Rewarding Learning

Centre Number

Candidate Number

General Certificate of Secondary Education
2015–2016

Double Award Science: Chemistry

MV18

Unit C1

Foundation Tier

[GSD21]

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.
Complete in blue or black ink only.
Answer **all ten** questions.

Information for Candidates

The total mark for this paper is 70.
Figures in brackets printed at the end of each question indicate the marks awarded to each question or part question.
Quality of written communication will be assessed in Question **9**.
A Data Leaflet, which includes a Periodic Table of the elements is provided.

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1 Many chemical compounds are white but some are not. Draw a line to match each chemical compound to its colour. [4 marks]

chemical compound	**colour**
	black
hydrated copper sulfate	
	white
aluminium oxide	
	red
copper oxide	
	green
copper carbonate	
	blue

2 Sulfuric acid is a strong acid.

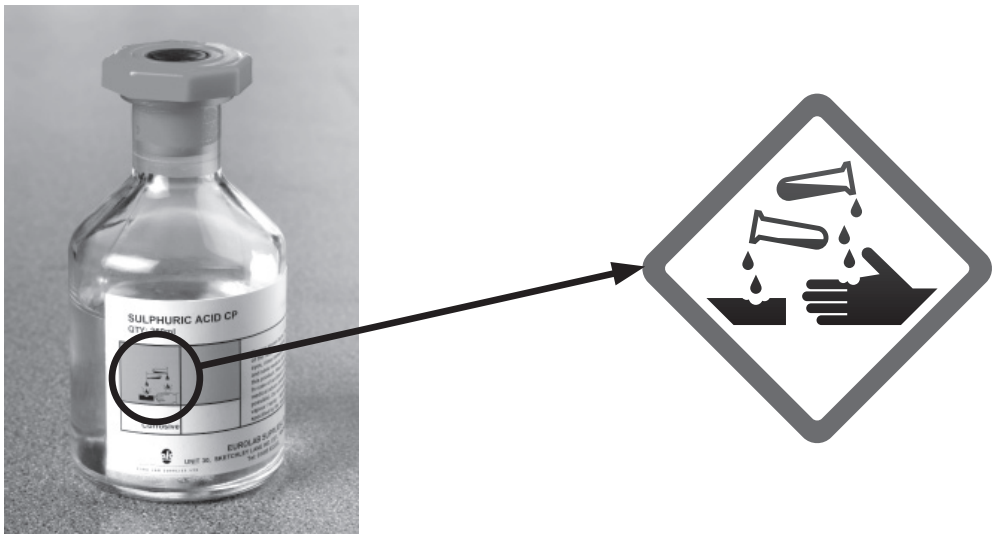
(a) What pH would you expect for sulfuric acid?
Circle the correct value. [1 mark]

1 5 7 9 10

(b) Four drops of universal indicator are placed into a sample of sulfuric acid.
What colour will be seen? [1 mark]

_____

(c) Bottles of sulfuric acid are labelled with the hazard symbol as shown in the photograph below.



(i) Name the hazard symbol shown. [1 mark]

_____

(ii) Give two reasons why hazard symbols are shown on bottles of chemicals. [2 marks]

1. _____

_____

2. _____

_____

(d) A molecule of sulfuric acid contains 4 oxygen atoms, 2 hydrogen atoms and 1 sulfur atom.
What is the formula for sulfuric acid?
Circle the correct formula. [1 mark]

HSO_4 $H_2(SO_2)_2$ H_2SO_4 $H_2S(O_2)_2$

3 Four sets of apparatus, **A**, **B**, **C** and **D** are given below.

A beaker, stirring rod, thermometer	**B** filter paper, filter funnel, conical flask
C tripod stand, heatproof mat, wire gauze, evaporating dish	**D** separating funnel, retort stand, clamp

(a) Which set of apparatus, **A**, **B**, or **D**, would be used to separate sand from water? [1 mark]

_____

(b) A student selects apparatus set **C** to evaporate water from a mixture of sand and water.
Name one other piece of apparatus which would be needed to make the evaporation happen quickly.
[1 mark]

_____

(c) Water is a compound containing the elements hydrogen and oxygen.

