

Please check the examination details below before entering your candidate information

Candidate surname

Other names

Pearson Edexcel
International GCSE (9–1)

Centre Number

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Candidate Number

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Thursday 14 May 2020

Morning (Time: 2 hours)

Paper Reference **4CH1/1CR 4SD0/1CR**

Chemistry

Unit: 4CH1

Science (Double Award) 4SD0

Paper: 1CR

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.*
- Show all the steps in any calculations and state the units.
- 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.
- Write your answers neatly and in good English.
- Try to answer every question.
- Check your answers if you have time at the end.

Turn over ►

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The Periodic Table of the Elements

1	2	3	4	5	6	7	0	
7 Li lithium 3	9 Be beryllium 4	11 Na sodium 11	12 C carbon 6	13 Al aluminium 13	14 N nitrogen 7	15 O oxygen 8	16 F fluorine 9	17 Ne neon 10
19 K potassium 19	20 Ca calcium 20	23 Na sodium 11	24 Mg magnesium 12	27 Co cobalt 27	28 Ni nickel 28	29 Cu copper 29	30 Zn zinc 30	35 Br bromine 35
37 Rb rubidium 37	38 Sr strontium 38	39 Y yttrium 39	40 Zr zirconium 40	41 Nb niobium 41	42 Mo molybdenum 42	43 Tc technetium 43	44 Ru ruthenium 44	45 Rh rhodium 45
55 Cs caesium 55	56 Ba barium 56	57 La* lanthanum 57	72 Hf hafnium 72	73 Ta tantalum 73	74 W tungsten 74	75 Re rhenium 75	76 Os osmium 76	77 Ir iridium 77
87 Fr francium 87	88 Ra radium 88	89 Ac* actinium 89	104 Rf rutherfordium 104	105 Db dubnium 105	106 Sg seaborgium 106	107 Bh bohrium 107	108 Hs hassium 108	109 Mt meitnerium 109
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
199 U uranium 92	201 Pb lead 82	208 Po polonium 84	209 Bi bismuth 83	210 At astatine 85	211 Rn radon 86	212 Ac actinium 87	213 Th thorium 88	214 Pa protactinium 89
223 Fr francium 87	226 Ra radium 88	227 Ac* actinium 89	261 Rf rutherfordium 104	262 Db dubnium 105	266 Sg seaborgium 106	268 Mt meitnerium 109	271 Ds darmstadtium 110	272 Rg roentgenium 111
285 Og oganesson 118	286 Lv livermorium 116	287 Ts tennessine 115	288 Fl flerovium 114	289 Mc moscovium 113	290 Lr lawrencium 103	291 Uu ununoctium 118	292 Uub unubium 116	293 Uuq unquincium 117
294 Uub unubium 116	295 Uuq unquincium 117	296 Uuq unquincium 117	297 Uuq unquincium 117	298 Uuq unquincium 117	299 Uuq unquincium 117	300 Uuq unquincium 117	301 Uuq unquincium 117	302 Uuq unquincium 117
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Answer ALL questions.

- 1 (a) The box gives some methods used in the separation of mixtures.

chromatography	crystallisation	evaporation
filtration	fractional distillation	simple distillation

Use words from the box to answer these questions.

- (i) Identify the method used to obtain pure water from sea water. (1)

- (ii) Identify the method used to separate the dyes in a food colouring. (1)

- (iii) Identify the method used to obtain ethanol from a mixture of ethanol and water. (1)

- (b) Complete the sentences by writing a suitable word in each blank space. (3)

When salt is added to water and stirred until no more will , a saturated solution forms.

The salt is the

The water is the

(Total for Question 1 = 6 marks)



2 The diagram shows the positions of some elements in the Periodic Table.

1	2											3	4	5	6	7	0
																	He
																F	
Na																Cl	
K																Br	

(a) Use symbols from this table to answer these questions.

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

(i) Give the symbol of a metal.

(1)

(ii) Give the symbol of a noble gas.

(1)

(iii) Give the symbol of a liquid at room temperature.

(1)

(iv) Give the symbols of the two elements in Period 3

(1)

..... and

(b) Deduce the electronic configuration of Na

(1)

(Total for Question 2 = 5 marks)



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3 This question is about alkenes and alkanes.

