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Write your name here

Surname	Other names

Edexcel
International GCSE

Centre Number | | | | | |

Candidate Number | | | | |

Chemistry

Unit: 4CH0
Paper: 2C

Friday 20 January 2012 – Morning
Time: 1 hour

Paper Reference
4CH0/2C

You must have:
Ruler
Calculator.

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 60.
- 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.
- Keep an eye on the time.
- 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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1/1/1/1/

P 4 0 1 2 7 A 0 1 1 6

PEARSON

THE PERIODIC TABLE

Period	1	2											Group 3	4	5	6	7	0
1							1 H Hydrogen 1											4 He Helium 2
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
3	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
4	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
5	86 Rb Rubidium 37	88 Sr Strontium 38	89 Y Yttrium 39	91 Zr Zirconium 40	93 Nb Niobium 41	96 Mo Molybdenum 42	99 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
6	133 Cs Caesium 55	137 Ba Barium 56	139 La Lanthanum 57	179 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	210 Po Polonium 84	210 At Astatine 85	222 Rn Radon 86
7	223 Fr Francium 87	226 Ra Radium 88	227 Ac Actinium 89															

Key

Relative atomic mass
Symbol
Name
Atomic number

Answer ALL questions.

1 (a) Complete the table to show the relative mass and relative charge of a proton, a neutron and an electron.

(4)

	Proton	Neutron	Electron
Relative mass	1	1	1/1840
Relative charge	+ 1	0	−1

(b) The symbol for an atom of one isotope of hydrogen is $^{3}_{1}H$

(i) State the number of protons, neutrons and electrons present in one atom of this isotope.

(2)

Number of protons 1

Number of neutrons 2

Number of electrons 1

(ii) What is meant by the term **isotopes**?

(2)

atoms of the same element with different number of neutrons

(c) Bromine has two naturally-occurring isotopes with mass numbers 79 and 81.
A sample of bromine contained the two isotopes in the following proportions:

bromine-79 = 50.7% and bromine-81 = 49.3%

Use this information to calculate the relative atomic mass of bromine.
Give your answer to **two** decimal places.

(2)

$$\frac{(79 \times 50.7 + 81 \times 49.3)}{100}$$

$$= 79.99.$$

(Total for Question 1 = 10 marks)

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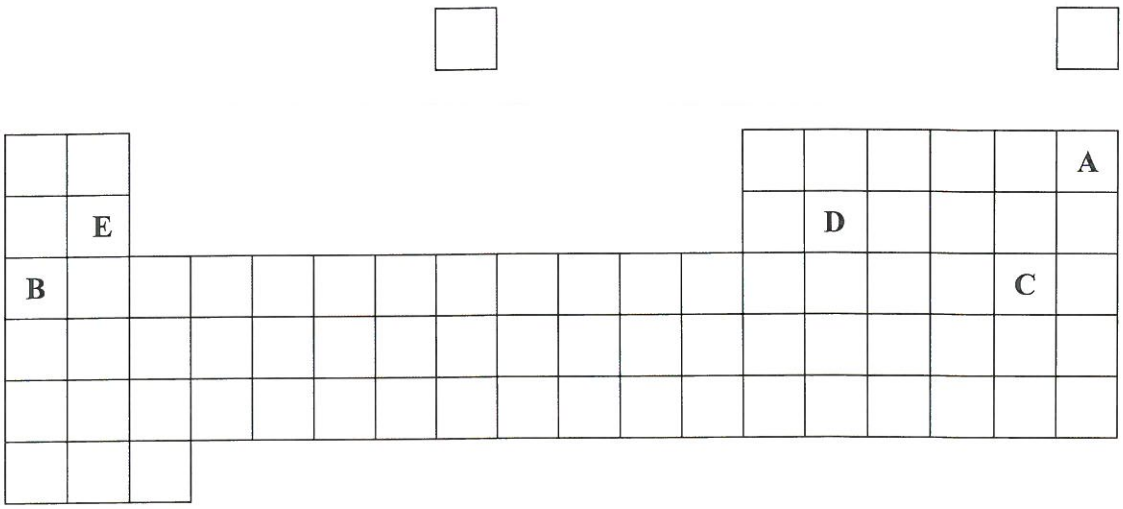
2 Use the Periodic Table on page 2 to help you answer this question.

