

Please check the examination details below before entering your candidate information

Candidate surname

Other names

Centre Number

Candidate Number

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## Pearson Edexcel International GCSE (9–1)

Time 2 hours

Paper

reference

4CH1/1C 4SD0/1C

# Chemistry

**UNIT: 4CH1**

**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.

### 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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Q:1/1/1/ 1C-JU-22



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# The Periodic Table of the Elements

1	2	3	4	5	6	7	0												
7 <b>Li</b> lithium 3	9 <b>Be</b> beryllium 4	11 <b>Na</b> sodium 11	12 <b>C</b> carbon 6	13 <b>Al</b> aluminium 13	14 <b>N</b> nitrogen 7	15 <b>P</b> phosphorus 15	16 <b>O</b> oxygen 8	17 <b>F</b> fluorine 9	18 <b>Ar</b> argon 18										
19 <b>K</b> potassium 19	20 <b>Ca</b> calcium 20	23 <b>Sc</b> scandium 21	24 <b>Ti</b> titanium 22	25 <b>V</b> vanadium 23	26 <b>Cr</b> chromium 24	27 <b>Mn</b> manganese 25	28 <b>Fe</b> iron 26	29 <b>Co</b> cobalt 27	30 <b>Ni</b> nickel 28	31 <b>Cu</b> copper 29	32 <b>Zn</b> zinc 30	33 <b>Ga</b> gallium 31	34 <b>Ge</b> germanium 32	35 <b>As</b> arsenic 33	36 <b>Se</b> selenium 34	37 <b>Br</b> bromine 35	38 <b>Kr</b> krypton 36		
39 <b>Rb</b> rubidium 37	40 <b>Sr</b> strontium 38	45 <b>Y</b> yttrium 39	48 <b>Zr</b> zirconium 40	51 <b>Nb</b> niobium 41	52 <b>Mo</b> molybdenum 42	55 <b>Tc</b> technetium 43	56 <b>Ru</b> ruthenium 44	59 <b>Rh</b> rhodium 45	65 <b>Pd</b> palladium 46	63.5 <b>Ag</b> silver 47	70 <b>Cd</b> cadmium 48	73 <b>In</b> indium 49	75 <b>Sb</b> antimony 51	77 <b>Te</b> tellurium 52	79 <b>I</b> iodine 53	80 <b>Xe</b> xenon 54	84 <b>Rn</b> radon 86		
55 <b>Cs</b> caesium 55	56 <b>Ba</b> barium 56	88 <b>La*</b> lanthanum 57	89 <b>Ce*</b> cerium 58	91 <b>Pr*</b> praseodymium 59	92 <b>Nd*</b> neodymium 60	93 <b>Pm*</b> promethium 61	94 <b>Sm*</b> samarium 62	96 <b>Eu*</b> europium 63	98 <b>Gd*</b> gadolinium 64	101 <b>Tb*</b> terbium 65	103 <b>Dy*</b> dysprosium 66	106 <b>Ho*</b> holmium 67	108 <b>Er*</b> erbium 68	112 <b>Tm*</b> thulium 69	114 <b>Pb</b> lead 82	115 <b>Bi</b> bismuth 83	116 <b>Po</b> polonium 84	117 <b>At</b> astatine 85	118 <b>Rn</b> radon 86
87 <b>Fr</b> francium 87	88 <b>Ra</b> radium 88	89 <b>Ac*</b> actinium 89	104 <b>Rf</b> rutherfordium 104	105 <b>Db</b> dubnium 105	106 <b>Sg</b> seaborgium 106	107 <b>Bh</b> bohrium 107	108 <b>Hs</b> hassium 108	109 <b>Mt</b> meitnerium 109	110 <b>Ds</b> darmstadtium 110	111 <b>Rg</b> roentgenium 111	112 <b>Cn</b> copernicium 112	113 <b>Nh</b> nihonium 113	114 <b>Fl</b> flerovium 114	115 <b>Mc</b> moscovium 115	116 <b>Lv</b> livermorium 116	117 <b>Ts</b> tennessine 117	118 <b>Og</b> oganesson 118	119 <b>Uue</b> unbinilium 119	120 <b>Uub</b> ununbium 120
Elements with atomic numbers 112–116 have been reported but not fully authenticated																			

1  
**H**  
hydrogen  
1

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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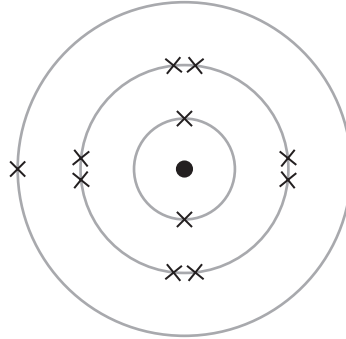
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**Answer ALL questions.**

Some questions must be answered with a cross ☒. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.

