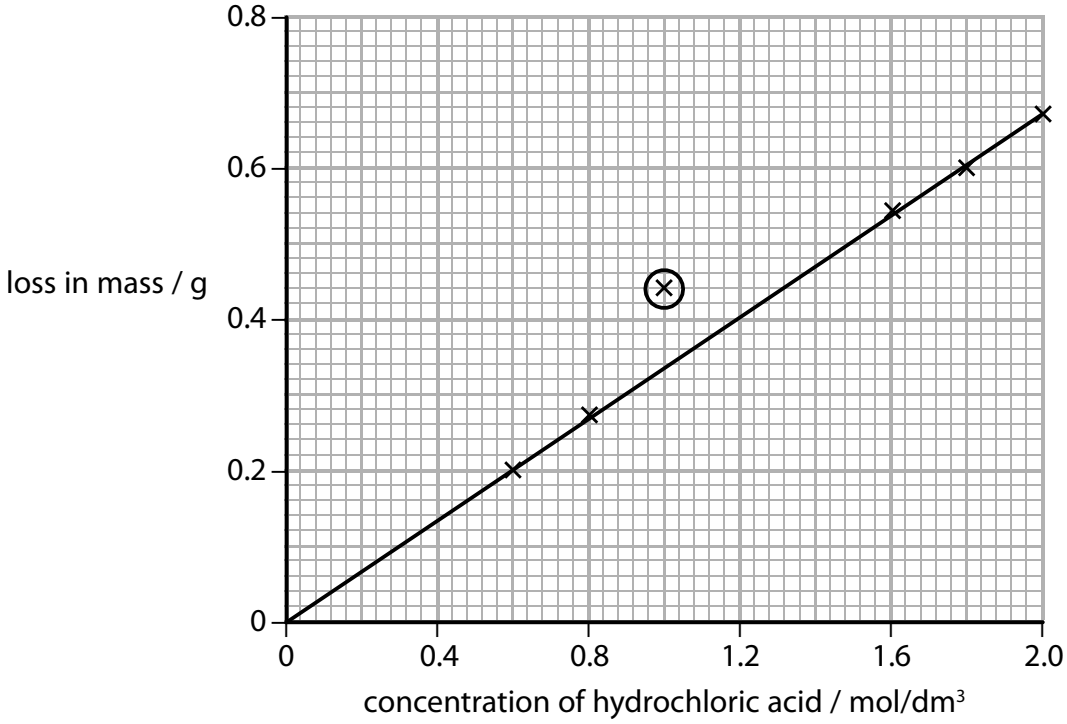
(1)

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(b) The graph shows the results of this series of experiments.



The circled point indicates an anomalous result.

(i) Suggest **one** mistake the students could have made to produce this result.

(1)

.....

(ii) State the relationship shown by the graph.

(1)

.....

.....

(c) Explain why an increase in the concentration of the acid causes an increase in the rate of the reaction. You should use the particle collision theory in your answer.

(2)

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(Total for Question 8 = 5 marks)

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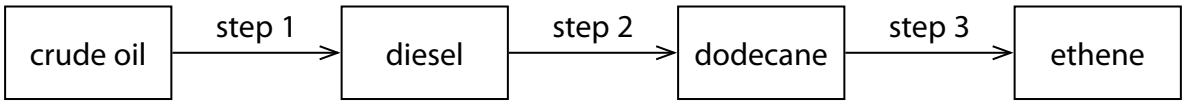
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9 The flow chart shows how ethene can be obtained industrially from crude oil.



(a) Step 1 involves the use of a tall column.

Describe how the diesel fraction is obtained from the crude oil in step 1.

(5)

(b) In step 2, saturated compounds such as dodecane are obtained from the mixture of hydrocarbons in the diesel fraction.

Explain why dodecane is described as a **saturated hydrocarbon**.

(3)

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(c) Which of these formulae is that of an alkane?

(1)

☒ **A** C_7H_{12}

☒ **B** C_9H_{18}

☒ **C** $C_{11}H_{24}$

☒ **D** $C_{13}H_{30}$

(d) In step 3, cracking is used to convert alkanes into alkenes.