(a) Complete the table by giving the missing information about the alkene with the molecular formula C_3H_6

(4)

Molecular formula	C_3H_6
Name	
Empirical formula	
General formula	
Displayed formula	

(b) Alkenes are unsaturated compounds.

(i) State what is meant by the term **unsaturated**.

(1)

.....

.....

(ii) Describe a test to show that a compound is unsaturated.

(2)

.....

.....

.....

.....



(c) When the alkane methane reacts with chlorine, the products are chloromethane (CH_3Cl) and hydrogen chloride gas.

(i) Give a chemical equation for this reaction. (1)

(ii) What is the name of this type of reaction? (1)

- A addition
- B decomposition
- C neutralisation
- D substitution

(iii) State the condition needed for this reaction to occur. (1)



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(d) When ethane reacts with chlorine, one of the products of the reaction has the formula $C_2H_4Cl_2$

There are two isomers with this formula.

(i) State what is meant by the term **isomers**.

(2)

.....

.....

.....

.....

(ii) Draw the displayed formulae of the two isomers with the formula $C_2H_4Cl_2$

(2)

isomer 1	isomer 2

(Total for Question 3 = 14 marks)



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- 4 A solution of hydrogen peroxide decomposes when a catalyst of manganese(IV) oxide is added.

The products of the reaction are water and oxygen.

- (a) Complete the chemical equation for this reaction.

(1)



- (b) Give a test for oxygen.

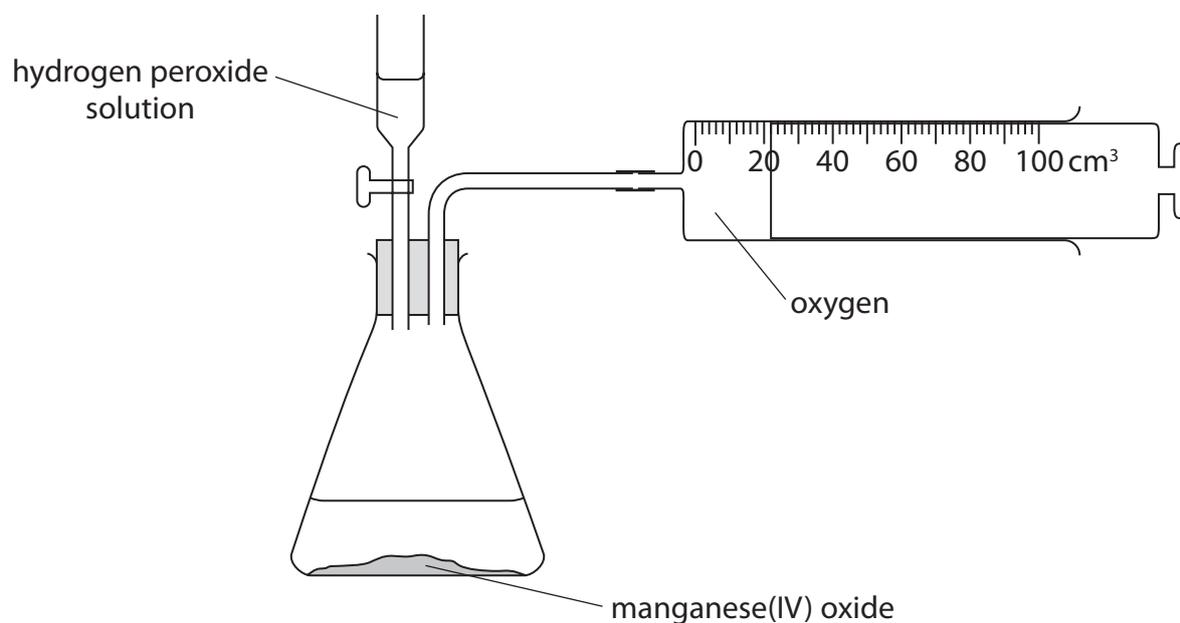
(1)

- (c) State the reason for adding a catalyst.

(1)

- (d) A student investigates how changing the concentration of the hydrogen peroxide solution affects the rate of this reaction.