- 1 The diagram shows the electronic configuration of an atom of an element.



- (a) Name the part of the atom that contains the protons and neutrons. (1)

- (b) Give the number of protons in this atom. (1)

- (c) Give the number of the group that contains this element. (1)

- (d) Give the number of the period that contains this element. (1)

- (e) Give the charge on the ion formed from this atom. (1)

**(Total for Question 1 = 5 marks)**



2 (a) The box shows some changes of state.

boiling	condensation	evaporation
freezing	melting	sublimation

The table lists some physical changes.

Complete the table using words from the box to show the change of state for each physical change.

(4)

Physical change	Change of state
water to ice	
steam to water	
solid wax to liquid wax	
iodine crystals to iodine vapour	

(b) A student plans to obtain salt crystals from a mixture of salt and sand.

The student adds pure water to the mixture to dissolve the salt.

(i) State two things the student could do to make the salt dissolve quickly.

(2)

1 .....

2 .....

(ii) State what the student should do next to separate the sand from the salt solution.

(1)

.....

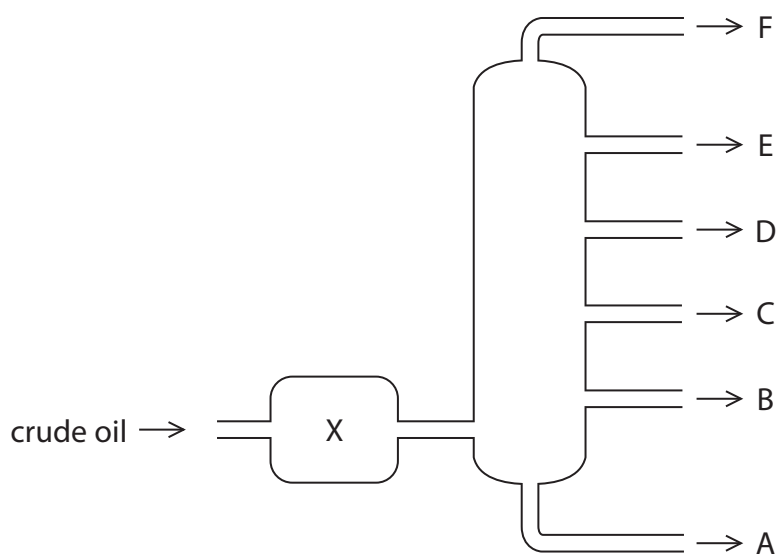
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3 Crude oil is an important source of organic compounds.

(a) The diagram shows how crude oil can be separated into fractions by fractional distillation.



(i) State what happens to the crude oil when it is in X.

(1)

(ii) Give the name of fraction E.

(1)

(iii) Give a use for fraction A.

(1)



(b) One of the compounds in fraction D is tridecane ( $C_{13}H_{28}$ ) which can be cracked to form shorter-chain hydrocarbons.

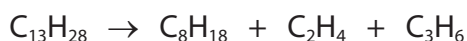
(i) State the catalyst and temperature used in this cracking reaction.

(2)

catalyst

temperature

(ii) The equation shows an example of a catalytic cracking reaction.



Give two reasons why this reaction is important.

(2)

1 .....

2 .....

(c) Sulfur is an impurity in crude oil.  
Explain why this is a problem for the environment.

