Please check the examination details below before entering your candidate information

Candidate surname	Other names

Pearson Edexcel International GCSE (9–1)

Centre Number | Candidate Number

Time 2 hours

Paper reference **4CH1/1C 4SD0/1C**

Chemistry

Science (Double Award) 4SD0
PAPER 1C

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.
- Good luck with your examination.

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.

Answer ALL questions.

1 The box shows the names of some substances.

bromine	carbon dioxide	copper	iodine
methane	nitrogen	sulfur dioxide	water

(a) Complete the table by choosing substances from the box that match the description.

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

(5)

Description	Substance
a good conductor of electricity	
an element that has a basic oxide	
a substance used as a fuel	
a major cause of acid rain	
a non-metallic element that is a solid at room temperature	

(b) Describe a test for carbon dioxide.

(2)

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(Total for Question 1 = 7 marks)

2 (a) Table 1 gives some information about three subatomic particles.

(i) Complete Table 1 by giving the missing information.

(3)

Subatomic particle	Relative mass	Relative charge
electron	0.0005	
proton		+1
neutron	1	

Table 1

(ii) Give the name of the part of the atom containing protons and neutrons.

(1)

.....

(b) Table 2 shows the numbers of protons, neutrons and electrons in the species U, V, W, X, Y and Z.

Species	Number of protons	Number of neutrons	Number of electrons
U	8	10	8
V	9	10	10
W	11	12	10
X	11	12	11
Y	12	12	12
Z	12	13	12

Table 2

Use the information in Table 2 to answer these questions.

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

(i) Give the letter of the species that has six electrons in its outer shell.

(1)

.....

(ii) Give the mass number of Z.

(1)

.....

(iii) Give the letter of the species that is a positive ion.

(1)

.....

(iv) Give the letters of the two species that are isotopes of the same element.

(1)

.....

(c) A sample of neon contains two isotopes, ^{20}Ne and ^{22}Ne

The relative abundances of the two isotopes in the sample are

^{20}Ne 91.2% ^{22}Ne 8.80%

Calculate the relative atomic mass of this sample of neon.

Give your answer to one decimal place.

(3)

relative atomic mass = ...

(Total for Question 2 = 11 marks)

3 Some sugar is added to cold water in a beaker.

After some time, all the sugar dissolves and spreads throughout the water.

(a) (i) Name the process that occurs which causes the sugar to spread throughout the water.

(1)

.....

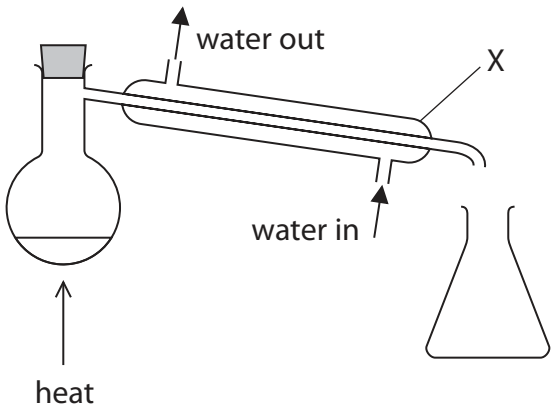
(ii) State two ways to make the sugar dissolve more quickly.

(2)

1 .....

2 .....

(b) Pure water can be obtained from the sugar solution using this apparatus.



(i) Name the process used to obtain pure water from the sugar solution.

(1)

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(ii) Explain the purpose of the piece of apparatus labelled X.

(2)

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(Total for Question 3 = 6 marks)

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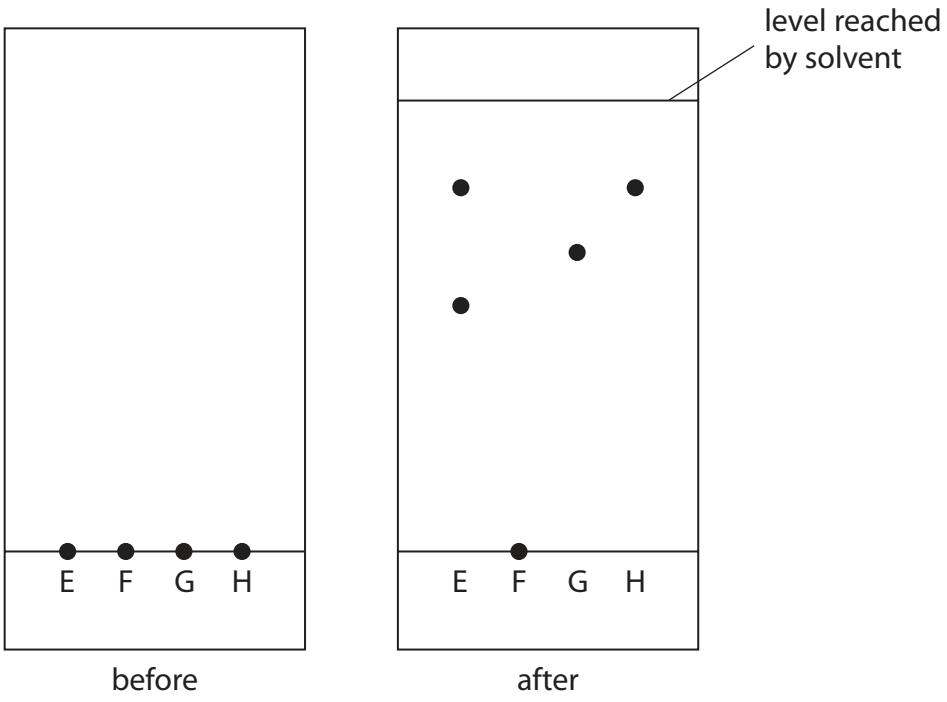
4 A student uses paper chromatography in an experiment to separate the dyes in four different food colourings, E, F, G and H.