(i) What is meant by the term **element**? [1 mark]

_____

_____

(ii) Why can water be described as a **compound**?
[2 marks]

_____

_____

(iii) Write the formula for water. [1 mark]

_____

(d) Complete the sentence below which describes the test for carbon dioxide. [3 marks]

When carbon dioxide gas is bubbled through _____, the solution changes from _____ to a _____ colour.

4 This question is about electrolysis.

Circle the correct answer to each part.

(a) In electrolysis the electrodes are sometimes made out of: [1 mark]

graphite **polythene** **sulfur**

(b) Electrodes need to be inert. This means that they are: [1 mark]

light **colourless** **unreactive**

(c) In electrolysis the particles which move and carry the charge are called: [1 mark]

ions **electrons** **atoms**

(d) When molten lithium chloride undergoes electrolysis the products are lithium and: [1 mark]

chloride **chlorine** **water**

(e) When aluminium is extracted by electrolysis the metal forms at: [1 mark]

the anode **the cathode** **both electrodes**

5 This question is about atomic structure.

(a) Complete the table below to show the relative charge and mass of the different particles found in an atom and whether or not each particle is found in the nucleus. [6 marks]

Particle	Relative Charge	Relative Mass	Found in nucleus Yes or No?
electron	–1		
neutron			Yes
proton		1	

(b) Complete the table below about the atomic structure of three elements, by filling in the missing information. You may find your Data Leaflet helpful. [4 marks]

Element	Number of protons	Number of neutrons	Number of electrons	Electronic configuration
carbon	6	6		2,4
	11	12	11	
aluminium		14	13	2,8,3

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6 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. [4 marks]

Contribution	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				

(b) A student is given a Periodic Table.

Column A

Column B

																		helium 2 He 4.0026
											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
											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
lithium 3 Li 6.941	beryllium 4 Be 9.0122										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
sodium 11 Na 22.990	magnesium 12 Mg 24.305										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
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	cadmium 48 Cd 112.41	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
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	gold 79 Au 196.97	roentgenium 111 Rg 272						
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	darmstadtium 110 Ds 271								
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		copernicium 112 Cn 285								

hydrogen 1 H 1.0079

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: [1 mark]

alkali metals **Group 2** **Period 2**

(ii) The physical state at room temperature of all the elements in **Column B** is: [1 mark]

solid **liquid** **gas**

(iii) The elements N, O, F, Cl, Br and I are all: [1 mark]

gases **diatomic** **inert**

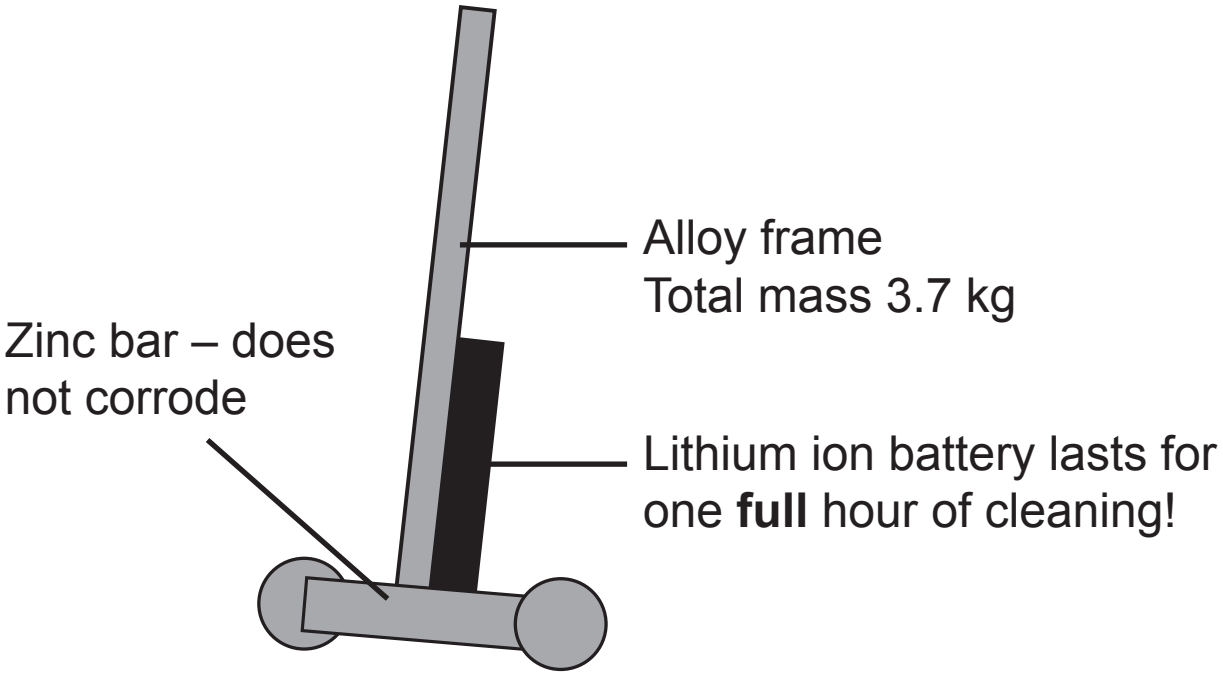
(iv) The elements in **Column B** all have: [1 mark]

