

Write your name here	
Surname	Other names
Edexcel	Centre Number
International GCSE	Candidate Number
Chemistry Unit: 4CH0 Paper: 2C	
Friday 20 January 2012 – Morning	Paper Reference
Time: 1 hour	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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PEARSON

THE PERIODIC TABLE

0

7

6

5

4

3

Group

2

1

Period

1

4	He	Helium	2
---	----	--------	---

1	H	Hydrogen	1
---	---	----------	---

7	Li	Lithium	3	9	Be	Beryllium	4
23	Na	Sodium	11	24	Mg	Magnesium	12
39	K	Potassium	19	40	Ca	Calcium	20
86	Rb	Rubidium	37	88	Sr	Strontium	38
133	Cs	Caesium	55	137	Ba	Barium	56
223	Fr	Francium	87	226	Ra	Radium	88
45	Sc	Scandium	21	89	Y	Yttrium	39
91	Zr	Zirconium	40	92	Nb	Niobium	41
101	Ru	Ruthenium	44	102	Rh	Rhodium	45
106	Pd	Palladium	46	107	Ag	Silver	47
112	Cd	Cadmium	48	113	In	Indium	49
127	I	Iodine	53	128	Te	Tellurium	52
131	Xe	Xenon	54	132	Sb	Antimony	51
179	Hf	Hafnium	72	180	Ta	Tantalum	73
181	La	Lanthanum	57	182	Os	Osmium	76
186	Re	Rhenium	75	187	Au	Gold	79
190	Pt	Platinum	78	191	Hg	Mercury	80
192	Ir	Iridium	77	193	Pb	Lead	82
194	Bi	Bismuth	83	195	Po	Polonium	84
201	At	Astatine	85	202	Rn	Radon	86
208	Fr	Francium	87	209	Ac	Actinium	89
210	Th	Thorium	90	211	Pa	Protactinium	91
214	U	Uranium	92	215	Np	Neptunium	93
226	Am	Americium	95	227	Pu	Plutonium	94
238	U	Uranium	92	239	Np	Neptunium	93
244	Am	Americium	95	245	Pu	Plutonium	94
254	Am	Americium	95	255	Pu	Plutonium	94
262	Am	Americium	95	263	Pu	Plutonium	94
270	Am	Americium	95	271	Pu	Plutonium	94
286	Am	Americium	95	287	Pu	Plutonium	94
294	Am	Americium	95	295	Pu	Plutonium	94
304	Am	Americium	95	305	Pu	Plutonium	94
312	Am	Americium	95	313	Pu	Plutonium	94
320	Am	Americium	95	321	Pu	Plutonium	94
326	Am	Americium	95	327	Pu	Plutonium	94
334	Am	Americium	95	335	Pu	Plutonium	94
342	Am	Americium	95	343	Pu	Plutonium	94
350	Am	Americium	95	351	Pu	Plutonium	94
358	Am	Americium	95	359	Pu	Plutonium	94
366	Am	Americium	95	367	Pu	Plutonium	94
374	Am	Americium	95	375	Pu	Plutonium	94
382	Am	Americium	95	383	Pu	Plutonium	94
390	Am	Americium	95	391	Pu	Plutonium	94
398	Am	Americium	95	399	Pu	Plutonium	94
406	Am	Americium	95	407	Pu	Plutonium	94
414	Am	Americium	95	415	Pu	Plutonium	94
422	Am	Americium	95	423	Pu	Plutonium	94
430	Am	Americium	95	431	Pu	Plutonium	94
438	Am	Americium	95	439	Pu	Plutonium	94
446	Am	Americium	95	447	Pu	Plutonium	94
454	Am	Americium	95	455	Pu	Plutonium	94
462	Am	Americium	95	463	Pu	Plutonium	94
470	Am	Americium	95	471	Pu	Plutonium	94
478	Am	Americium	95	479	Pu	Plutonium	94
486	Am	Americium	95	487	Pu	Plutonium	94
