



General Certificate of Secondary Education
2015–2016

Centre Number

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Candidate Number

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Double Award Science: Chemistry

Unit C1
Higher Tier

[GSD22]



THURSDAY 19 MAY 2016, MORNING

TIME

1 hour, plus your additional time allowance.

INSTRUCTIONS TO CANDIDATES

Write your Centre Number and Candidate Number in the spaces provided at the top of this page.

You must answer the questions in the spaces provided.

Do not write outside the boxed area on each page or on blank pages.

Complete in blue or black ink only.

Answer **all eight** questions.

INFORMATION FOR CANDIDATES

The total mark for this paper is 70.

Figures in brackets printed down the right-hand side of pages indicate the marks awarded to each question or part question.

Quality of written communication will be assessed in Question 4.

A Data Leaflet, which includes a Periodic Table of the elements is provided.

1 Newlands and Mendeleev, along with other chemists, helped to produce the modern Periodic Table.

(a) Place a tick (✓) in each correct box to show the area each chemist worked on.

Area worked on	Newlands <i>only</i>	Mendeleev <i>only</i>	<i>Both</i> Newlands and Mendeleev	<i>Neither</i> Newlands nor Mendeleev
stated the Law of Octaves				
arranged elements in order of relative atomic mass				
included noble gases				
left gaps for undiscovered elements				

[4]

(b) A student is given a Periodic Table.

Column A										Column B																																	
↓										↓																																	
<table border="1" style="margin: auto;"> <tr><td>lithium 3 Li</td><td>beryllium 4 Be</td></tr> <tr><td>sodium 11 Na</td><td>magnesium 12 Mg</td></tr> </table>										lithium 3 Li	beryllium 4 Be	sodium 11 Na	magnesium 12 Mg	<table border="1" style="margin: auto;"> <tr><td>hydrogen 1 H</td><td colspan="18"></td><td>helium 2 He</td></tr> </table>										hydrogen 1 H																			helium 2 He
lithium 3 Li	beryllium 4 Be																																										
sodium 11 Na	magnesium 12 Mg																																										
hydrogen 1 H																			helium 2 He																								
lithium 3 Li 6.941	beryllium 4 Be 9.0122																			boron 5 B 10.811	carbon 6 C 12.011	nitrogen 7 N 14.007	oxygen 8 O 15.999	fluorine 9 F 18.998	neon 10 Ne 20.180																		
sodium 11 Na 22.990	magnesium 12 Mg 24.305																			aluminum 13 Al 26.982	silicon 14 Si 28.086	phosphorus 15 P 30.974	sulfur 16 S 32.065	chlorine 17 Cl 35.453	argon 18 Ar 39.948																		
potassium 19 K 39.098	calcium 20 Ca 40.078	scandium 21 Sc 44.956	titanium 22 Ti 47.867	vanadium 23 V 50.942	chromium 24 Cr 51.996	manganese 25 Mn 54.938	iron 26 Fe 55.845	cobalt 27 Co 58.933	nickel 28 Ni 58.693	copper 29 Cu 63.546	zinc 30 Zn 65.38	gallium 31 Ga 69.723	germanium 32 Ge 72.64	arsenic 33 As 74.922	selenium 34 Se 78.96	bromine 35 Br 79.904	krypton 36 Kr 83.798																										
rubidium 37 Rb 85.468	strontium 38 Sr 87.62	yttrium 39 Y 88.906	zirconium 40 Zr 91.224	niobium 41 Nb 92.906	molybdenum 42 Mo 95.96	technetium 43 Tc [98]	ruthenium 44 Ru 101.07	rhodium 45 Rh 102.91	palladium 46 Pd 106.42	silver 47 Ag 107.87	cadmium 48 Cd 112.41	indium 49 In 114.82	tin 50 Sn 118.71	antimony 51 Sb 121.76	tellurium 52 Te 127.60	iodine 53 I 126.90	xenon 54 Xe 131.29																										
caesium 55 Cs 132.91	barium 56 Ba 137.33	lanthanum 57 La 138.91	hafnium 72 Hf 178.49	tantalum 73 Ta 180.95	tungsten 74 W 183.84	rhenium 75 Re 186.21	osmium 76 Os 190.23	iridium 77 Ir 192.22	platinum 78 Pt 195.08	gold 79 Au 196.97	mercury 80 Hg 200.59	thallium 81 Tl 204.38	lead 82 Pb 207.2	bismuth 83 Bi 208.98	polonium 84 Po 209	astatine 85 At 210	radon 86 Rn 222																										
francium 87 Fr 223	radium 88 Ra 226	actinium 89 Ac 227	rutherfordium 104 Rf 261	dubnium 105 Db 262	seaborgium 106 Sg 266	bohrium 107 Bh 264	hassium 108 Hs 277	meitnerium 109 Mt 268	darmstadtium 110 Ds 271	roentgenium 111 Rg 272	copernicium 112 Cn 285																																

Circle the correct answer in each of the five questions below.

