

Centre No.						Paper Reference	Surname	Initial(s)
Candidate No.						6 2 4 1 / 0 1	Signature	

Paper Reference(s)

6241/01

Examiner's use only

Edexcel GCE

Chemistry

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Team Leader's use only

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Advanced Subsidiary

Unit Test 1

Wednesday 4 June 2008 – Morning

Time: 1 hour

Question Number	Leave Blank
1	
2	
3	
4	
5	
6	
7	
Total	

Materials required for examination

Nil

Items included with question papers

Nil

Candidates may use a calculator.

Instructions to Candidates

In the boxes above, write your centre number, candidate number, your surname, initial(s) and signature.

Check that you have the correct question paper. The paper reference is shown above.

Answer **ALL** the questions. Write your answers in the spaces provided in this question paper.

Do not use pencil. Use blue or black ink.

Show all the steps in any calculations and state the units.

Information for Candidates

The total mark for this paper is 60. The marks for individual questions and parts of questions are shown in round brackets: e.g. (2). There are 16 pages in this question paper. All blank pages are indicated.

A Periodic Table is printed on the back cover of this question paper.

Advice to Candidates

You are reminded of the importance of clear English and careful presentation in your answers.

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N 3 0 4 2 5 A 0 1 1 6

Turn over

Answer ALL questions. Write your answers in the spaces provided.

1. (a) A sample of an element can be analysed to show its isotopic composition using a mass spectrometer.

- (i) Explain how the sample is ionised.

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(2)

- (ii) State the TWO properties **of the ion** that determine the path of the ion through the magnetic field.

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(2)

- (b) Define **relative isotopic mass**.

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(2)



- (c) The following data were obtained from the mass spectrum of a sample of chromium.

Relative isotopic mass	Percentage abundance
49.95	4.345
51.94	83.79
52.94	9.501
53.94	2.364

Calculate the relative atomic mass of this sample of chromium.

Give your answer to **four** significant figures.

(2)

- (d) Complete the electron configuration of an iron atom, atomic number 26.

1s	2s	2p		3s	3p		3d				4s
↑↓	↑↓	↑↓	↑↓	↑↓							

(2)

Q1

(Total 10 marks)

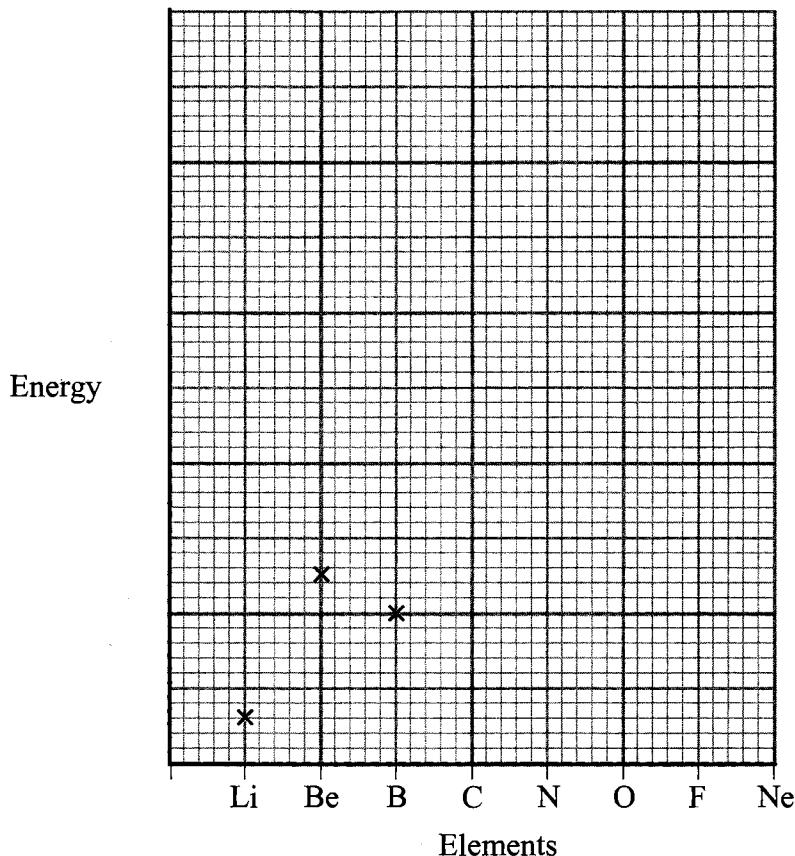


N 3 0 4 2 5 A 0 3 1 6

2. (a) The graph below shows the first ionisation energies of the elements Li, Be, and B.