only 3 electrons **3 electrons in outer shell** **3 electrons in first shell**

(v) The solid black line separates: [1 mark]

metals and gases **solids and liquids** **metals and non-metals**

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



(a) Give the symbol for a lithium ion. [1 mark]

_____

(b) What is an alloy? [2 marks]

_____

_____

(c) Give one property needed for the alloy used in the frame of the vacuum cleaner. [1 mark]

_____

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(Questions continue overleaf)

8 Water has a melting point of 0 °C and is an excellent solvent.

(a) What is meant by the chemical terms:

(i) solvent? [1 mark]

_____

_____

(ii) melting point? [2 marks]

_____

_____

_____

(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. [2 marks]

1. _____

2. _____

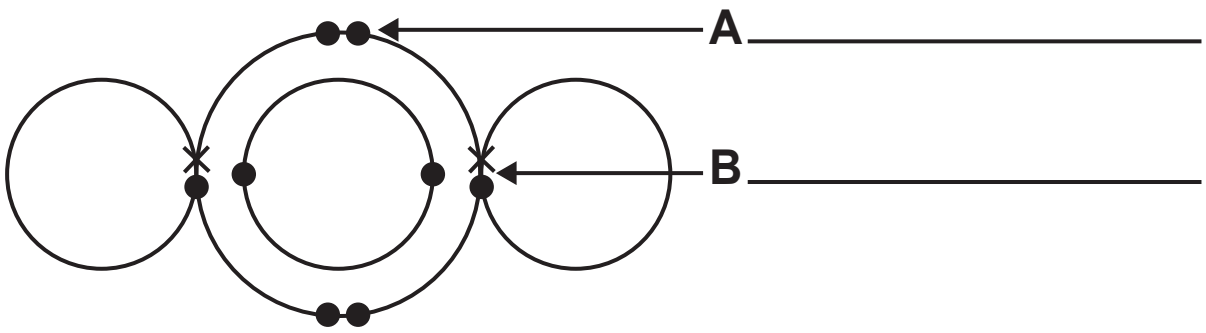
Compound A is soluble in water. It has a solubility of 2.9 g/100 g of water at 20 °C.

(c) Why must the temperature be stated when giving the solubility of a substance in water? [1 mark]

_____

_____

(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 marks]

(ii) Name the type of bonding in water. [1 mark]

_____

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

Tick (✓) the two correct boxes. [2 marks]

potassium iodide ☐

carbon dioxide ☐

copper sulfate ☐

calcium carbonate ☐

hydrogen sulfide ☐

9 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.
[6 marks]

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.

10 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. [2 marks]

copper oxide + sulfuric acid → +

(b) Balance the symbol equation below. [1 mark]

$$HCl + CuO \rightarrow CuCl_2 + H_2O$$

(c) Write a balanced symbol equation for the reaction between copper carbonate and hydrochloric acid. [3 marks]

THIS IS THE END OF THE QUESTION PAPER

SOURCES

Q2(c) Image - a bottle of sulfuric acid, © Martyn F. Chillmaid / Science Photo Library

For Examiner's use only	
Question Number	**Marks**
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
Total Marks	

Examiner Number