(i) The elements in **Column A** are:

alkali metals

Group 2

Period 2

[1]

(ii) The physical state at room temperature of all the elements in **Column B** is:

solid

liquid

gas

[1]

(iii) The elements N, O, F, Cl, Br and I are all:

gases

diatomic

inert

[1]

(iv) The elements in **Column B** all have:

only 3 electrons

3 electrons in outer shell

3 electrons in first shell

[1]

(v) The solid black line separates:

metals and gases

solids and liquids

metals and non-metals

[1]

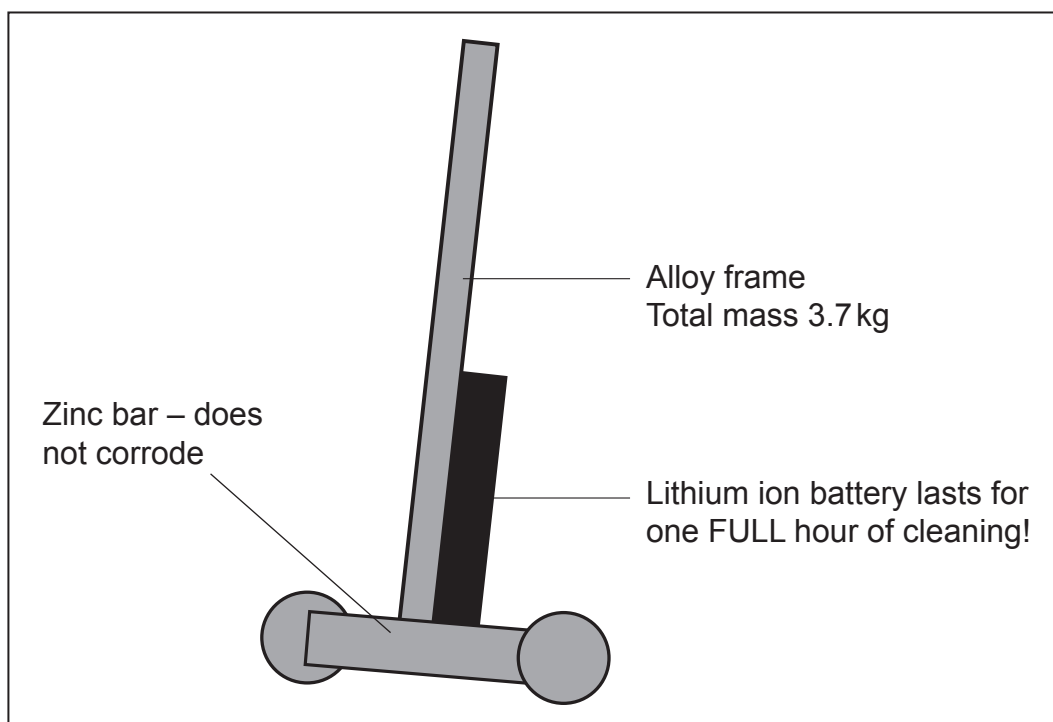
(c) (i) Name the element which is in Period 2 and Group 4.

_____ [1]

(ii) Name an element whose atoms have three shells and five electrons in the outer shell.

_____ [1]

2 A labelled diagram for a cordless vacuum cleaner, is shown below.



(a) Write down the symbol for a lithium ion.

_____ [1]

(b) What is an alloy?

_____ [2]

(c) Write down one property needed for the alloy used in the frame of the vacuum cleaner.

_____ [1]

3 Water has a melting point of 0 °C and it is a very good solvent.

(a) What is meant by the chemical terms:

(i) solvent?

[1]

(ii) melting point?

[2]

(b) Write down two other physical properties of water. Do not include that it has a melting point of 0 °C and is a very good solvent.

