Rewarding Learning

Centre Number

Candidate Number

General Certificate of Secondary Education
2016–2017

Double Award Science: Chemistry

GSD21

Unit C1
Foundation Tier

[GSD21]

THURSDAY 23 FEBRUARY 2017, MORNING

TIME

1 hour.

INSTRUCTIONS TO CANDIDATES

Write your Centre Number and Candidate Number in the spaces provided at the top of this page.
Write your answers in the spaces provided in this question paper.
Answer **all ten** 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 **9**.
A Data Leaflet, which includes a Periodic Table of the Elements, is included in this question paper.

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

Examiner Only	
Marks	Remark

1 Chemical containers in school laboratories have symbols to warn of danger.

(a) What name is given to these symbols?

Circle the correct answer.

safety **universal** **hazard** **harmful** **security** [1]

(b) Match each of the symbols below to the correct danger by drawing straight lines.

symbol	danger
	explosive
	toxic
	causes cancer
	corrosive

[3]

(c) Give two other reasons, apart from warning of danger, to explain why these symbols are used.

1. _____ [1]

2. _____ [1]

Examiner Only	
Marks	Remark

2 The picture below shows part of a guitar showing some frets and strings. Frets are the horizontal strips which are placed in the long neck of the guitar.

Read the information in the passage below and answer the questions that follow.

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The frets on a guitar are usually made of bronze which is an alloy often made of copper, tin, aluminium, manganese and nickel. Sometimes stainless steel is used which is an alloy of iron, carbon, and chromium which prevents corrosion.

(a) Explain why bronze can be described as an alloy.

_____

_____ [2]

(b) How many transition elements are mentioned in the passage?

_____ [1]

(c) Which non-metal is used in making stainless steel?

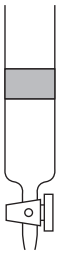
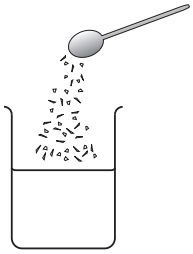
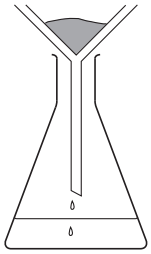
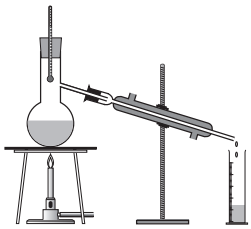
_____ [1]

(d) Give the name of a metal, mentioned in the passage, which does not belong to the transition metal block.

_____ [1]

3 The following diagrams show apparatus used in chemistry laboratories.

Link each diagram to the correct **use** of the apparatus by drawing straight lines.

Diagram	Use of apparatus
	To add a solid to a solvent
	To separate sand from salty water
	To separate two immiscible liquids
	To collect a distillate from a mixture of salty water
	To collect a dry sample of copper sulfate crystals

[4]

Examiner Only

Marks	Remark

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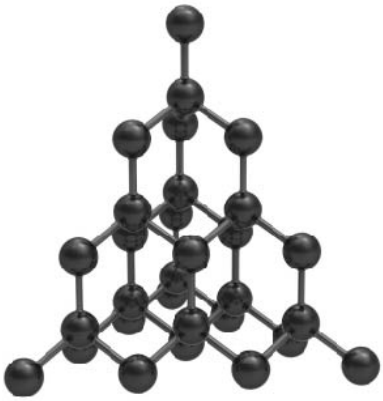
(Questions continue overleaf)

4 The diagram below shows the structure of diamond.



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Complete the following sentences about diamond.

Circle the correct words.

(a) Each atom in diamond is joined to | one / two / four | other atoms. [1]

(b) The bonds in diamond are | covalent. / metallic. / ionic. | [1]

(c) Diamond has a high melting point because | some / none / all | of the atoms are joined by strong bonds. [1]

Examiner Only

Marks	Remark

Examiner Only	
Marks	Remark

(d) Diamond is used in cutting tools because it is

hard.
soft.
shiny.

