



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											
↓										hydrogen <b>H</b> 1.0079	↓										helium <b>He</b> 4.0026
lithium <b>Li</b> 3 6.941	beryllium <b>Be</b> 4 9.0122									boron <b>B</b> 5 10.811	carbon <b>C</b> 6 12.011	nitrogen <b>N</b> 7 14.007	oxygen <b>O</b> 8 15.999	fluorine <b>F</b> 9 18.998	neon <b>Ne</b> 10 20.180						
sodium <b>Na</b> 11 22.990	magnesium <b>Mg</b> 12 24.305									aluminum <b>Al</b> 13 26.982	silicon <b>Si</b> 14 28.086	phosphorus <b>P</b> 15 30.974	sulfur <b>S</b> 16 32.065	chlorine <b>Cl</b> 17 35.453	argon <b>Ar</b> 18 39.948						
potassium <b>K</b> 19 39.098	calcium <b>Ca</b> 20 40.078	scandium <b>Sc</b> 21 44.956	titanium <b>Ti</b> 22 47.867	vanadium <b>V</b> 23 50.942	chromium <b>Cr</b> 24 51.996	manganese <b>Mn</b> 25 54.938	iron <b>Fe</b> 26 55.845	cobalt <b>Co</b> 27 58.933	nickel <b>Ni</b> 28 58.693	copper <b>Cu</b> 29 63.546	zinc <b>Zn</b> 30 65.38	gallium <b>Ga</b> 31 69.723	germanium <b>Ge</b> 32 72.64	arsenic <b>As</b> 33 74.922	selenium <b>Se</b> 34 78.96	bromine <b>Br</b> 35 79.904	krypton <b>Kr</b> 36 83.798				
rubidium <b>Rb</b> 37 85.468	strontium <b>Sr</b> 38 87.62	yttrium <b>Y</b> 39 88.906	zirconium <b>Zr</b> 40 91.224	niobium <b>Nb</b> 41 92.906	molybdenum <b>Mo</b> 42 95.96	technetium <b>Tc</b> 43 [98]	ruthenium <b>Ru</b> 44 101.07	rhodium <b>Rh</b> 45 102.91	palladium <b>Pd</b> 46 106.42	silver <b>Ag</b> 47 107.87	cadmium <b>Cd</b> 48 112.41	indium <b>In</b> 49 114.82	tin <b>Sn</b> 50 118.71	antimony <b>Sb</b> 51 121.76	tellurium <b>Te</b> 52 127.60	iodine <b>I</b> 53 126.90	xenon <b>Xe</b> 54 131.29				
caesium <b>Cs</b> 55 132.91	barium <b>Ba</b> 56 137.33	lanthanum <b>La</b> 57 138.91	hafnium <b>Hf</b> 72 178.49	tantalum <b>Ta</b> 73 180.95	tungsten <b>W</b> 74 183.84	rhenium <b>Re</b> 75 186.21	osmium <b>Os</b> 76 190.23	iridium <b>Ir</b> 77 192.22	platinum <b>Pt</b> 78 195.08	gold <b>Au</b> 79 196.97	mercury <b>Hg</b> 80 200.59	thallium <b>Tl</b> 81 204.38	lead <b>Pb</b> 82 207.2	bismuth <b>Bi</b> 83 208.98	polonium <b>Po</b> 84 209	astatine <b>At</b> 85 210	radon <b>Rn</b> 86 222				
francium <b>Fr</b> 87 223	radium <b>Ra</b> 88 226	actinium <b>Ac</b> 89 227	rutherfordium <b>Rf</b> 104 261	dubnium <b>Db</b> 105 262	seaborgium <b>Sg</b> 106 266	bohrium <b>Bh</b> 107 264	hassium <b>Hs</b> 108 277	meitnerium <b>Mt</b> 109 268	darmstadtium <b>Ds</b> 110 271	roentgenium <b>Rg</b> 111 272	copernicium <b>Cn</b> 112 285										

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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]