Complete the graph by adding the **approximate** first ionisation energies of the elements C to Ne.

First ionisation energy of the elements Li to Ne



(2)



- (b) Explain why the general trend is for the first ionisation energy to increase across the period.

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(3)

- (c) Explain why the first ionisation energy of boron, B, is lower than that of beryllium, Be.

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(2)

Q2

(Total 7 marks)

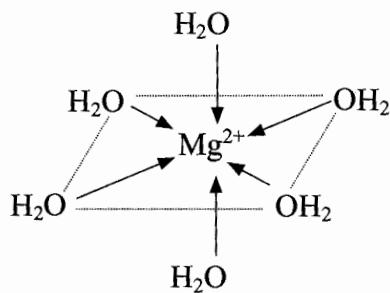


N 3 0 4 2 5 A 0 5 1 6

3. (a) Write an equation, with state symbols, to illustrate the process occurring when the **second ionisation energy** of magnesium is measured.

.....
(2)

- (b) Hydrated magnesium chloride crystals, $[\text{Mg}(\text{H}_2\text{O})_6]\text{Cl}_2$, have six molecules of water attached to the central magnesium ion as shown below.



State the type of bond that exists in this ion between

- (i) the oxygen in the water molecules and the magnesium ion

.....
(1)

- (ii) hydrogen and oxygen in the water molecules

.....
(1)



- (c) The data below shows the decomposition temperatures of the carbonates of two Group 2 elements.

Compound	Decomposition temperature / °C
MgCO ₃	400
BaCO ₃	1360

Use the idea of polarisation of ions to explain why MgCO₃ decomposes more readily than BaCO₃.

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(3)

Q3

(Total 7 marks)



4. (a) Sodium chloride and sodium iodide both have the same crystal structure.
- (i) Use your knowledge of the structure of solid sodium chloride to draw a labelled diagram of the three-dimensional structure of solid **sodium iodide**.

(2)

- (ii) What are the TWO major factors that affect the strength of an ionic bond?

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.....

(2)

- (iii) Suggest why sodium iodide has a lower melting temperature than that of sodium chloride.

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(2)



- (b) Explain why **molten** sodium iodide conducts electricity but **solid** sodium iodide does not.

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(2)

- (c) Suggest why molten sodium iodide and molten sodium chloride have very high boiling temperatures.

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(1)

Q4

(Total 9 marks)



N 3 0 4 2 5 A 0 9 1 6

5. Bromine is extracted from seawater using chlorine.

- (a) (i) Write the equation for the reaction of chlorine with sodium bromide solution.
Do **not** include state symbols.

.....

(1)

- (ii) The seawater is acidified before the reaction with chlorine to prevent the bromine produced reacting with the water.



Name the type of reaction taking place between bromine and water.

Explain your answer in terms of the changes in oxidation number of bromine.

Type of reaction

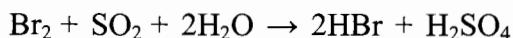
Explanation

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(2)



(iii) Bromine vapour reacts with sulphur dioxide and water as follows.



State the oxidation number of sulphur in

SO_2

H_2SO_4

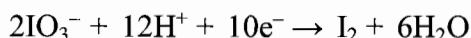
(2)

(iv) Use the data from (iii) to show that bromine is acting as an oxidising agent.

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(1)

(b) The ionic half-equation for the reduction of iodate(V) ions, IO_3^- , to iodine in acid solution is



(i) Write the ionic half-equation for the oxidation of SO_2 in water to SO_4^{2-} and H^+ ions. Do **not** include state symbols.

.....
(1)

(ii) Combine the reduction reaction of iodate(V) ions, IO_3^- , with the oxidation reaction of SO_2 to give the full ionic equation for the reaction of IO_3^- with SO_2 . Do **not** include state symbols.

.....
(2)

Q5

(Total 9 marks)



6. (a) State the flame colours of

(i) barium

.....

(1)

(ii) strontium

.....

(1)

(b) When barium is burnt in excess oxygen a compound containing 81.1% barium and 18.9% of oxygen is formed.

Calculate the empirical formula of this compound.

.....

