Rewarding Learning

Centre Number

Candidate Number

General Certificate of Secondary Education
2015–2016

Double Award Science: Chemistry

Unit C1
Higher Tier

ML

[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 ***only***	Mendeleev ***only***	***Both*** Newlands and Mendeleev	***Neither*** 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 1 **H** 1.0079										helium 2 **He** 4.0026
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											aluminium 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.

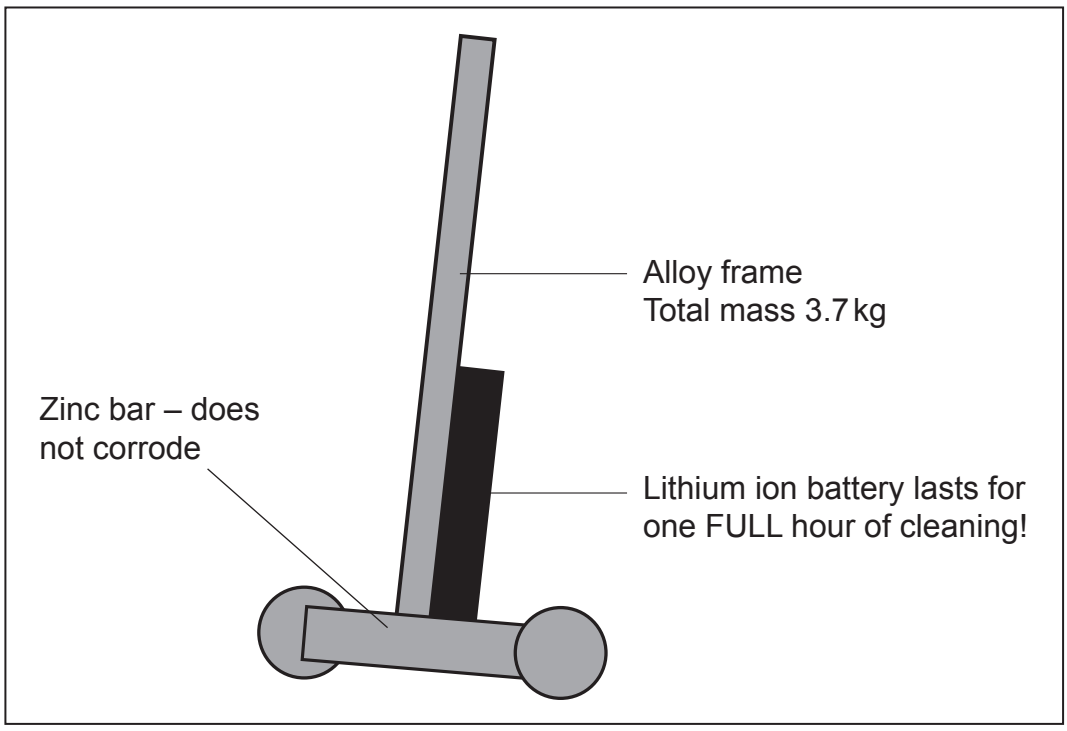
_____ [1]

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

_____ [1]

[Turn over

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 2.9 g/100 g of water at 20 °C.

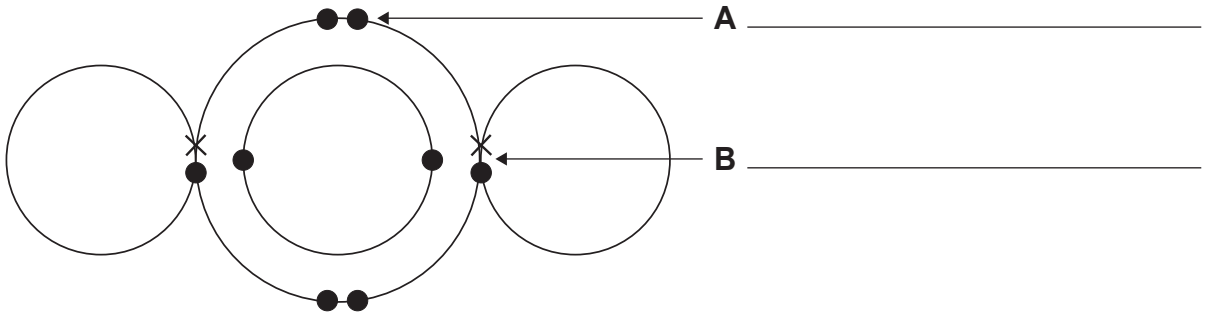
(c) Why is the temperature important when giving the solubility of a substance in water?

_____

_____ [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]

[Turn over

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.

copper oxide + sulfuric acid → + [2]

(b) Balance the symbol equation below.

$HCl + CuO \rightarrow CuCl_2 + H_2O$ [1]

(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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For Examiner's use only	
Question Number	**Marks**
1	
2	
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Total Marks	

Examiner Number