[1]

(e) Diamond and graphite are both

isotopes
allotropes
mixtures

of carbon. [1]

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Marks	Remark

5 **(a)** The table below gives information about the colours of three different indicators in five substances. The fifth substance is not yet named in the table.

substance	pH range	colour of universal indicator	colour of litmus paper	colour of red cabbage solution
dilute sulfuric acid		red	red	red
ammonia solution	8–11	blue	blue	green
pure water	7		red/blue	purple
lemon juice	3–6	orange		pink
	12–14	purple	blue	yellow

(i) Complete the table by filling in the **four** gaps. [4]

(ii) Why can red cabbage solution be described as an indicator?

_____

_____ [1]

(iii) Why does the table give both red and blue for the colour of litmus in pure water?

_____

_____ [2]

(iv) Which solution in the table can be described as a weak alkali?

_____ [1]

(b) Many crops require the soil to be within a particular pH range.

Crop	pH range of soil
potatoes	4.8–5.5
broccoli	6.7–8.0
strawberries	5.5–6.5
blueberries	4.0–5.5

(i) What instrument should the farmer use to measure **accurately** the pH of the soil?

_____ [1]

(ii) Which of the four listed crops can grow in the most acidic conditions?

_____ [1]

(iii) Which is the only one of the four listed crops which can grow in alkaline soil?

_____ [1]

Examiner Only

Marks	Remark

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Marks	Remark

6 Metals react with acids to produce salts and hydrogen.

The symbol equation below shows one of these reactions.

$$2\,HCl + Mg \rightarrow MgCl_2 + H_2$$

(a) From this reaction **name**:

(i) the **reactant** which is a compound

_____ [1]

(ii) the **product** which is an element

_____ [1]

(iii) the **salt** produced

_____ [1]

(iv) Apart from giving out heat, give two other observations you would make during this reaction.

1. _____

2. _____ [2]

(b) Describe the test for hydrogen gas.

_____

_____ [2]

(c) Potassium also reacts with hydrochloric acid to produce a salt.

(i) Complete and balance the symbol equation for this reaction.

$$K + HCl \rightarrow \quad + \qquad [2]$$

(ii) Give two reasons why this reaction is **not** carried out in the school laboratory.

1. _____

2. _____ [2]

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(Questions continue overleaf)

7 **(a)** Five of the six statements, **A, B, C, D, E** and **F** below can be used to describe the words given in the table which follows.

Examiner Only	
Marks	Remark

Descriptions

A a liquid which can dissolve a solid

B a solid which has lost its water of crystallisation

C when a solute is dissolved in a solvent

D the mass of solute needed to saturate 100 g of water at a certain temperature

E a solid which has water of crystallisation

F a solid that dissolves in a liquid

Match each word to the correct description letter **A, B, C, D, E** or **F**.

Word	Description letter
hydrated	
solvent	
solubility	
anhydrous	
solution	

[5]

(b) The colours and formulae of three forms of solid copper sulfate are given in the table below.

colour of copper sulfate	**formula of copper sulfate**
blue	$CuSO_4 . 5H_2O$
green	$CuSO_4 . H_2O$
white	$CuSO_4$

(i) What word can be used to describe **blue** copper sulfate? Circle the correct answer.

anhydrous **dehydrated** **hydrated** **hydrogenated** [1]

(ii) Give the formula of the form of solid copper sulfate which would be best for detecting the presence of water.

_____ [1]

Examiner Only

Marks	Remark

8 The table below shows information about elements from Period 3 of the Periodic Table.

	sodium	magnesium	aluminium	silicon	phosphorus	sulfur	chlorine	argon
electronic configuration	2,8,1	2,8,2	2,8,3	2,8,4	2,8,5	2,8,6	2,8,7	2,8,8
melting point/°C	98	639	660	1410	44	113	–101	–189
boiling point/°C	883	1090	2467	2680	280	445	–35	–186
metal or non-metal	metal	metal	metal	non-metal	non-metal	non-metal	non-metal	non-metal
mass number	23	24	27	28	31	32	35	40

Use this information and your own knowledge to answer the following questions about elements from Period 3 of the Periodic Table.