494	Am	Americium	95	495	Pu	Plutonium	94
502	Am	Americium	95	503	Pu	Plutonium	94
510	Am	Americium	95	511	Pu	Plutonium	94
518	Am	Americium	95	519	Pu	Plutonium	94
526	Am	Americium	95	527	Pu	Plutonium	94
534	Am	Americium	95	535	Pu	Plutonium	94
542	Am	Americium	95	543	Pu	Plutonium	94
550	Am	Americium	95	551	Pu	Plutonium	94
558	Am	Americium	95	559	Pu	Plutonium	94
566	Am	Americium	95	567	Pu	Plutonium	94
574	Am	Americium	95	575	Pu	Plutonium	94
582	Am	Americium	95	583	Pu	Plutonium	94
590	Am	Americium	95	591	Pu	Plutonium	94
598	Am	Americium	95	599	Pu	Plutonium	94
606	Am	Americium	95	607	Pu	Plutonium	94
614	Am	Americium	95	615	Pu	Plutonium	94
622	Am	Americium	95	623	Pu	Plutonium	94
630	Am	Americium	95	631	Pu	Plutonium	94
638	Am	Americium	95	639	Pu	Plutonium	94
646	Am	Americium	95	647	Pu	Plutonium	94
654	Am	Americium	95	655	Pu	Plutonium	94
662	Am	Americium	95	663	Pu	Plutonium	94
670	Am	Americium	95	671	Pu	Plutonium	94
678	Am	Americium	95	679	Pu	Plutonium	94
686	Am	Americium	95	687	Pu	Plutonium	94
694	Am	Americium	95	695	Pu	Plutonium	94
702	Am	Americium	95	703	Pu	Plutonium	94
710	Am	Americium	95	711	Pu	Plutonium	94
718	Am	Americium	95	719	Pu	Plutonium	94
726	Am	Americium	95	727	Pu	Plutonium	94
734	Am	Americium	95	735	Pu	Plutonium	94
742	Am	Americium	95	743	Pu	Plutonium	94
750	Am	Americium	95	751	Pu	Plutonium	94
758	Am	Americium	95	759	Pu	Plutonium	94
766	Am	Americium	95	767	Pu	Plutonium	94
774	Am	Americium	95	775	Pu	Plutonium	94
782	Am	Americium	95	783	Pu	Plutonium	94
790	Am	Americium	95	791	Pu	Plutonium	94
798	Am	Americium	95	799	Pu	Plutonium	94
806	Am	Americium	95	807	Pu	Plutonium	94
814	Am	Americium	95	815	Pu	Plutonium	94
822	Am	Americium	95	823	Pu	Plutonium	94
830	Am	Americium	95	831	Pu	Plutonium	94
838	Am	Americium	95	839	Pu	Plutonium	94
846	Am	Americium	95	847	Pu	Plutonium	94
854	Am	Americium	95	855	Pu	Plutonium	94
862	Am	Americium	95	863	Pu	Plutonium	94
870	Am	Americium	95	871	Pu	Plutonium	94
878	Am	Americium	95	879	Pu	Plutonium	94
886	Am	Americium	95	887	Pu	Plutonium	94
894	Am	Americium	95	895	Pu	Plutonium	94
902	Am	Americium	95	903	Pu	Plutonium	94
910	Am	Americium	95	911	Pu	Plutonium	94
918	Am	Americium	95	919	Pu	Plutonium	94
926	Am	Americium	95	927	Pu	Plutonium	94
934	Am	Americium	95	935	Pu	Plutonium	94
942	Am	Americium	95	943	Pu	Plutonium	94
950	Am	Americium	95	951	Pu	Plutonium	94
958	Am	Americium	95	959	Pu	Plutonium	94
966	Am	Americium	95	967	Pu	Plutonium	94
974	Am	Americium	95	975	Pu	Plutonium	94
982	Am	Americium	95	983	Pu	Plutonium	94
990	Am	Americium	95	991	Pu	Plutonium	94
998	Am	Americium	95	999	Pu	Plutonium	94