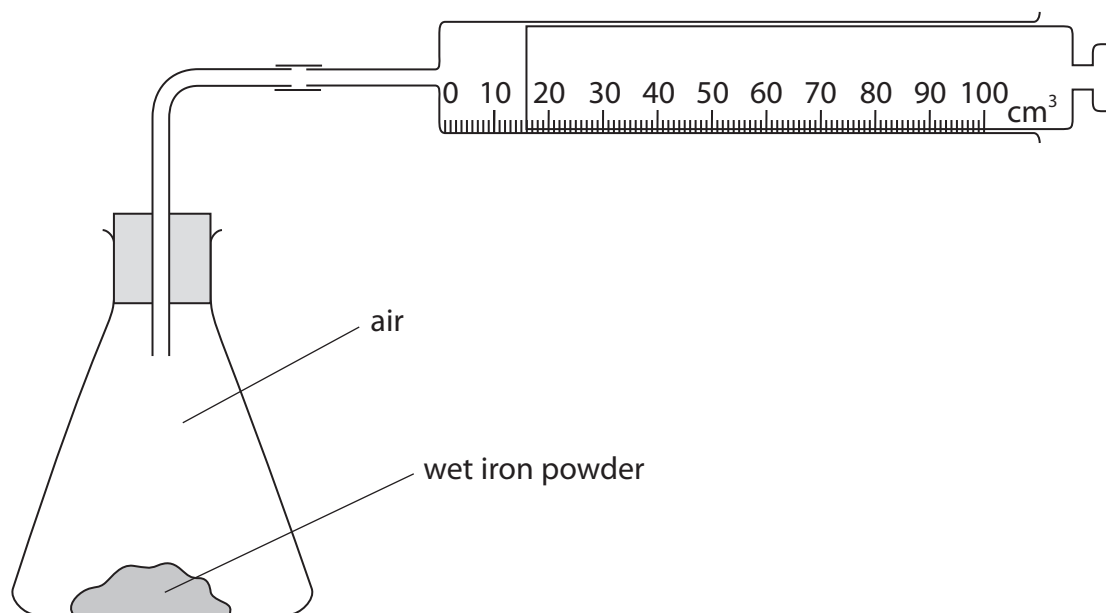
(3)

(Total for Question 3 = 10 marks)



- 4 A student uses the reaction between iron and oxygen to find the percentage of oxygen in air.

The diagram shows the apparatus the student uses.



- (a) (i) State why the iron powder needs to be wet. (1)

- (ii) State the colour of the compound formed in the reaction between iron and oxygen. (1)

- (iii) Give the formula of the compound formed. (1)

- (iv) Explain the advantage of using iron powder rather than pieces of iron. (2)

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(b) The syringe in the diagram shows the reading at the end of the experiment.

Complete table 1 to show the readings on the syringe.

Give both values to the nearest  $1 \text{ cm}^3$ .

(2)

syringe reading at start	
syringe reading at end	
change in volume in $\text{cm}^3$	65

**Table 1**

(c) The student repeats the experiment and obtains a different set of results.

Table 2 shows these results.

volume of air in conical flask and glass tube in $\text{cm}^3$	260
syringe reading at start	90
syringe reading at end	22

**Table 2**

Use the results from table 2 to calculate the percentage by volume of oxygen in the air.

(3)

percentage by volume of oxygen in air = ..... %

**(Total for Question 4 = 10 marks)**





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(b) Ethane (C<sub>2</sub>H<sub>6</sub>) and ethene (C<sub>2</sub>H<sub>4</sub>) both react with bromine.

Describe the differences in the reactions of ethane and ethene with bromine.

Refer to the conditions, the products and the types of reaction involved.

(5)

Area with horizontal dotted lines for writing the answer.

**(Total for Question 5 = 11 marks)**



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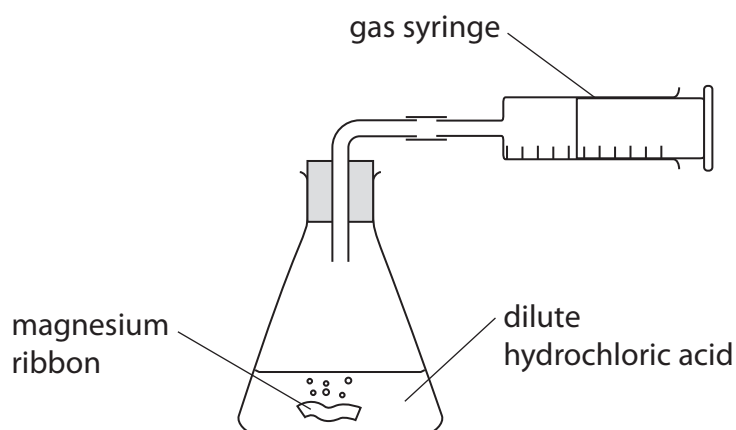
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- 6 A student uses this apparatus to investigate the reaction between magnesium and dilute hydrochloric acid.



- (a) The word equation for the reaction is

magnesium + hydrochloric acid  $\rightarrow$  magnesium chloride + hydrogen

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

(1)



- (ii) Give the test for hydrogen.

(1)

- (iii) The student uses 0.090 g of magnesium and 0.025 mol of hydrochloric acid.