(a) Name the **metal** which has the highest **melting point**.

_____ [1]

(b) Name the **non-metal** which has the lowest **boiling point**.

_____ [1]

(c) How many of the Period 3 elements are gases at room temperature (20 °C)?

_____ [1]

(d) How can you tell from the table that sulfur is in Group 6 of the Periodic Table?

_____

_____ [1]

(e) Describe the trend in mass number as you move across the table.

_____

_____ [1]

Examiner Only

Marks	Remark

(f) Use the information in the table to:

(i) work out the atomic number of argon.

_____ [1]

(ii) work out the number of neutrons in an argon atom.

_____ [1]

(iii) explain why argon is unreactive.

_____

_____ [1]

Examiner Only	
Marks	Remark

9 When calcium reacts with fluorine it produces an ionic substance called calcium fluoride.
Explain how the atoms of calcium and fluorine bond together.

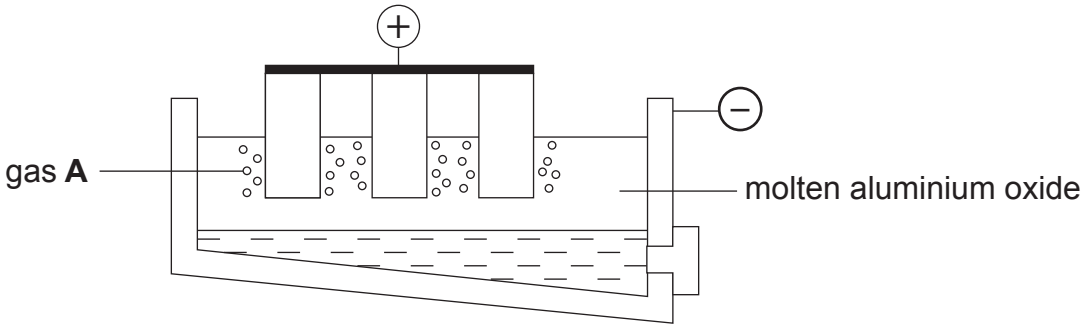
Your answer should include details of the:
- electronic structures of both calcium and fluorine atoms
- movement of electrons
- charges on the ions produced
- way in which the ions bond together
- formula of the substance formed

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

[6]

Examiner Only
Marks | Remark

10 The diagram below shows how aluminium is extracted from molten aluminium oxide.



(a) What name is given to the process used to extract aluminium from aluminium oxide?

_____ [1]

(b) What name is given to the electrodes at which gas **A** is produced?

_____ [1]

(c) What element is gas **A**?

_____ [1]

(d) Explain why the electrodes at which gas **A** is produced need to be replaced regularly.

_____

_____ [2]

(e) Give two reasons why recycling aluminium is good for the environment.

1. _____

2. _____ [2]

THIS IS THE END OF THE QUESTION PAPER

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Marks	Remark

SYMBOLS OF SELECTED IONS

Positive ions

Name	Symbol
Ammonium	NH_4^+
Chromium(III)	Cr^{3+}
Copper(II)	Cu^{2+}
Iron(II)	Fe^{2+}
Iron(III)	Fe^{3+}
Lead(II)	Pb^{2+}
Silver	Ag^+
Zinc	Zn^{2+}

Negative ions

Name	Symbol
Carbonate	CO_3^{2-}
Dichromate	$Cr_2O_7^{2-}$
Ethanoate	CH_3COO^-
Hydrogen carbonate	HCO_3^-
Hydroxide	OH^-
Methanoate	$HCOO^-$
Nitrate	NO_3^-
Sulfate	SO_4^{2-}
Sulfite	SO_3^{2-}

SOLUBILITY IN COLD WATER OF COMMON SALTS, HYDROXIDES AND OXIDES

Soluble
All sodium, potassium and ammonium salts
All nitrates
Most chlorides, bromides and iodides EXCEPT silver and lead chlorides, bromides and iodides
Most sulfates EXCEPT lead and barium sulfates Calcium sulfate is slightly soluble

Insoluble
Most carbonates EXCEPT sodium, potassium and ammonium carbonates
Most hydroxides EXCEPT sodium, potassium and ammonium hydroxides
Most oxides EXCEPT sodium, potassium and calcium oxides which react with water

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DATA LEAFLET

For the use of candidates taking
Science: Chemistry,
Science: Double Award
or Science: Single Award

Copies must be free from notes or additions of any kind. No other type of data booklet or information sheet is authorised for use in the examinations.