Complete the equation to show the reaction in which one molecule of dodecane is converted into two molecules of ethene and one molecule of another hydrocarbon.

(1)

$$C_{12}H_{26} \rightarrow 2C_2H_4 + \text{.....}$$

(e) Alkanes and alkenes both react with halogens, but in different ways.
The equations for two examples of these different reactions are shown.

equation 1 $C_2H_6 + Cl_2 \rightarrow C_2H_5Cl$ + compound X

equation 2 $C_2H_4 + Br_2 \rightarrow C_2H_4Br_2$

(i) State the condition needed for the reaction in equation 1 to occur.

(1)

.....

(ii) Deduce the formula of compound X.

(1)

.....

(iii) Draw a dot-and-cross diagram to represent a molecule of C_2H_5Cl

Show only the outer electrons of each atom.

(2)

(iv) Equation 2 shows an example of an addition reaction.

State the type of reaction shown by equation 1.

(1)

.....

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(f) Alkenes can be distinguished from alkanes using bromine water.

(i) What colour change occurs in the reaction between propene and bromine water?

(1)

☒ **A** colourless to orange

☒ **B** colourless to green

☒ **C** green to colourless

☒ **D** orange to colourless

(ii) A compound formed in the reaction between propene and bromine water has the percentage composition by mass

C = 25.9%, H = 5.0%, Br = 57.6% and O = 11.5%

Calculate the empirical formula of this compound.

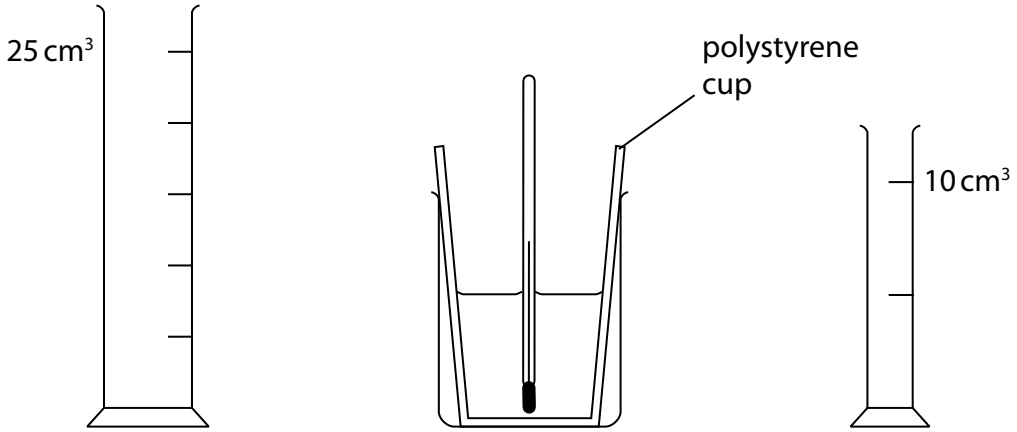
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empirical formula = ...

(Total for Question 9 = 19 marks)

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10 When aqueous solutions of potassium hydroxide and nitric acid are mixed together, an exothermic reaction occurs. The diagram shows the apparatus used in an experiment to measure the temperature increase.



This is the student's method;

- use the larger measuring cylinder to add 25 cm^3 of aqueous potassium hydroxide to the polystyrene cup
- record the steady temperature
- use the smaller measuring cylinder to add 5 cm^3 of dilute nitric acid to the cup, stir the mixture with the thermometer
- record the highest temperature of the mixture
- continue adding further 5 cm^3 portions of dilute nitric acid to the cup, stirring and recording the temperature, until a total volume of 35 cm^3 has been added.

(a) A teacher advises the student to use a 50 cm^3 burette instead of the 10 cm^3 measuring cylinder.

Suggest **two** reasons why it would be better to use a burette instead of a measuring cylinder to add the acid in this experiment.