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			1/1840
Relative charge	+ 1		

- (b) The symbol for an atom of one isotope of hydrogen is ${}^3_1\text{H}$

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

(2)

Number of protons

Number of neutrons

Number of electrons

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

(2)

.....

.....

.....

- (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)

(Total for Question 1 = 10 marks)



(a) Part of the Periodic Table is shown.

[illegible]

(i) a metal that reacts violently with water

A **B** **C** **D** **E**

(1)

A ☐ **B** ☐ **C** ☐ **D** ☐ **E** ☐

(1)

A ☐ **B** ☐ **C** ☐ **D** ☐ **E** ☐

(1)

A ☐ **B** ☐ **C** ☐ **D** ☐ **E** ☐

(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)



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

It can be made as a precipitate from a solution of lead(II) nitrate, $\text{Pb}(\text{NO}_3)_2$

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

(1)

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

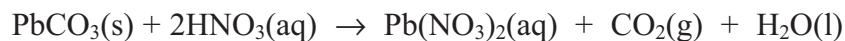
(2)

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

(3)

- (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:



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

(2)

1

2

(Total for Question 3 = 8 marks)



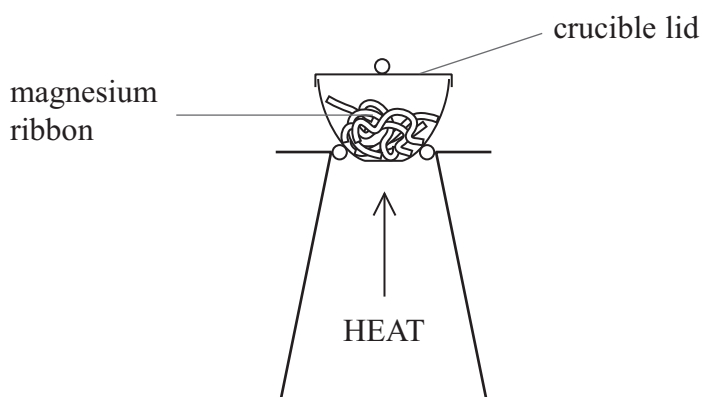
- 4 When magnesium is burned in air, it reacts with oxygen, O_2 , to form magnesium oxide, MgO

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)

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

(1)



(b) Show how the mass of magnesium oxide formed can be calculated from the readings obtained.
(1)

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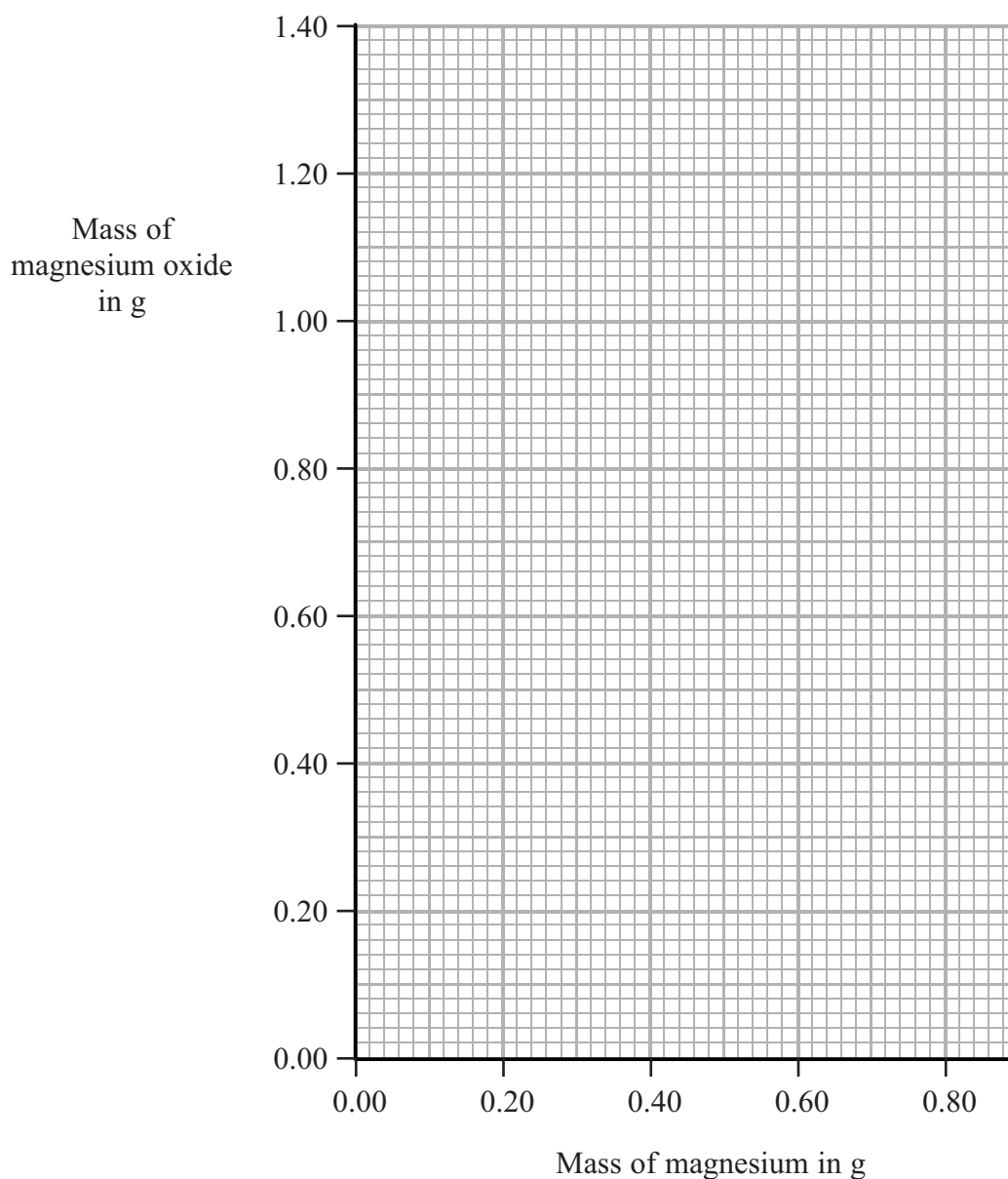
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(c) The results of each experiment are given in the table.