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gcse

science

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THE PERIODIC TABLE OF ELEMENTS

Group

1	2											3	4	5	6	7	0
							1 H Hydrogen 1										4 He Helium 2
7 Li Lithium 3	9 Be Beryllium 4											11 B Boron 5	12 C Carbon 6	14 N Nitrogen 7	16 O Oxygen 8	19 F Fluorine 9	20 Ne Neon 10
23 Na Sodium 11	24 Mg Magnesium 12											27 Al Aluminium 13	28 Si Silicon 14	31 P Phosphorus 15	32 S Sulfur 16	35.5 Cl Chlorine 17	40 Ar Argon 18
39 K Potassium 19	40 Ca Calcium 20	45 Sc Scandium 21	48 Ti Titanium 22	51 V Vanadium 23	52 Cr Chromium 24	55 Mn Manganese 25	56 Fe Iron 26	59 Co Cobalt 27	59 Ni Nickel 28	64 Cu Copper 29	65 Zn Zinc 30	70 Ga Gallium 31	73 Ge Germanium 32	75 As Arsenic 33	79 Se Selenium 34	80 Br Bromine 35	84 Kr Krypton 36
85 Rb Rubidium 37	88 Sr Strontium 38	89 Y Yttrium 39	91 Zr Zirconium 40	93 Nb Niobium 41	96 Mo Molybdenum 42	99 Tc Technetium 43	101 Ru Ruthenium 44	103 Rh Rhodium 45	106 Pd Palladium 46	108 Ag Silver 47	112 Cd Cadmium 48	115 In Indium 49	119 Sn Tin 50	122 Sb Antimony 51	128 Te Tellurium 52	127 I Iodine 53	131 Xe Xenon 54
133 Cs Caesium 55	137 Ba Barium 56	139 La* Lanthanum 57	178 Hf Hafnium 72	181 Ta Tantalum 73	184 W Tungsten 74	186 Re Rhenium 75	190 Os Osmium 76	192 Ir Iridium 77	195 Pt Platinum 78	197 Au Gold 79	201 Hg Mercury 80	204 Tl Thallium 81	207 Pb Lead 82	209 Bi Bismuth 83	210 Po Polonium 84	210 At Astatine 85	222 Rn Radon 86
223 Fr Francium 87	226 Ra Radium 88	227 Ac† Actinium 89	261 Rf Rutherfordium 104	262 Db Dubnium 105	263 Sg Seaborgium 106	262 Bh Bohrium 107	265 Hs Hassium 108	266 Mt Meitnerium 109	269 Ds Darmstadtium 110	272 Rg Roentgenium 111	285 Cn Copernicium 112						

140 Ce Cerium 58	141 Pr Praseodymium 59	144 Nd Neodymium 60	147 Pm Promethium 61	150 Sm Samarium 62	152 Eu Europium 63	157 Gd Gadolinium 64	159 Tb Terbium 65	162 Dy Dysprosium 66	165 Ho Holmium 67	167 Er Erbium 68	169 Tm Thulium 69	173 Yb Ytterbium 70	175 Lu Lutetium 71
232 Th Thorium 90	231 Pa Protactinium 91	238 U Uranium 92	237 Np Neptunium 93	242 Pu Plutonium 94	243 Am Americium 95	247 Cm Curium 96	245 Bk Berkelium 97	251 Cf Californium 98	254 Es Einsteinium 99	253 Fm Fermium 100	256 Md Mendelevium 101	254 No Nobelium 102	257 Lr Lawrencium 103

* 58 – 71 Lanthanum series
† 90 – 103 Actinium series

a / b x
a = relative atomic mass (approx)
x = atomic symbol
b = atomic number