Rewarding Learning

Centre Number

Candidate Number

General Certificate of Secondary Education
2017–2018

Double Award Science: Chemistry

GSD22

Unit C1
Higher Tier

[GSD22]

THURSDAY 9 NOVEMBER 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 seven** questions.

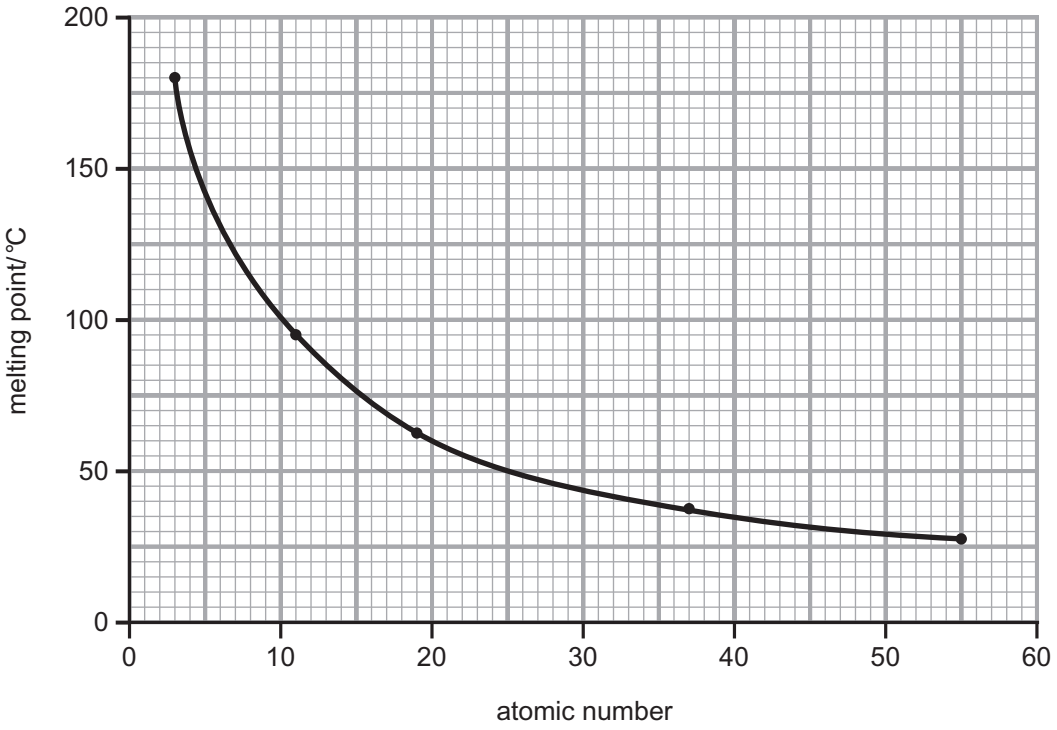
INFORMATION FOR CANDIDATES

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 **3(b)**.
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	
Total Marks	

Examiner Only	
Marks	Remark

1 The graph below shows how the melting points change with atomic number for five elements. All five elements are in the same Group of the Periodic Table.



(a) What is the melting point of the element with atomic number 11?

_____ [1]

(b) **(i)** What is the atomic number of the element, shown in the graph, which has the lowest melting point?

_____ [1]

(ii) Using your Data Leaflet to help you, name the element, which has the lowest melting point of the five elements shown in the graph.

_____ [1]

(c) In what Group of the Periodic Table are these five elements found?

_____ [1]

(d) Describe the trend shown in this graph.

_____

_____ [2]

(e) What is the pattern of reactivity for these elements?

_____

_____ [1]

Examiner Only	
Marks	Remark

Examiner Only	
Marks	Remark

2 Labels, showing the contents of two drinks bottles **X** and **Y** are shown below.

carbonated water sugar phosphoric acid colour **pH = 2.5**	carbonated water sugar citric acid colour **pH = 3.2**
X	**Y**

The pH of carbonated water is 3.6.

