



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]

\*GSD22\*

**THURSDAY 19 MAY 2016, MORNING**

## TIME

1 hour.

## 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. **Do not write with a gel pen.**

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.

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\*16GSD2201\*

1 Many chemists contributed to the modern Periodic Table including Newlands and Mendeleev.

(a) Complete the table below to show the contribution of each chemist.  
Place a tick (✓) in each correct box.

Contribution	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**

↓

lithium 3 <b>Li</b> 6.941	beryllium 4 <b>Be</b> 9.0122
sodium 11 <b>Na</b> 22.990	magnesium 12 <b>Mg</b> 24.305

↓

boron 5 <b>B</b> 10.811	carbon 6 <b>C</b> 12.011	nitrogen 7 <b>N</b> 14.007	oxygen 8 <b>O</b> 15.999	fluorine 9 <b>F</b> 18.998	helium 2 <b>He</b> 4.0026
aluminum 13 <b>Al</b> 26.982	silicon 14 <b>Si</b> 28.086	phosphorus 15 <b>P</b> 30.974	sulfur 16 <b>S</b> 32.065	chlorine 17 <b>Cl</b> 35.453	argon 18 <b>Ar</b> 39.948

potassium 19 <b>K</b> 39.098	calcium 20 <b>Ca</b> 40.078	scandium 21 <b>Sc</b> 44.956	titanium 22 <b>Ti</b> 47.867	vanadium 23 <b>V</b> 50.942	chromium 24 <b>Cr</b> 51.996	manganese 25 <b>Mn</b> 54.938	iron 26 <b>Fe</b> 55.845	cobalt 27 <b>Co</b> 58.933	nickel 28 <b>Ni</b> 58.693	copper 29 <b>Cu</b> 63.546	zinc 30 <b>Zn</b> 65.38	gallium 31 <b>Ga</b> 69.723	germanium 32 <b>Ge</b> 72.64	arsenic 33 <b>As</b> 74.922	selenium 34 <b>Se</b> 78.96	bromine 35 <b>Br</b> 79.904	krypton 36 <b>Kr</b> 83.798
rubidium 37 <b>Rb</b> 85.468	strontium 38 <b>Sr</b> 87.62	yttrium 39 <b>Y</b> 88.906	zirconium 40 <b>Zr</b> 91.224	niobium 41 <b>Nb</b> 92.906	molybdenum 42 <b>Mo</b> 95.96	technetium 43 <b>Tc</b> [98]	ruthenium 44 <b>Ru</b> 101.07	rhodium 45 <b>Rh</b> 102.91	palladium 46 <b>Pd</b> 106.42	silver 47 <b>Ag</b> 107.87	cadmium 48 <b>Cd</b> 112.41	indium 49 <b>In</b> 114.82	tin 50 <b>Sn</b> 118.71	antimony 51 <b>Sb</b> 121.76	tellurium 52 <b>Te</b> 127.60	iodine 53 <b>I</b> 126.90	xenon 54 <b>Xe</b> 131.29
caesium 55 <b>Cs</b> 132.91	barium 56 <b>Ba</b> 137.33	lanthanum 57 <b>La</b> 138.91	hafnium 72 <b>Hf</b> 178.49	tantalum 73 <b>Ta</b> 180.95	tungsten 74 <b>W</b> 183.84	rhenium 75 <b>Re</b> 186.21	osmium 76 <b>Os</b> 190.23	iridium 77 <b>Ir</b> 192.22	platinum 78 <b>Pt</b> 195.08	gold 79 <b>Au</b> 196.97	mercury 80 <b>Hg</b> 200.59	thallium 81 <b>Tl</b> 204.38	lead 82 <b>Pb</b> 207.2	bismuth 83 <b>Bi</b> 208.98	polonium 84 <b>Po</b> 209	astatine 85 <b>At</b> 210	radon 86 <b>Rn</b> 222
francium 87 <b>Fr</b> 223	radium 88 <b>Ra</b> 226	actinium 89 <b>Ac</b> 227	rutherfordium 104 <b>Rf</b> 261	dubnium 105 <b>Db</b> 262	seaborgium 106 <b>Sg</b> 266	bohrium 107 <b>Bh</b> 264	hassium 108 <b>Hs</b> 277	meitnerium 109 <b>Mt</b> 268	darmstadtium 110 <b>Ds</b> 271	roentgenium 111 <b>Rg</b> 272	copernicium 112 <b>Cn</b> 285						

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For each of the five questions below three answers are given. Only one is correct. Circle the correct answer.