She uses this apparatus.

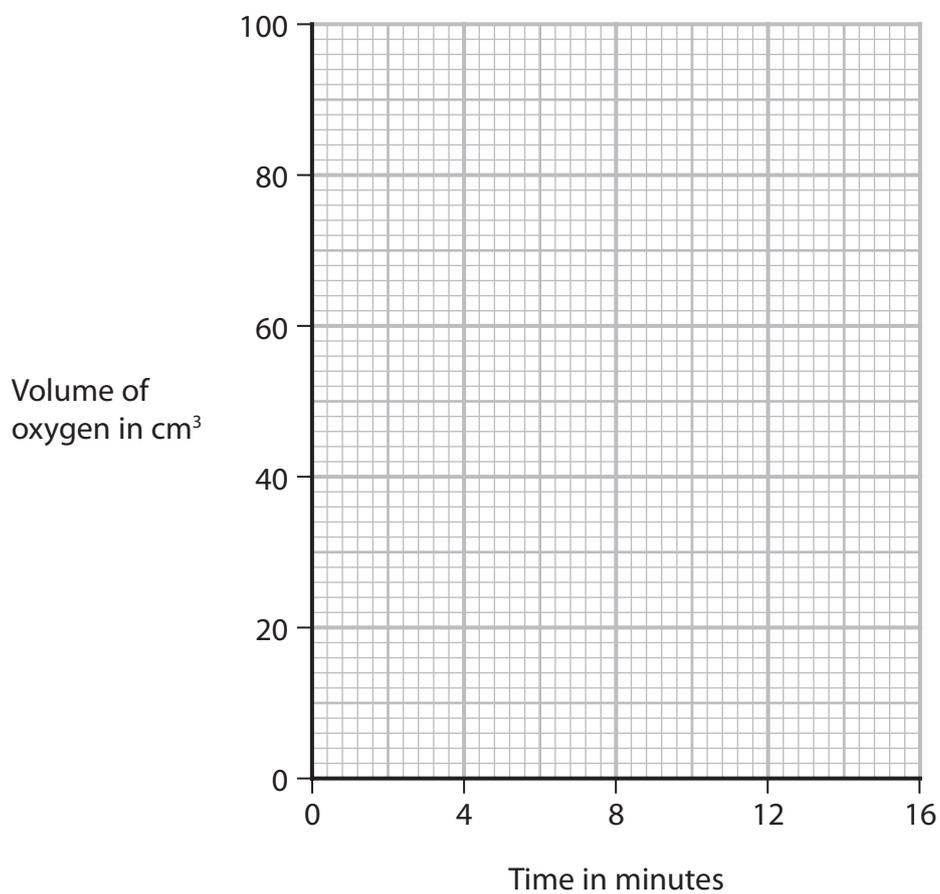


The student records the volume of oxygen that collects every 2 minutes for 16 minutes.

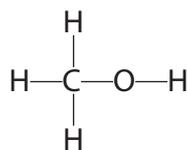
The table shows her results.

Time in minutes	0	2	4	6	8	10	12	14	16
Volume of oxygen in cm^3	0	22	38	50	55	69	76	80	80

- (i) Plot the student's results on the grid. (1)
- (ii) Draw a circle on the grid around the anomalous result. (1)
- (iii) Draw a curve of best fit through the points, ignoring the anomalous result. (1)



5 (a) The diagram shows the displayed formula of the organic compound methanol, CH₃OH



(i) Determine the number of atoms in one molecule of methanol. (1)

(ii) State why methanol is not a hydrocarbon. (1)

(b) The atoms in methanol are held together by covalent bonds.

(i) State what is meant by the term **covalent bond**. (2)

(ii) Draw a dot-and-cross diagram to show the bonding in a molecule of methanol.
Show only the outer electrons of each atom. (2)



(c) Another organic compound has the percentage composition by mass

$$C = 38.7\% \quad H = 9.7\% \quad O = 51.6\%$$

(i) Calculate the empirical formula of this compound.

(3)

empirical formula =

(ii) The relative molecular mass (M_r) of the compound is 62

Determine the molecular formula of the compound.