Show by calculation that the hydrochloric acid is in excess.

(2)

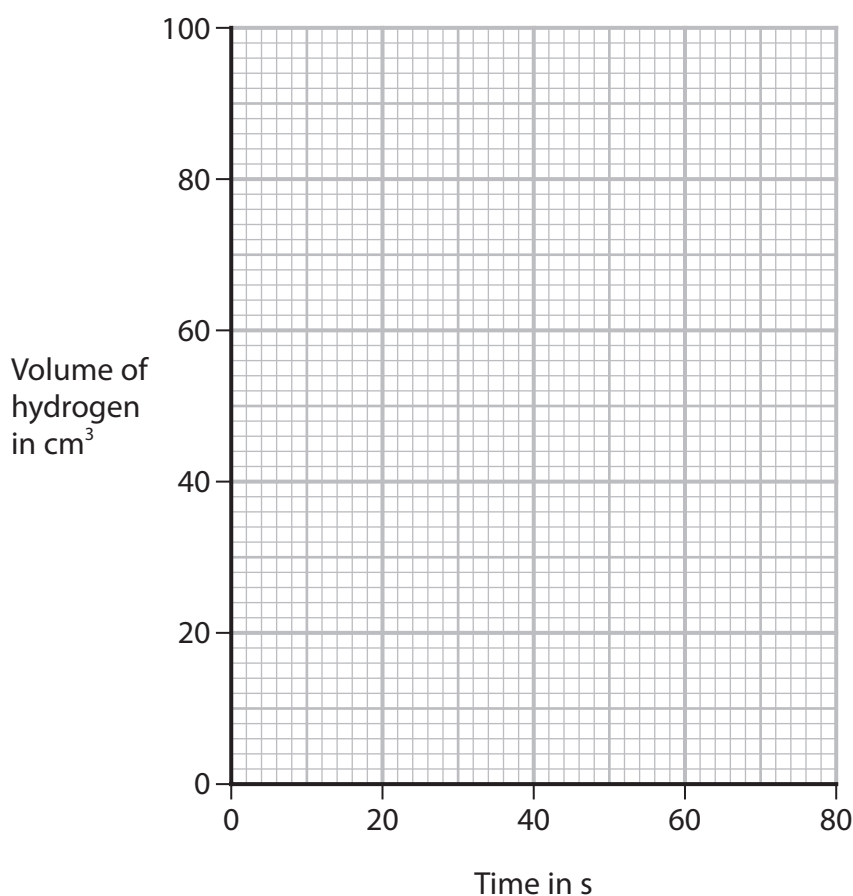


- (b) The student measures the volume of hydrogen collected at regular intervals until the reaction stops.

The table shows the student's results.

<b>Time in s</b>	0	15	30	45	60	75
<b>Volume of hydrogen in cm<sup>3</sup></b>	0	40	68	80	88	88

- (i) Plot the student's results. (1)
- (ii) Draw a curve of best fit. (1)



- (iii) Determine the volume of hydrogen collected in the first 10 seconds.

Show on the graph how you obtained your answer.

(2)

volume of hydrogen = ..... cm<sup>3</sup>





7 This question is about copper and copper compounds.

(a) A sample of copper contains two isotopes.

- Cu-63 with relative abundance 69.5%
- Cu-65 with relative abundance 30.5%

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

(2)

.....

.....

.....

.....

(ii) Calculate the relative atomic mass ( $A_r$ ) of this sample of copper.

Give your answer to three significant figures.

(3)

$A_r$  of copper = .....





(b) When copper(II) carbonate is heated, copper(II) oxide and carbon dioxide are formed.

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

(1)

- A decomposition
- B neutralisation
- C oxidation
- D reduction

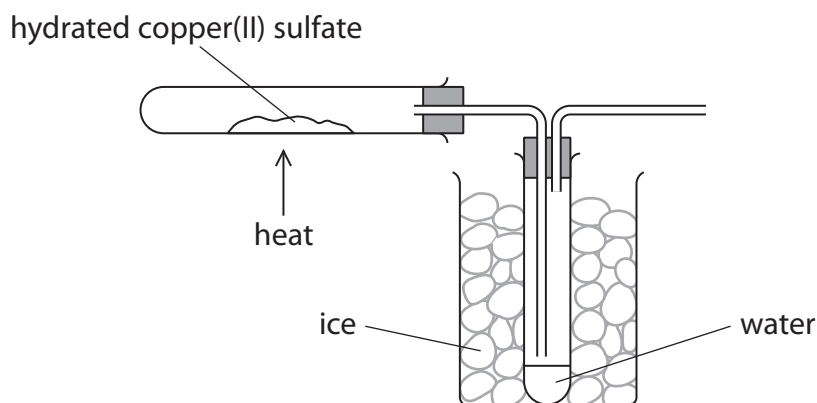
(ii) Which colour change occurs during this reaction?