(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]

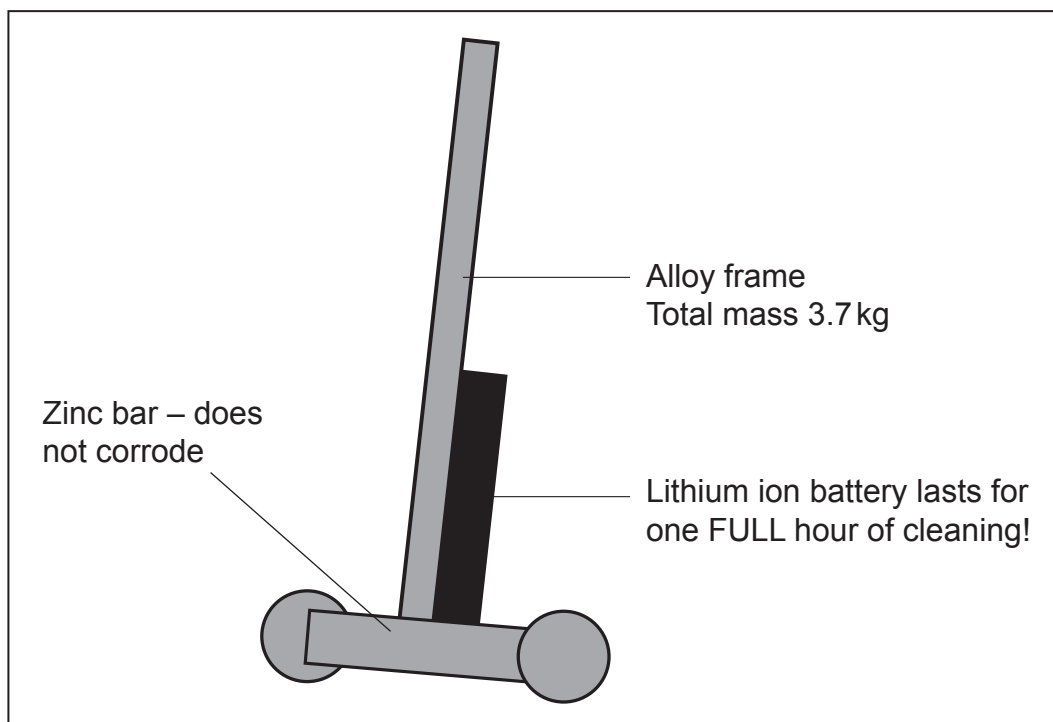
(ii) Name an element whose atoms have three shells and five electrons in the outer shell.

\_\_\_\_\_ [1]

[Turn over



- 2 A labelled diagram, used in an advertisement for a cordless vacuum cleaner, is shown below.



- (a) Give the symbol for a lithium ion.

\_\_\_\_\_ [1]

- (b) What is an alloy?

\_\_\_\_\_  
\_\_\_\_\_ [2]

- (c) Give 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 is an excellent solvent.

(a) What is meant by the chemical terms:

(i) solvent?

---

---

[1]

(ii) melting point?

---

---

---

[2]

(b) Give two physical properties of water apart from the fact that it has a melting point of 0 °C and is an excellent solvent.

1. \_\_\_\_\_

2. \_\_\_\_\_ [2]

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

(c) Why must the temperature be stated when giving the solubility of a substance in water?

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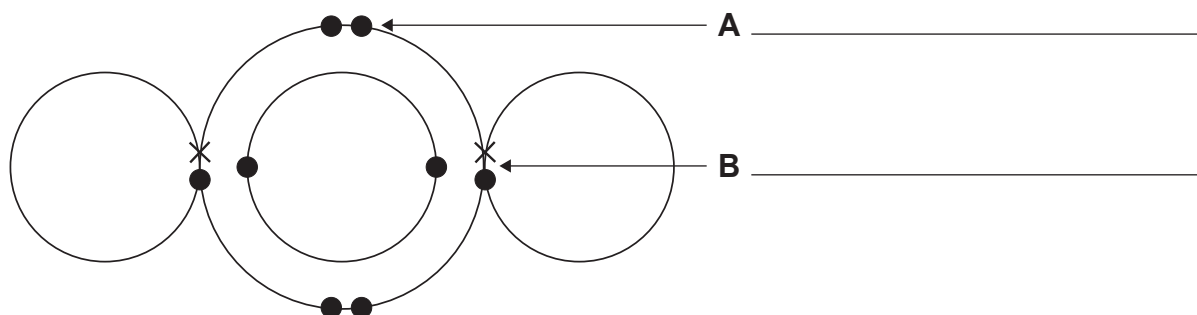
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[1]

[Turn over



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



(i) Fill in the correct labels for the pairs of electrons labelled **A** and **B**. [2]

(ii) Name the type of bonding in water.

\_\_\_\_\_ [1]

(iii) Choose two compounds from the list below which have the same type of bonding as water.

Tick (✓) the two correct boxes.

potassium iodide

carbon dioxide

copper sulfate

calcium carbonate

hydrogen sulfide

[2]





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

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\*16GSD2209\*

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

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

[5]

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

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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[Turn over



\*16GSD2211\*

8 Calcium metal can be produced by passing an electric current through molten calcium fluoride,  $\text{CaF}_2$ , 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.  
Give two other properties of graphite which make it suitable for use as electrodes.

1. \_\_\_\_\_  
\_\_\_\_\_

2. \_\_\_\_\_  
\_\_\_\_\_

[2]

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**THIS IS THE END OF THE QUESTION PAPER**

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For Examiner's use only	
Question Number	Marks
1	
2	
3	
4	
5	
6	
7	
8	

<b>Total Marks</b>	
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Examiner Number

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