(a) Part of the Periodic Table is shown.



In each part of this question, place a cross (☒) in **one** box to identify the letter, **A** to **E**, that represents

(i) a metal that reacts violently with water

(1)

A	B	C	D	E
☐	☑	☐	☐	☐

(ii) a noble gas

(1)

A	B	C	D	E
☑	☐	☐	☐	☐

(iii) a Group 2 metal

(1)

A	B	C	D	E
☐	☐	☐	☐	☑

(iv) a halogen

(1)

A	B	C	D	E
☐	☐	☑	☐	☐

2 (b) Complete these sentences by placing a cross (☒) in **one** box next to the correct answer.

(i) The elements in the Periodic Table are arranged in order of increasing

(1)

- ☐ number of neutrons
- ☑ atomic number
- ☐ relative atomic mass
- ☐ mass number

(ii) Elements in the same group in the Periodic Table have the same number of

(1)

- ☑ electrons in the outer shell
- ☐ protons in the nucleus
- ☐ neutrons in the nucleus
- ☐ atoms

(Total for Question 2 = 6 marks)

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3 Lead(II) sulfate, $PbSO_4$, is an insoluble salt.

It can be made as a precipitate from a solution of lead(II) nitrate, $Pb(NO_3)_2$

(a) (i) Identify a substance that could be added to lead(II) nitrate solution to form a precipitate of lead(II) sulfate.

(1)

sodium sulfate (or any soluble sulfate)

(ii) Write a chemical equation for the reaction between lead(II) nitrate and the substance you identified in (a)(i).

(2)

$Na_2SO_4 + Pb(NO_3)_2 \rightarrow PbSO_4 + 2NaNO_3$

(iii) Outline how you would produce a pure, dry sample of lead(II) sulfate from the reaction mixture in (a)(ii).

(3)

- filter
- wash residue with distilled water
- leave on filter paper to dry

(b) A solution of lead(II) nitrate can be made by reacting solid lead(II) carbonate with dilute nitric acid.

The equation for this reaction is:

$$PbCO_3(s) + 2HNO_3(aq) \rightarrow Pb(NO_3)_2(aq) + CO_2(g) + H_2O(l)$$

State **two** observations you would make when dilute nitric acid is added to solid lead(II) carbonate.

(2)

1 fizzing

2 $PbCO_3$ disappears

or (solution formed)

(Total for Question 3 = 8 marks)

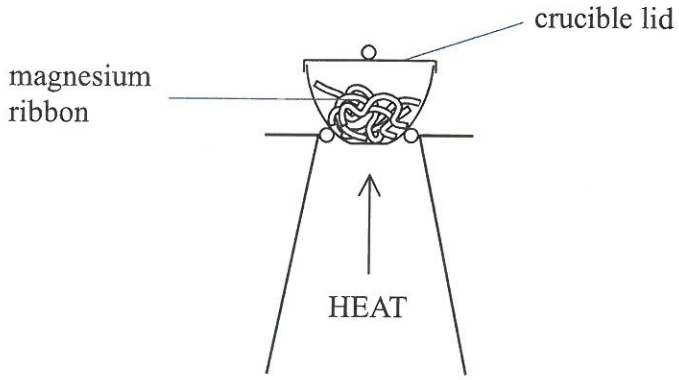
4 When magnesium is burned in air, it reacts with oxygen, O_2, to form magnesium oxide, MgO

A class of students investigated the relationship between the mass of magnesium burned and the mass of magnesium oxide formed.

Each student was given a different mass of clean magnesium to heat.

The students used the following method.

- Weigh a crucible and lid
- Place the magnesium ribbon in the crucible, replace the lid, and reweigh
- Heat the crucible as shown in the diagram until the magnesium burns



- Lift the lid from time to time until there is no sign of further reaction
- Allow the crucible and lid to cool and reweigh
- Repeat the heating, cooling and reweighing until two consecutive masses are the same
- Calculate the mass of magnesium oxide formed

(a) (i) Why is it necessary to lift the lid from time to time while heating?