(1)

- A blue to black
- B blue to white
- C green to black
- D green to orange



(c) A student uses this apparatus to find the value of  $x$  in the formula  $\text{CuSO}_4 \cdot x\text{H}_2\text{O}$



This is the student's method.

- find the mass of an empty boiling tube
- add hydrated copper(II) sulfate to the tube and record the new mass
- heat the hydrated copper(II) sulfate until it changes colour
- allow the tube to cool and record the mass again



The table shows the student's results.

mass of empty tube in g	20.52
mass of tube and $\text{CuSO}_4 \cdot x\text{H}_2\text{O}$ in g	31.77
mass of tube and $\text{CuSO}_4$ in g	28.20

(i) Calculate the mass of  $\text{CuSO}_4$  formed.

(1)

mass of  $\text{CuSO}_4$  = ..... g

(ii) Calculate the mass of water formed.

(1)

mass of water = ..... g

(iii) Show that the value of  $x$  is approximately 4

$[M_r \text{ of } \text{CuSO}_4 = 159.5 \quad M_r \text{ of } \text{H}_2\text{O} = 18]$

(3)

(iv) The actual value of  $x$  is 5

Give a reason why the calculated value of  $x$  is lower than the actual value.

(1)

(Total for Question 7 = 13 marks)



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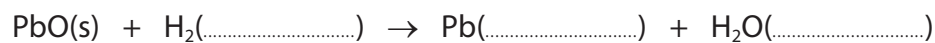


9 This question is about the oxides of lead.

(a) Yellow lead oxide (PbO) can be reacted with hydrogen to produce lead.

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

(1)



(ii) What is the charge on the lead ion in PbO?

(1)

A 1-

B 1+

C 2-

D 2+

(iii) Explain why the reaction of yellow lead oxide with hydrogen is a redox reaction.

(2)

.....

.....

.....

.....

(iv) Describe a physical test to show that the water produced in this reaction is pure.

(2)

.....

.....

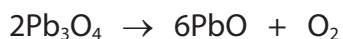
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(b) When red lead oxide ( $\text{Pb}_3\text{O}_4$ ) is heated, yellow lead oxide forms.

The equation for the reaction is



A scientist heats a known mass of red lead oxide in a crucible in a fume cupboard.

The scientist leaves the crucible to cool, then records the total mass of the crucible and its contents.

(i) Describe what the scientist should do next to make sure that all the red lead oxide has reacted.

(2)

.....

.....

.....

.....

(ii) The red lead oxide used in the reaction has a mass of 5.48 g.

Calculate the maximum mass of yellow lead oxide that could form.

[ $M_r$  of  $\text{Pb}_3\text{O}_4 = 685$        $M_r$  of  $\text{PbO} = 223$ ]

(3)

maximum mass of PbO = ..... g

**(Total for Question 9 = 11 marks)**



10 This question is about ammonia and ammonium compounds.

(a) Ammonia ( $\text{NH}_3$ ) is a simple covalent molecule.

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

(2)

(b) The table shows the names and formulae of some ammonium compounds.

<b>Name</b>	ammonium sulfate		ammonium carbonate
<b>Formula</b>	$(\text{NH}_4)_2\text{SO}_4$	$\text{NH}_4\text{Cl}$	

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

(2)





(ii) When ammonia reacts with sulfuric acid, ammonium sulfate is formed.

Write a chemical equation for this reaction.

(1)

(iii) Describe a test for ammonium ions.

(3)



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(c) The table gives some information about ammonia and ammonium compounds.

Name	Formula	Percentage of nitrogen (%)	Approximate pH in solution
ammonia	$\text{NH}_3(\text{g})$	82	11
ammonium nitrate	$\text{NH}_4\text{NO}_3(\text{s})$		5.5
ammonium sulfate	$(\text{NH}_4)_2\text{SO}_4(\text{s})$	21	5.5

(i) Calculate the percentage of nitrogen in ammonium nitrate.

$[M_r \text{ of } \text{NH}_4\text{NO}_3 = 80]$

(2)

percentage of nitrogen = ..... %





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