1. _____

2. _____ [2]

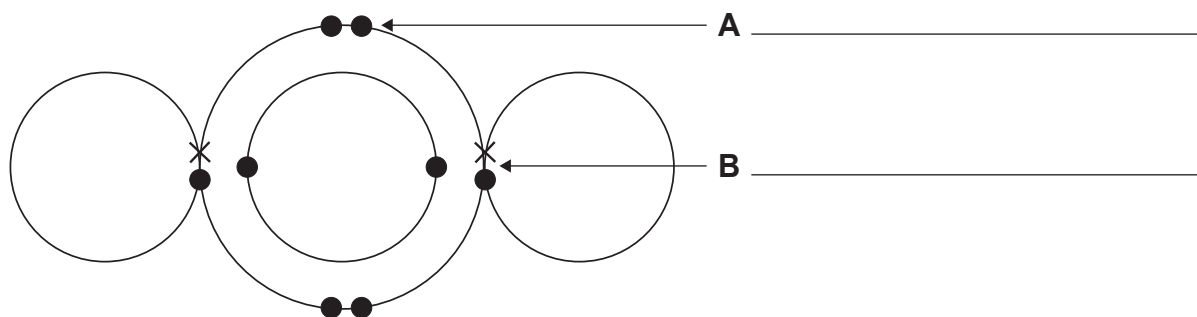
Compound A is soluble in water. It has a solubility of 2.9g/100 g of water at 20 °C.

(c) Why is the temperature important when giving the solubility of a substance in water?

[1]

[Turn over

(d) A dot and cross diagram of the bonding in water is shown below.



(i) Write down the name of each pair of electrons **A** and **B**. [2]

(ii) Name the type of bonding in water.

_____ [1]

(iii) Which two compounds from the list below have the same type of bonding as water?

Tick (✓) the two correct boxes.

potassium iodide

carbon dioxide

copper sulfate

calcium carbonate

hydrogen sulfide

[2]



4 In this question you will be assessed on your written communication skills including the use of specialist scientific terms.

Magnesium forms a 2^+ ion and oxygen forms a 2^- ion.
Compare and contrast the Mg^{2+} ion and the O^{2-} ion.

You should include information about:

- the number and type of the particles present in each ion
- the electron configuration of each ion and
- how the ions are formed from their atoms.

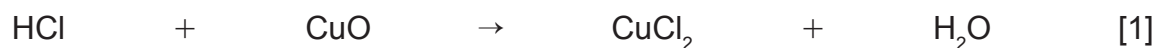
[6]

5 Metal oxides and metal carbonates will react with acids to form salts.

- (a) Complete the word equation for the reaction between copper oxide and sulfuric acid.



- (b) Balance the symbol equation below.



- (c) Write a balanced symbol equation for the reaction between copper carbonate and hydrochloric acid.

_____ [3]

- (d) The reaction between sodium hydroxide and hydrochloric acid is known as a neutralisation reaction. Write an **ionic** equation to describe this neutralisation. Include state symbols.

_____ [3]

6 Air is a mixture of gases including nitrogen, N_2 , and very small amounts of methane, CH_4 .

Draw **dot and cross** diagrams to show the bonding in a molecule of methane and a molecule of nitrogen.

Show the outer electrons only.

methane

[2]

nitrogen

[3]

[Turn over

- 7 (a) The table below gives information about the physical properties of the halogens. Complete the table.

Name	Formula	State at room temperature	Colour
bromine			red-brown
chlorine		gas	
fluorine		gas	yellow
iodine			grey-black

[5]

- (b) The sentence below describes the trend in melting points of the halogens as Group 7 is descended. Complete the sentence.

The melting points of halogens _____ as Group 7 is descended.

[1]

- (c) Explain why the halogens all form ions with a single negative charge.

[2]

- (d) When chlorine is bubbled through a solution of sodium iodide the colour of the solution darkens.

- (i) Write a balanced symbol equation for the reaction of chlorine with sodium iodide.

_____ [3]

- (ii) Explain why the colour of the solution darkens in this reaction.

[2]



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(Questions continue overleaf)

8 Calcium metal can be produced by passing an electric current through molten calcium fluoride, CaF_2 , using graphite rods known as electrodes.

(a) What name is given to this process?

_____ [1]

(b) Explain why molten calcium fluoride can conduct electricity.

_____ [2]

(c) What happens to the molten calcium fluoride as the electricity passes through?

_____ [1]

Calcium is produced at the cathode.

(d) (i) Why is calcium produced at the **cathode**?

_____ [2]

(ii) Explain, **in words**, in terms of the electrons involved, **how** the calcium is produced at the cathode during the electrolysis.

_____ [3]

(e) Graphite is a suitable material for the electrodes as it is a good conductor of electricity.
Write down two other properties of graphite which make it suitable for use as electrodes.

1. _____

2. _____

[2]

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Question Number	Marks
1	
2	
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Examiner Number

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