(1)

allow air to enter

or make sure all magnesium has reacted

(ii) Why is it necessary to repeat the heating until two consecutive masses are the same?

(1)

Make sure all Mg has reacted.

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4 (b) Show how the mass of magnesium oxide formed can be calculated from the readings obtained.

(1)

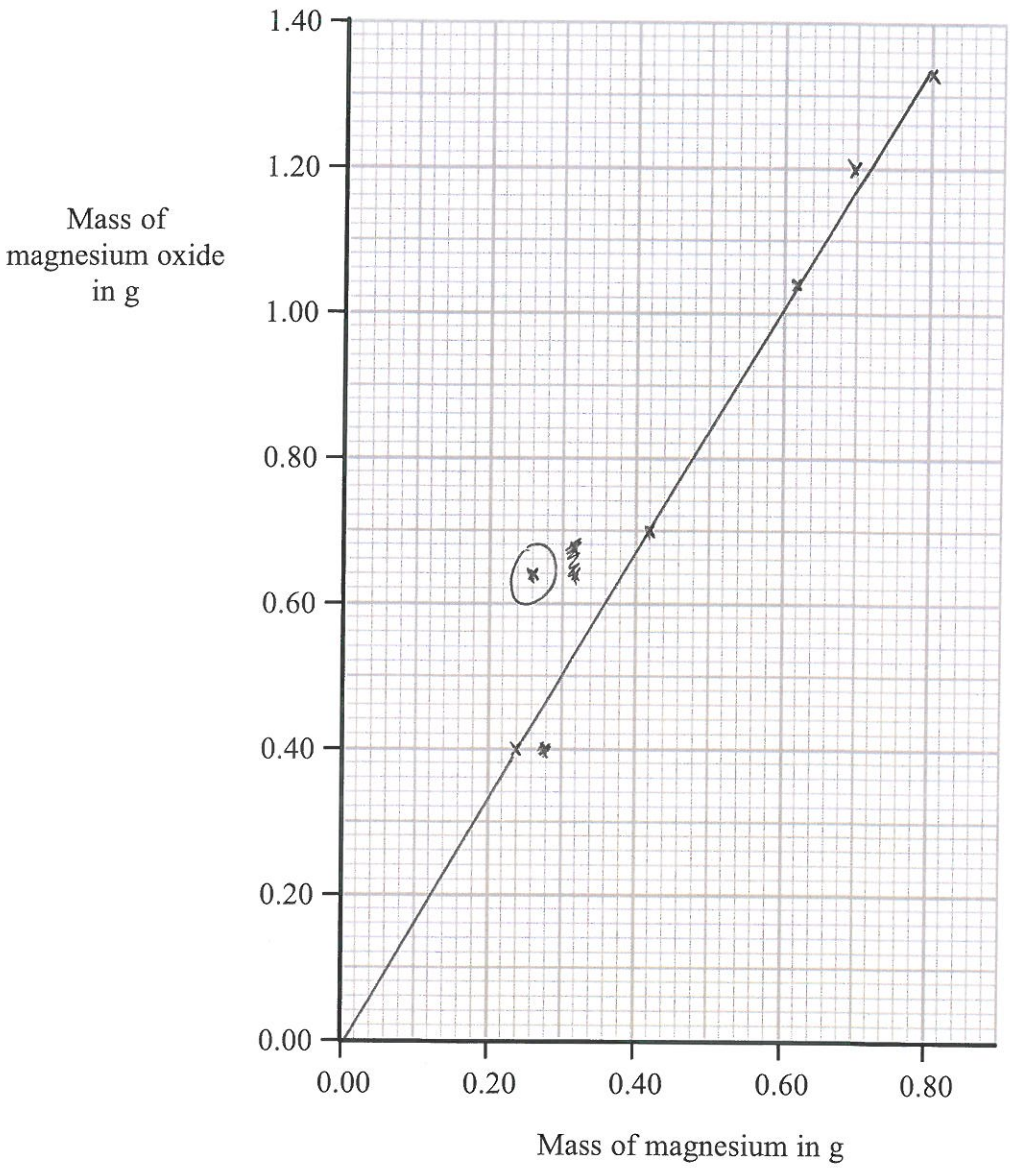
mass of crucible + lid + MgO − mass of crucible + lid.