(2)

(c) (i) Write the equation for the reaction of barium with water. Do **not** include any state symbols.

.....

(1)

(ii) When a small piece of barium is added to water, the barium gets smaller and eventually disappears.

State TWO other observations you could make.

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.....

(2)

(iii) What would be the effect of adding a piece of blue litmus paper and a piece of red litmus paper to the aqueous product of the reaction in (ii)?

Red litmus

Blue litmus

(1)

Q6

(Total 8 marks)



7. Phosphorus reacts with a limited amount of chlorine to produce phosphorus trichloride, PCl_3 .

- (a) (i) Draw a dot and cross diagram to show the arrangement of the electrons in phosphorus trichloride, PCl_3 . You need only show the outer shell electrons.

(2)

- (ii) Draw the phosphorus trichloride molecule, making its three-dimensional shape clear.

(1)



(iii) Explain

- the shape of the phosphorus trichloride molecule.
- why the Cl—P—Cl bond angle is different from the H—C—H bond angle in methane, CH₄.

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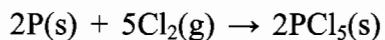
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(3)



(b) Phosphorus reacts with excess chlorine to produce phosphorus pentachloride, PCl_5 .



- (i) Calculate the mass of phosphorus needed to produce 7.19 g of phosphorus pentachloride.

(2)

- (ii) Calculate the volume of chlorine needed to produce 7.19 g of phosphorus pentachloride.

[molar volume of chlorine under the conditions of this experiment = $24.0 \text{ dm}^3 \text{ mol}^{-1}$]

(2)

Q7

(Total 10 marks)

TOTAL FOR PAPER: 60 MARKS**END**

THE PERIODIC TABLE

1 2

Group

Period

1	H
	Hydrogen

Key		
Molar mass g mol ⁻¹	Symbol	Name
		Atomic number

1	H	He
		Helium

2	Li	Be
Lithium	9	Beryllium

3	Na	Mg
Sodium	11	Magnesium
4	K	Ca
Potassium	19	Calcium
5	Rb	Sr
Rubidium	37	Strontium
6	Cs	Ba
Ceasium	55	Barium
7	Fr	Ra
Francium	87	Radium

2	Sc	Ti	V	Cr	Mn	Fe	Co	Ni	Cu	Zn	Ge	As	S	F	Ne
	Scandium	Titanium	Vanadium	Chromium	Manganese	Iron	Cobalt	Nickel	Copper	Zinc	Gallium	Arsenic	Selenium	Fluorine	Neon
3	Nb	Mo	Tc	Ru	Rh	Pd	Ag	Cd	Ir	In	Tl	Sb	Te	Cl	Ar
	Niobium	Molybdenum	Techneium	Ruthenium	Rhodium	Palladium	Silver	Cadmium	Indium	Tin	Antimony	Tellurium	Iodine	Chlorine	Argon
4	Zr	Y	Ta	W	Re	Os	Ir	Pt	Au	Hg	Tl	Pb	Bi	Po	Neon
	Zirconium	Yttrium	Tantalum	Tungsten	Rhenium	Osmium	Iridium	Platinum	Gold	Mercury	Thallium	Lead	Bismuth	Po	Xenon
5	Ta	Hf	Ta	W	Re	Os	Ir	Pt	Au	Hg	Tl	Pb	Bi	Po	Radon
	Tantalum	Hafnium	Tantalum	Tungsten	Rhenium	Osmium	Iridium	Platinum	Gold	Mercury	Thallium	Lead	Bismuth	Po	Radon
6	La	Lu													
	Lanthanum	Lanthanum													
7	Ac														
	Actinium														

140	Ce	Pr	Nd	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu	
	Cerium	Praseodymium	Nodymium	Promethium	Samarium	Europerium	Gadolinium	Terbium	Dysprosium	Holmium	Thulium	Ytterbium	Lutetium	
141	Pr	Nd	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu	Lu	
	58	59	60	61	62	63	64	65	66	67	68	69	70	71
232	Th	Pa	U	Np	Pu	Am	Cm	Bk	Cf	Fm	Md	No	Lr	Lawrencium
	Thorium	Protactinium	Uranium	Neptunium	Plutonium	Americium	Curium	Berkelium	Californium	Einsteinium	Fermium	Mendelevium	Nobelium	Lawrencium
	90	91	92	93	94	95	96	97	98	99	100	101	102	103
231														