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

- (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)

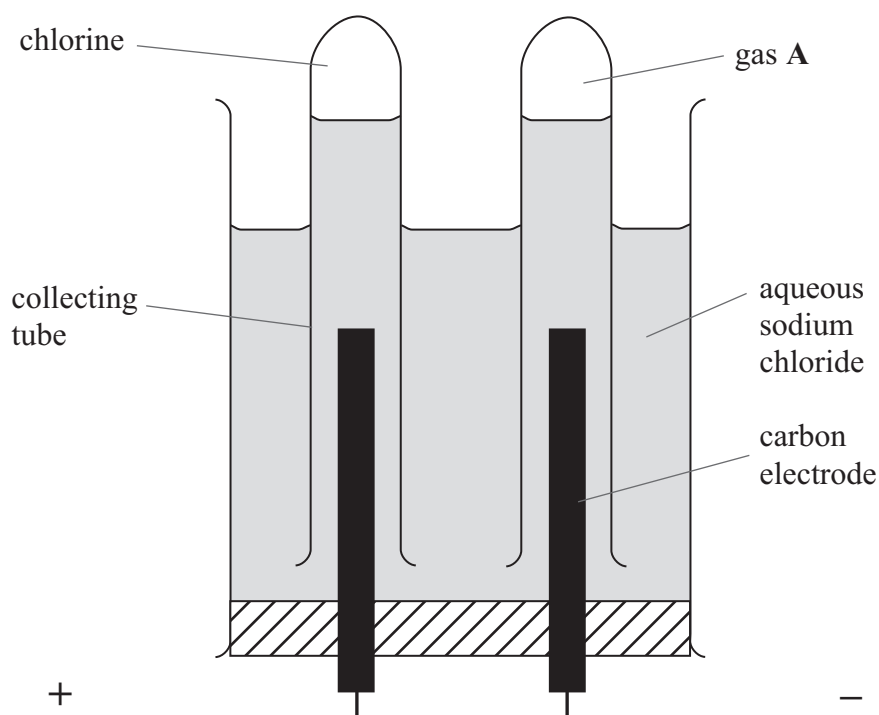
- (iii) Use your graph to find the mass of magnesium oxide formed when 0.48 g of magnesium is burned.

(1)

(Total for Question 4 = 8 marks)



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)

.....

.....

.....

.....

(ii) Identify gas A.

(1)

.....

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

Explain this result.

(1)

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



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)

- (ii) Calculate the volume of chlorine formed.

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

(2)

(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)

(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)

(c) The empirical formula of compound **X** is $\text{CuSO}_4 \cdot \text{H}_2\text{O}$

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

(1)

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

Outline how you would carry out a flame test.

(2)

(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)

- (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)



- (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

Temperature

- (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

.....

2

.....

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

(2)

1

.....

2

.....

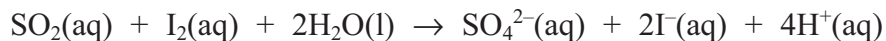
(Total for Question 7 = 8 marks)

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, $\text{I}_2(\text{aq})$.

The equation for the reaction is



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

(2)

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

(1)

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

(2)

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

(2)

(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)

(Total for Question 8 = 8 marks)

TOTAL FOR PAPER = 60 MARKS