(c) The results of each experiment are given in the table.

Mass of magnesium in g	Mass of magnesium oxide in g
0.24	0.40
0.26	0.64
0.42	0.70
0.62	1.04
0.70	1.20
0.80	1.33

4 (i) Plot the results on the grid and draw a straight line of best fit.

(3)



(ii) Draw a circle around the anomalous result.

(1)

(iii) Use your graph to find the mass of magnesium oxide formed when 0.48 g of magnesium is burned.

(1)

0·80g

(Total for Question 4 = 8 marks)

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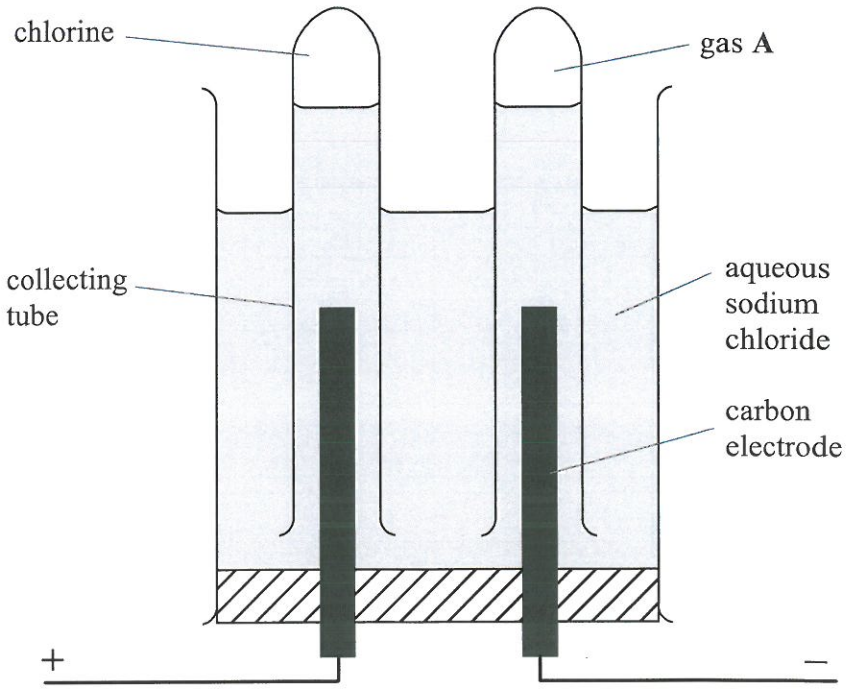
5 The apparatus shown can be used to electrolyse aqueous sodium chloride in the laboratory.



(a) Gases are evolved at both electrodes.

(i) Describe a chemical test to show that the gas evolved at the positive electrode is chlorine.

(2)

Turns (moist) litmus paper white

(ii) Identify gas **A**.

(1)

hydrogen

5 (b) Some of the solution formed after the electrolysis was tested with the indicator phenolphthalein. The indicator turned pink

Explain this result.

(1)

solution is alkali

(c) The equation for the reaction taking place at the positive electrode is:

$$2Cl^-(aq) \rightarrow Cl_2(g) + 2e^-$$

Ten faradays (10 F) of electricity were passed through an aqueous solution of sodium chloride.

(i) Calculate the amount, in moles, of chlorine formed.

(1)

$\frac{10}{2} = 5$

(ii) Calculate the volume of chlorine formed.

(One mole of a gas occupies 24 dm^3 at this temperature and pressure)

(2)

$5 \times 24 = 120\ dm^3$

(Total for Question 5 = 7 marks)

6 Compound **X** is a blue, crystalline solid. It contains copper(II) ions (Cu^{2+}), sulfate ions (SO_4^{2-}) and water of crystallisation.

(a) A student dissolved some of compound **X** in water and then added aqueous sodium hydroxide solution. She obtained a blue precipitate.