The diagram shows the appearance of the paper before and after the experiment.



(a) (i) Describe how the student should complete the experiment after putting a spot of each food colouring on the paper.

(3)

(ii) Deduce the number of dyes in food colouring H.

(1)

.....

(iii) Suggest why food colouring F does not move during the experiment.

(1)

.....

.....

(iv) Explain which two food colourings contain the dye that is likely to be the most soluble in the solvent.

(2)

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.....

(b) Determine which food colouring contains a dye with R_f value closest to 0.67

Show your working.

(3)

(Total for Question 4 = 10 marks)

5 This question is about alkanes and alkenes.

(a) (i) Complete the boxes by giving the missing information about the alkane with the molecular formula C_2H_6

(3)

molecular formula	C_2H_6
name	
empirical formula	
displayed formula	

(ii) Complete the chemical equation for the complete combustion of the alkane C_2H_6

(1)

.....C_2H_6 + ...O_2 → .....CO_2 + ...H_2O

(iii) Incomplete combustion occurs when the air supply is limited.

Give the names of two products of incomplete combustion.

(2)

1 .....

2 .....

(b) An alkene with molecular formula C_4H_8 reacts with bromine to form a compound with molecular formula $C_4H_8Br_2$

(i) What is the name of this type of reaction?

(1)

☒ **A** addition

☒ **B** decomposition

☒ **C** precipitation

☒ **D** substitution

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(ii) Draw displayed formulae for two different alkenes with the molecular formula C_4H_8

(2)

alkene 1	alkene 2

(iii) State the term used for compounds with the same molecular formula but different structural formulae.

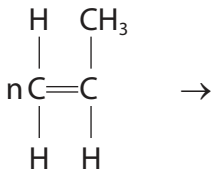
(1)

.....

(c) The alkene C_3H_6 can be polymerised to form the polymer poly(propene).

(i) Complete the equation for this polymerisation reaction.

(2)



(ii) Two ways of disposing of polymers such as poly(propene) are

- burying them in landfill sites
- burning them to release heat energy

Discuss the environmental problems caused by these two methods of disposal.

(3)

(Total for Question 5 = 15 marks)

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6 This question is about some of the Group 1 elements and their compounds.

(a) A teacher adds a small piece of lithium to water in a trough.

(i) Give three observations that are made when lithium reacts with water.

(3)

1 .....

2 .....

3 .....

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

Explain the colour of the universal indicator after it is added to the solution.

(2)

.....

.....

.....

.....

(iii) Write a chemical equation for the reaction of lithium with water.

(2)

.....

(b) A student does a flame test to see if a white solid contains sodium ions.

She cleans a platinum wire before using it for the flame test.

(i) Explain why the student needs to clean the platinum wire.

(2)

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(ii) Which of these is the colour of the flame if the solid contains sodium ions? **(1)**

- ☒ **A** green
- ☒ **B** lilac
- ☒ **C** red
- ☒ **D** yellow

(c) Potassium sulfate (K_2SO_4) is an ionic compound.

(i) Give the formula of each ion in potassium sulfate. **(1)**

potassium ion ..... sulfate ion .....

(ii) The melting point of potassium sulfate is 1069 °C.

Explain why potassium sulfate has a high melting point.

Refer to structure and bonding in your answer. **(4)**

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(Total for Question 6 = 15 marks)

7 A student investigates the reaction between magnesium and hydrochloric acid.

He uses this method.