(2)

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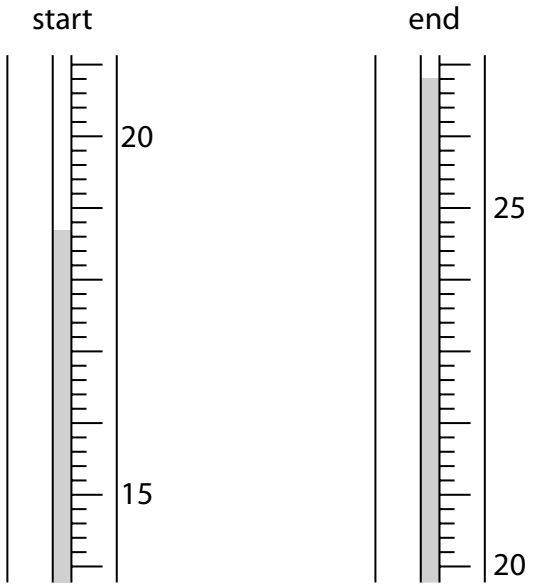
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(b) The diagram shows the thermometer readings at the start and at the end of one experiment.



Complete the table to show:

- the thermometer reading at the start of the experiment
- the temperature rise in the experiment.

(2)

thermometer reading at end / °C	26.8
thermometer reading at start / °C	
thermometer rise / °C	

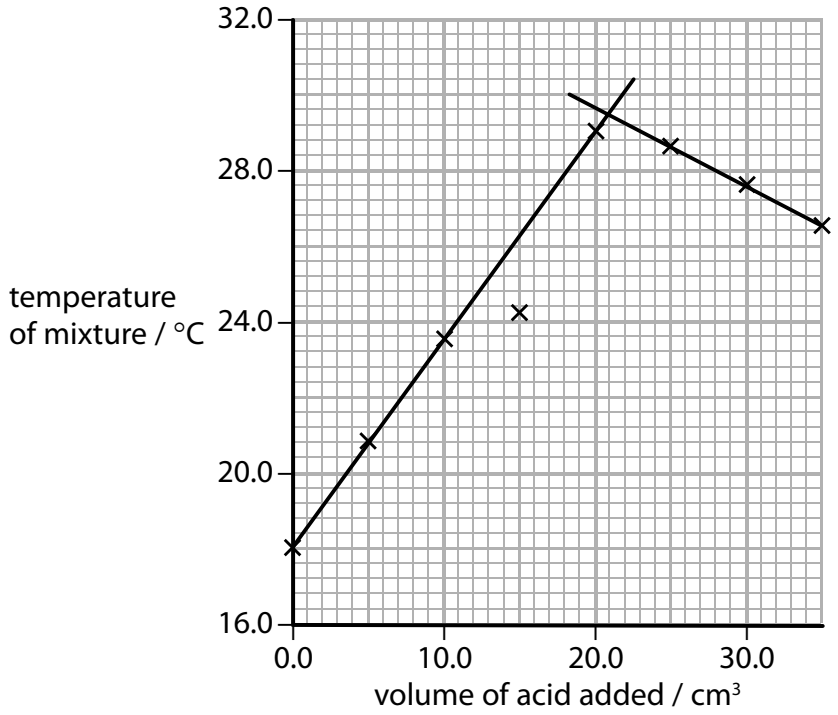
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(c) Another student uses the same method, adding the dilute nitric acid from a burette.

The table shows his results.

volume of acid added / cm^3	0.0	5.0	10.0	15.0	20.0	25.0	30.0	35.0
temperature of mixture / °C	18.0	20.8	23.5	24.2	29.0	28.6	27.6	26.5

This is the student's graph.



The point where the lines cross represents complete neutralisation.

(i) Identify the maximum temperature reached during the experiment.

(1)

maximum temperature = ... °C

(ii) Identify the volume of dilute nitric acid that exactly neutralises the 25 cm^3 of aqueous potassium hydroxide.

(1)

volume = ... cm^3

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(d) Another student records these results.

volume of aqueous potassium hydroxide = 20.0 cm^3

starting temperature of aqueous potassium hydroxide = 18.5 °C

maximum temperature of mixture = 30.0 °C

volume of dilute nitric acid = 20.0 cm^3

Calculate the heat energy released in this experiment.

c = 4.2 J/g / °C

mass of 1 cm^3 of mixture = 1 g

(4)

heat energy = ... J

(e) In another experiment, the heat energy released is 1600 J when 0.040 mol of potassium hydroxide is neutralised.