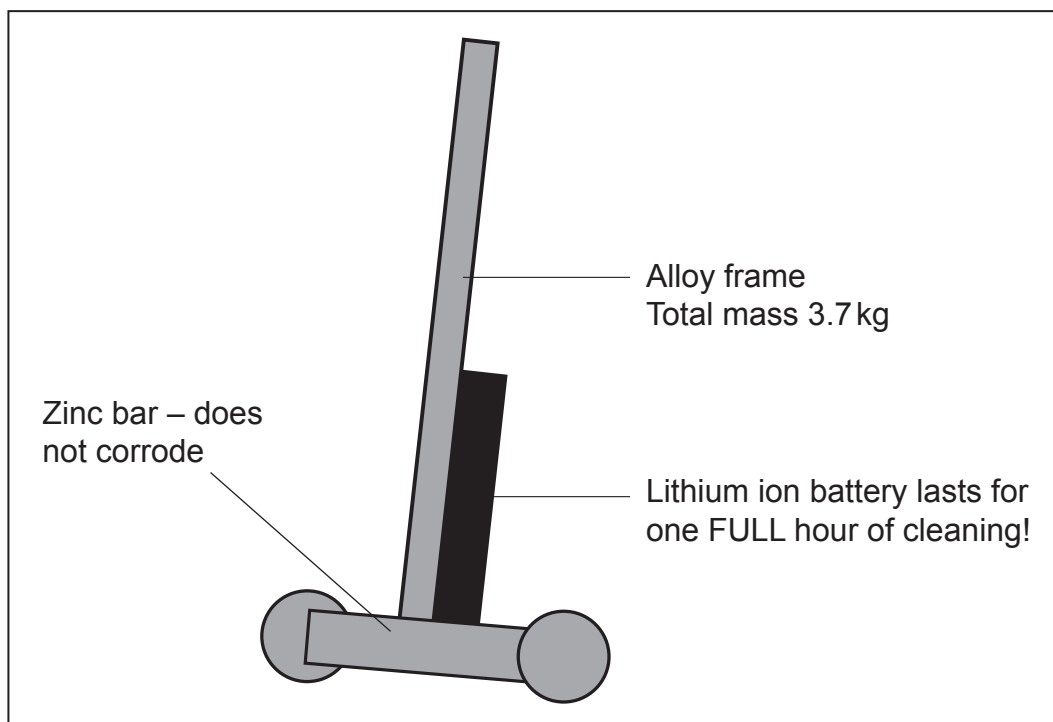
(ii) Name an element whose atoms have three shells and five electrons in the outer shell.

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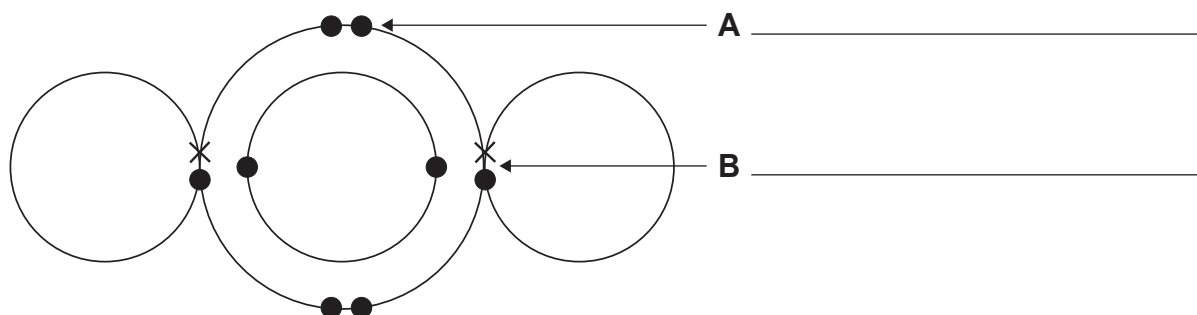
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[1]

[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	
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6	
7	
8	

<b>Total Marks</b>	
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Examiner Number

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