Step 1 add 25 cm^3 of dilute hydrochloric acid to a polystyrene cup

Step 2 record the temperature of the acid

Step 3 find the mass of a 10 cm strip of magnesium ribbon

Step 4 add the magnesium ribbon to the hydrochloric acid

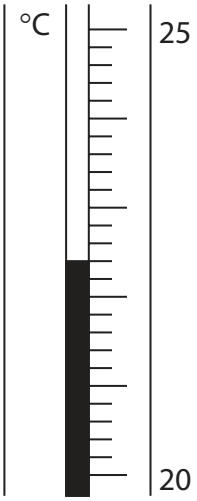
Step 5 when all the magnesium has reacted, record the highest temperature reached

(a) Complete the word equation for the reaction.

(1)

magnesium + hydrochloric acid → ..... + ...

(b) The thermometer shows the temperature of the acid at the start of the experiment.



(i) Complete the table by giving the temperatures to the nearest 0.1 °C.

(2)

temperature of the acid at the start in °C	
highest temperature reached in °C	
temperature rise in °C	20.8

(ii) Show that the heat energy change (Q) for this reaction is about 2200 J.

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

[for the solution, c = 4.2 J/g/°C]

(2)

(iii) The mass of magnesium used by the student was 0.12 g.

Calculate the value of the enthalpy change (ΔH), in kilojoules per mole of magnesium, for the reaction between magnesium and hydrochloric acid.

Include a sign in your answer.

(4)

ΔH = ... kJ/mol

(Total for Question 7 = 9 marks)

8 (a) A scientist finds an unlabelled bottle on a shelf.

She thinks the bottle contains a solution of ammonium sulfate, $(NH_4)_2SO_4$

Describe tests the scientist could do to show that the solution is ammonium sulfate.

(6)

(b) Ammonium sulfate is often used as a fertiliser.

It is prepared by reacting ammonia (NH_3) with sulfuric acid (H_2SO_4).

(i) Name the type of reaction that occurs between ammonia and sulfuric acid.

(1)

.....

(ii) Write a chemical equation for the reaction of ammonia with sulfuric acid.

(1)

.....

(iii) Draw a dot-and-cross diagram to show the bonding in a molecule of ammonia.

Show outer electrons only.

(2)

(Total for Question 8 = 10 marks)

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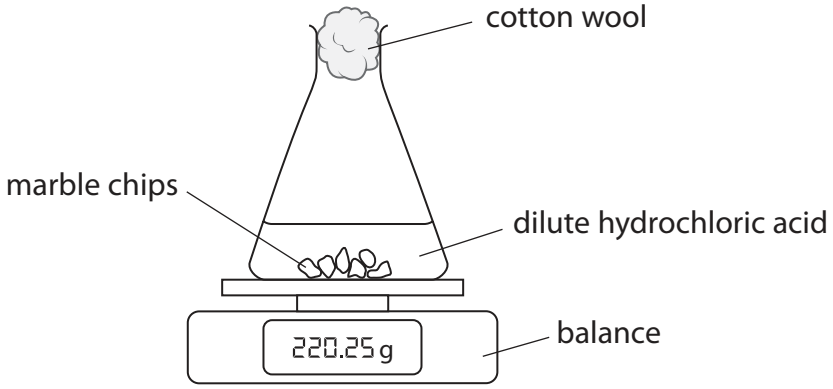
9 A student uses this apparatus to investigate the rate of reaction between marble chips and dilute hydrochloric acid.



The equation for the reaction is

$$CaCO_3 + 2HCl \rightarrow CaCl_2 + H_2O + CO_2$$

(a) During the reaction the mass of the contents of the flask decreases.

(i) State why the mass of the contents of the flask decreases.

(1)

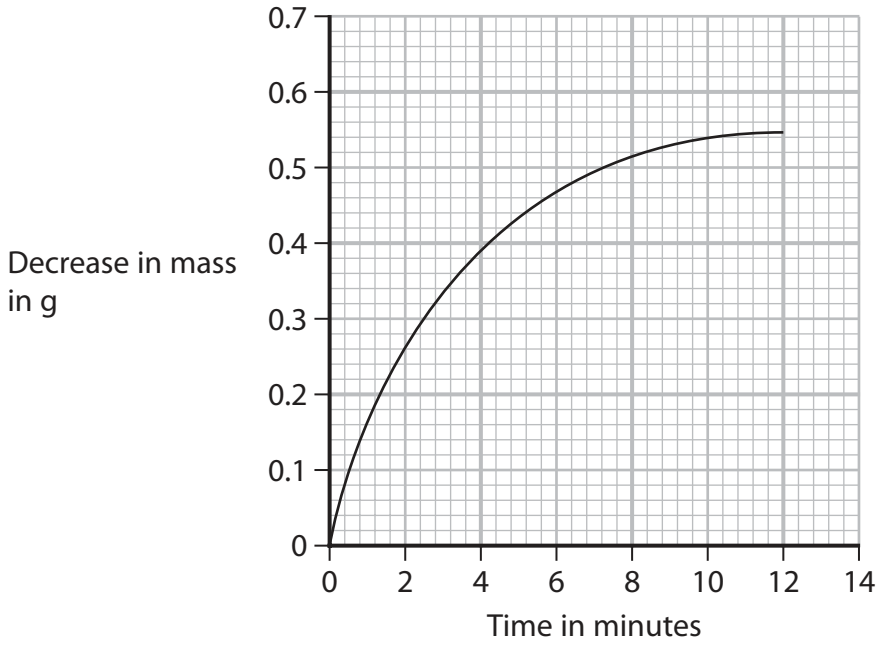
(ii) State the purpose of the cotton wool.