Calculate the value of ΔH, in kJ/mol, for the neutralisation of potassium hydroxide.

(2)

ΔH = ... kJ/mol

(Total for Question 10 = 12 marks)

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11 Many different salts can be prepared from acids.

(a) The table shows the reactants used in two salt preparations.

Complete the table to show the name of the salt formed and the other product(s) in each case.

(4)

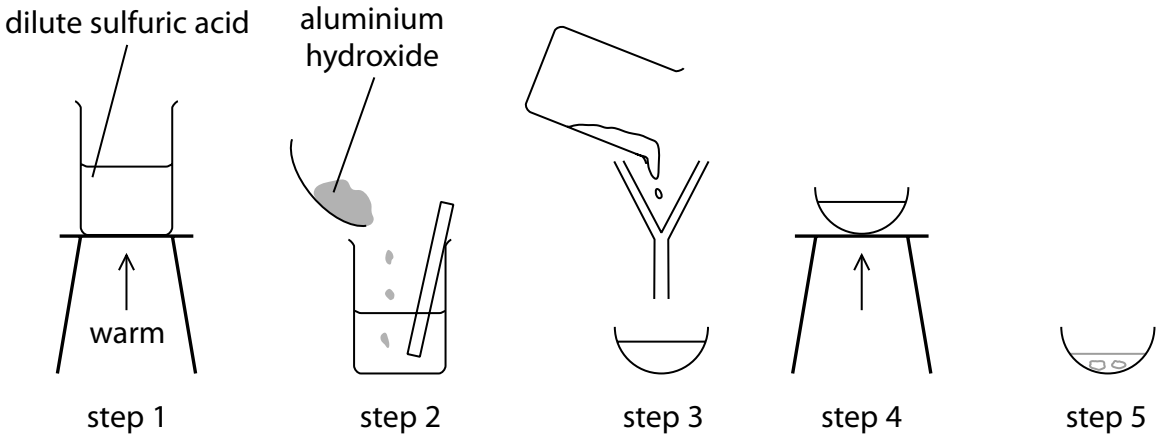
Reactants	Name of salt formed	Other product(s)
zinc + hydrochloric acid		
calcium carbonate + nitric acid		

(b) A student uses the reaction between aluminium hydroxide and dilute sulfuric acid to prepare a pure, dry sample of aluminium sulfate crystals.

The equation for the reaction used to prepare this salt is

$$2Al(OH)_3 + 3H_2SO_4 \rightarrow Al_2(SO_4)_3 + 6H_2O$$

The diagram shows the steps in the student's method.



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(i) State **two** ways to make sure that all the acid is reacted in step 2.

(2)

1 .....

.....

2 .....

.....

(ii) State the purpose of filtration in step 3.

(1)

.....

.....

(iii) In step 5, the basin is left to cool to room temperature to allow crystals of aluminium sulfate to form.

State **one** method of drying these crystals.

(1)

.....

.....

(c) The student records this information about the reagents she uses in her preparation.

mass of aluminium hydroxide = 3.9 g

amount of sulfuric acid = 0.090 mol

Determine which reagent is in excess, making use of this information and the equation in part (b).

(3)

reagent used in excess = ...

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(d) Another student prepares 0.25 mol of aluminium sulfate. The formula of aluminium sulfate is $Al_2(SO_4)_3$

Calculate the mass of aluminium sulfate prepared.

(3)

mass = ... g

(e) The equation for another reaction used to prepare a sample of a salt is

$$PbO + 2HNO_3 \rightarrow Pb(NO_3)_2 + H_2O$$

In one experiment, the amount of lead(II) oxide used was 0.75 mol and the amount of nitric acid used was 1.5 mol. At the end of the experiment, the mass of lead(II) nitrate obtained was 209 g.

Calculate the percentage yield of lead(II) nitrate in this experiment.

[M_r of lead(II) nitrate = 331]

(3)

percentage yield = ... %

(Total for Question 11 = 17 marks)

TOTAL FOR PAPER = 110 MARKS

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