(2)

molecular formula =

(Total for Question 5 = 11 marks)

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6 This question is about elements in Group 7 of the Periodic Table and their compounds.

(a) (i) Give the name of this group of elements. (1)

.....

(ii) State the colour of chlorine gas. (1)

.....

(iii) Give a test for chlorine gas. (2)

.....

.....

.....

.....

(b) Give a test to show that a solution contains iodide ions. (3)

test

.....

.....

.....

result

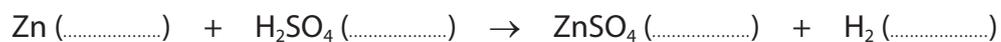
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7 A student uses the reaction between zinc and dilute sulfuric acid to prepare some zinc sulfate crystals.

- (a) (i) Complete the equation for this reaction by giving the correct state symbols. (1)



- (ii) State what would be observed during this reaction. (1)

.....

.....

(b) The student adds excess zinc to a beaker of dilute sulfuric acid.

- (i) Explain why it is necessary to add excess zinc. (2)

.....

.....

.....

- (ii) Draw a diagram of the apparatus the student should use to remove the unreacted zinc and collect the zinc sulfate solution. (2)



(c) The student obtains a pure, dry sample of zinc sulfate crystals.

The formula of zinc sulfate crystals is $\text{ZnSO}_4 \cdot 7\text{H}_2\text{O}$

(i) Calculate the relative molecular mass (M_r) of zinc sulfate crystals.

(2)

$M_r = \dots\dots\dots$

(ii) The student uses 0.0200 mol of dilute sulfuric acid in her preparation.

Show that the maximum mass of zinc sulfate crystals that the student could obtain is about 6 g.

(2)

(iii) The student obtains a mass of 4.28 g of zinc sulfate crystals.

Calculate the percentage yield of the zinc sulfate crystals.

Give your answer to three significant figures.

(3)

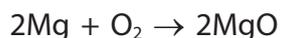
percentage yield = $\dots\dots\dots$ %

(Total for Question 7 = 13 marks)



- 8 (a) A piece of magnesium ribbon is ignited and placed in a gas jar of oxygen.

The equation for the reaction is



- (i) Give two observations that would be made in this reaction.

(2)

1.....

.....

2.....

.....

- (ii) State why this is an oxidation reaction.

(1)

.....

.....

- (b) A second piece of magnesium ribbon is ignited and placed in a gas jar of carbon dioxide.

A very exothermic reaction occurs, forming magnesium oxide and carbon.

- (i) State what is meant by the term **exothermic**.

(1)

.....

.....

- (ii) Give the chemical equation for this reaction.

(1)

.....

- (iii) A fire starts in a warehouse where magnesium is stored.

Suggest why it would **not** be suitable to use a carbon dioxide fire extinguisher to put out this fire.

(1)

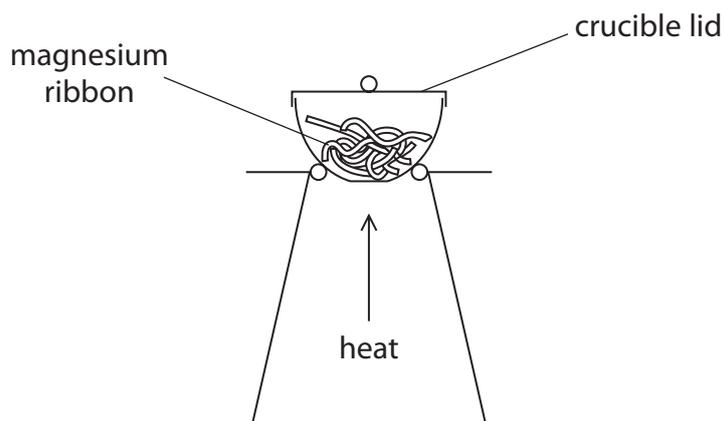
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- (c) A student uses this apparatus to find the mass of magnesium oxide that forms when a known mass of magnesium is heated.



This is his method.

- find the mass of the crucible and lid
- place some magnesium ribbon in the crucible
- find the mass of the crucible, lid and magnesium
- heat the crucible with the lid on for a few minutes
- find the mass of the crucible, lid and magnesium oxide

Using this method, the mass of magnesium oxide formed is less than expected.