(1)

(iii) Explain why sulfuric acid is not a suitable acid to use in this investigation.

(2)

(b) The graph shows the student's results.



(i) In the investigation the marble chips are in excess.

Explain the shape of the graph.

(4)

(ii) The student repeats the experiment using the same volume of hydrochloric acid but of half the concentration of the original acid. All other conditions are kept the same.

On the grid, draw the curve the student would obtain.

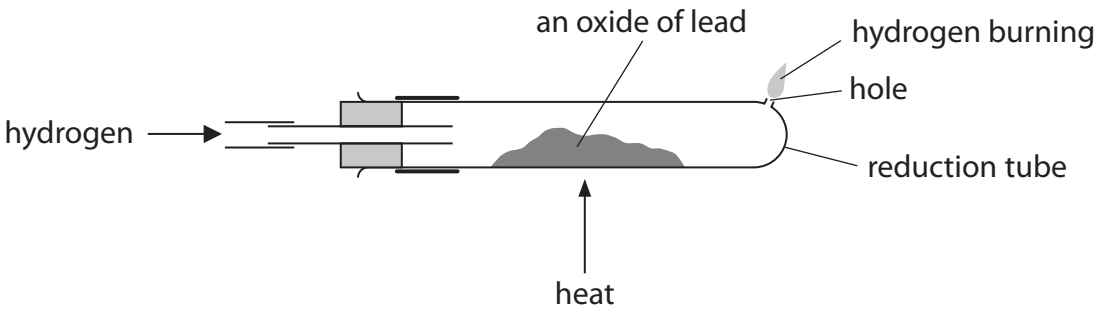
(2)

(c) Explain, using particle collision theory, how increasing the temperature affects the rate of a reaction.

(4)

(Total for Question 9 = 14 marks)

10 (a) The diagram shows the apparatus a teacher uses to determine the formula of an oxide of lead.



This is the teacher's method.

Step 1 find the mass of the reduction tube

Step 2 add some of the lead oxide to the reduction tube

Step 3 find the mass of the reduction tube and lead oxide

Step 4 pass hydrogen gas over the lead oxide and ignite the hydrogen at the hole

Step 5 heat the lead oxide strongly for 10 minutes

Step 6 keep passing hydrogen through the reduction tube until the tube and contents are cool

Step 7 find the new mass of the reduction tube and its contents

(i) Give a reason why hydrogen is passed through the reduction tube until the tube and contents are cool.

(1)

.....

.....

(ii) Describe what the teacher should do next to make sure all the lead oxide has been reduced to lead.

(2)

.....

.....

.....

.....

(b) The teacher completes the experiment and obtains these results.

mass of reduction tube = 23.50 g

mass of tube + lead oxide = 28.64 g

mass of tube + lead = 28.16 g

(i) Calculate the mass of lead formed.

(1)

mass of lead = ... g

(ii) Calculate the mass of oxygen removed from the lead oxide.

(1)

mass of oxygen = ... g

(iii) Determine the empirical formula of the lead oxide.

(4)

empirical formula of the lead oxide .....

(c) The insoluble salt lead(II) chloride ($PbCl_2$) can be prepared by reacting a solution of lead(II) nitrate with dilute hydrochloric acid.

(i) Complete the equation for the reaction by adding the state symbols.

(1)

$$Pb(NO_3)_2(\ldots\ldots) + 2HCl(\ldots\ldots) \rightarrow PbCl_2(\ldots\ldots) + 2HNO_3(\ldots\ldots)$$

(ii) Show that the maximum mass of lead(II) chloride that can be made from 0.0370 mol of hydrochloric acid is about 5 g.

[M_r of $PbCl_2$ = 278]

(3)

maximum mass = ... g

(Total for Question 10 = 13 marks)

TOTAL FOR PAPER = 110 MARKS

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