Give the formula of the blue precipitate formed in the reaction.

(1)

$Cu(OH)_2$

(b) Another student tested a solution of compound **X** for sulfate ions using dilute hydrochloric acid, followed by a few drops of barium chloride solution. She obtained a white precipitate.

Why is the dilute hydrochloric acid necessary in this test?

(1)

to remove carbonate ions

(c) The empirical formula of compound **X** is $CuSO_9H_{10}$

Write the formula of compound **X** to show its water of crystallisation.

(1)

$CuSO_4 . 5H_2O$

(d) Compound **X** gives a blue-green colour in a flame test.

Outline how you would carry out a flame test.

(2)

- Put solid onto a wire
- put into blue flame.

(Total for Question 6 = 5 marks)

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7 The table shows percentage by mass of the fractions obtained from a sample of crude oil and the percentage market demand for these fractions.

Fraction	Percentage by mass in crude oil	Market demand (%)
refinery gases	3	5
gasoline	12	28
kerosene	9	20
diesel	15	25
fuel oil	51	20
bitumen	10	2

(a) Why is the market demand for the gasoline fraction greater than that for the fuel oil fraction?

(1)

used for cars.

(b) Cracking is used to make long-chain hydrocarbon molecules into shorter-chain hydrocarbon molecules.

(i) Complete the equation to show the other hydrocarbon molecule formed when $C_{20}H_{42}$ is cracked.

(1)

$$C_{20}H_{42} \rightarrow C_{16}H_{34} + \text{C}_4\text{H}_8$$

(ii) Give the name of a catalyst used in industry to crack long-chain hydrocarbons and state a temperature at which cracking is carried out.

(2)

Catalyst aluminium oxide

Temperature 600 - 700°C.

7 (c) Ethene (C_2H_4) can be produced by cracking long-chain hydrocarbon molecules obtained from crude oil. The ethene produced can then be used to make ethanol.

Ethanol can also be made by the fermentation of sugars.

(i) Give **two** advantages of making ethanol from ethene, rather than by fermentation.

(2)

1 • Continuous process • higher % yield

• purer product • 100% atom economy.

2 • faster rate

• larger scale

(ii) Suggest **two** reasons why ethanol is sometimes made by fermentation, rather than from ethene.

(2)

1 • Renewable source

• Suitable to make alcoholic drinks/vinegar

2 • Uses less energy

• County may have no crude oil.

(Total for Question 7 = 8 marks)

TURN OVER FOR QUESTION 8

8 Sulfur dioxide, SO_2, is used as a preservative in wine.

The sulfur dioxide content of a wine can be found by titration. A chemist found that 25.0 cm^3 of a sample of wine reacted with exactly 15.00 cm^3 of 0.0010 mol/dm^3 aqueous iodine, $I_2(aq)$.

The equation for the reaction is

$$SO_2(aq) + I_2(aq) + 2H_2O(l) \rightarrow SO_4^{2-}(aq) + 2I^-(aq) + 4H^+(aq)$$

(a) Calculate the amount, in moles, of iodine in 15.00 cm^3 of a 0.0010 mol/dm^3 solution.

(2)

moles = $\frac{c \times v}{1000} = \frac{0.001 \times 15}{1000} = 0.000015$ mol

(b) Deduce the amount, in moles, of sulfur dioxide in 25.0 cm^3 of the wine.

(1)

0.000015 mol

(c) Calculate the concentration, in mol/dm^3, of sulfur dioxide in the wine.

(2)

conc = $\frac{\text{moles}}{\text{vol}} = \frac{0.000015 \times 1000}{25} = 0.0006$ mol/dm^3

(d) Calculate the concentration, in g/dm^3, of sulfur dioxide in the wine.

(2)

mass = moles x Mr = 0.0006 x 64

$= 0.0384$ g/dm^3

(e) A concentration of sulfur dioxide that is greater than 0.16 g/dm^3 makes wine unpleasant to drink.

Use the value you have calculated in (d) to state whether the wine is drinkable.

(1)

it is drinkable.

(Total for Question 8 = 8 marks)

TOTAL FOR PAPER = 60 MARKS