Explain two changes that the student should make to his method to obtain a mass of magnesium oxide closer to the expected mass.

(4)

1

.....

.....

.....

2

.....

.....

.....

(Total for Question 8 = 10 marks)

9 This question is about some compounds of the elements in Group 4 of the Periodic Table.

(a) When carbon dioxide dissolves in water, a weak acid forms.

(i) Which of these could be the pH of this weak acid?

(1)

- A 1
- B 5
- C 7
- D 9

(ii) Which of these is a correct statement about acids?

(1)

- A acids contain OH^- ions
- B acids are electron donors
- C acids are proton acceptors
- D acids are proton donors

(b) When lead(II) carbonate is heated, lead(II) oxide and carbon dioxide form.

(i) Give the name of this type of reaction.

(1)

(ii) Complete the equation for this reaction.

(1)



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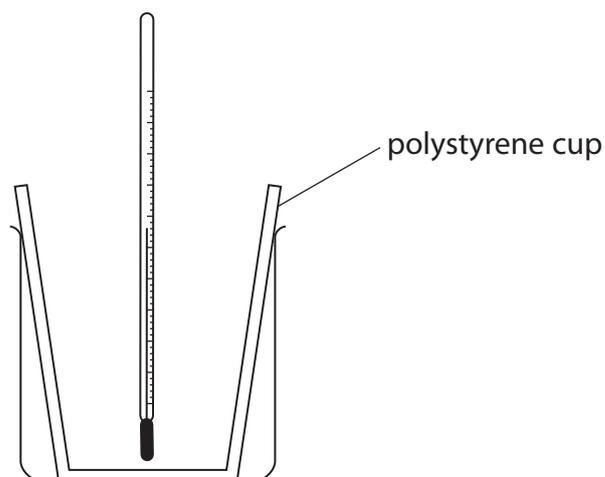
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- 10 A student uses this apparatus to investigate the reaction between potassium hydroxide solution and dilute hydrochloric acid.



This is her method.

- pour 25 cm^3 of potassium hydroxide solution into a polystyrene cup and record the temperature of the solution
- pour 25 cm^3 of dilute hydrochloric acid into a measuring cylinder and record the temperature of the acid
- add the acid to the polystyrene cup and stir the mixture
- record the highest temperature reached

- (a) (i) Give a word equation for the reaction between potassium hydroxide and hydrochloric acid.

(1)

- (ii) Explain why the student needs to stir the mixture.

(2)

(b) The table gives the temperatures of the solutions before the student mixes them.

potassium hydroxide solution	17.8 °C
dilute hydrochloric acid	18.4 °C

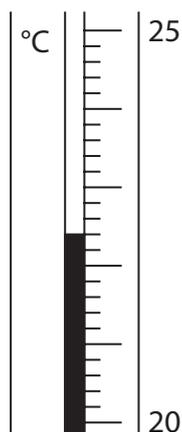
Calculate the mean (average) temperature of the two solutions.

(2)

mean temperature = °C

(c) The student repeats the experiment on a different day, using 25 cm³ of potassium hydroxide solution and 25 cm³ of dilute hydrochloric acid.

The thermometer shows the highest temperature reached at the **end** of the experiment.



(i) Complete the table by giving the missing information.

Give both temperatures to the nearest 0.1 °C.

(2)

mean temperature at start in °C	
temperature at end in °C	
temperature rise in °C	5.2

(ii) Show that the heat energy change, Q , in the student's experiment is about 1100 J.

[for the mixture, $c = 4.2 \text{ J/g/}^\circ\text{C}$]

[mass of 1.0 cm^3 of mixture = 1.0 g]

(3)

(iii) The student uses 0.020 mol of potassium hydroxide in his experiment.

Calculate the enthalpy change (ΔH) in kJ/mol, for 1.0 mol of potassium hydroxide.

Include a sign in your answer.

(3)

$\Delta H = \dots\dots\dots$ kJ/mol

(Total for Question 10 = 13 marks)

TOTAL FOR PAPER = 110 MARKS

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