(a) (i) Which drink contains the strongest acid?

_____ [1]

(ii) Which ingredient in drink **X** causes the pH to fall to 2.5?

_____ [1]

(iii) What method would you use to measure the pH of these drinks **accurately**?

_____ [1]

(iv) Which **ion**, present in both of the drinks, makes them acidic?

_____ [1]

(b) Write an **ionic equation** to show neutralisation. Your equation should include **state** symbols.

_____ [3]

(c) The table below gives information about salts formed when metal oxides react with acids. Complete the table.

metal oxide	**acid used**	**cation in salt**	**anion in salt**	**formula of salt**
copper oxide		Cu^{2+}	Cl^-	$CuCl_2$
sodium oxide	sulfuric acid	Na^+		Na_2SO_4
calcium oxide	nitric acid	Ca^{2+}	NO_3^-	

[3]

Examiner Only

Marks	Remark

Examiner Only	
Marks	Remark

3 **(a)** The symbol equation below shows the reaction between copper carbonate and dilute hydrochloric acid.

(i) Balance the equation and also add the three missing state symbols. [2]

$$CuCO_{3\ (s)} + HCl_{(\ \ )} \rightarrow CuCl_{2\ (aq)} + H_2O_{(\ \ )} + CO_{2\ (\ \ )}$$

(ii) Describe how you could prove that the gas formed in the reaction is carbon dioxide.

_____

_____

_____ [2]

(b) Describe **how** you would react some solid copper carbonate with dilute hydrochloric acid and what you would observe happening when you carry out this experiment.

Your answer should include:

- A description of the step or steps you would take and the apparatus you would need
- How you would make sure that the reaction was carried out safely
- Any colour changes or other observations

You will be assessed on your written communication skills including the use of specialist scientific terms.

Step or steps taken and apparatus used:

_____

_____

_____

_____

_____

Safety precautions:

_____

_____

_____

Colour changes and other observations:

_____

_____

_____

_____

_____

_____

_____

_____ [6]

(c) In a separate experiment dilute hydrochloric acid was reacted with solid calcium carbonate.

Give one observation that is **similar** and two observations that are **different**, when hydrochloric acid is reacted with **calcium carbonate**, rather than copper carbonate.

(i) similar observation:

_____ [1]

(ii) different observations:

1. _____

_____

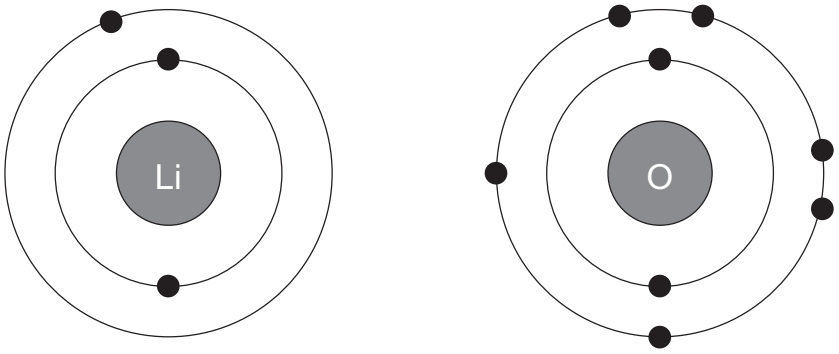
2. _____

_____ [2]

Examiner Only	
Marks	Remark

Examiner Only	
Marks	Remark

4 The diagrams below show the **electronic** structures of lithium and oxygen atoms.



lithium atom oxygen atom

(a) (i) Explain how the electronic arrangements of lithium and oxygen change when lithium oxide is formed.

_____

_____

_____

_____

_____

_____

_____ [3]

(ii) What is the formula for lithium oxide?

_____ [1]

(b) What name is given to the type of bonding in lithium oxide?

_____ [1]

(c) Oxygen atoms join together to form molecules of oxygen gas.

Examiner Only	
Marks	Remark

(i) In the space below draw a dot and cross diagram to show how **all** the electrons are arranged in an oxygen molecule.

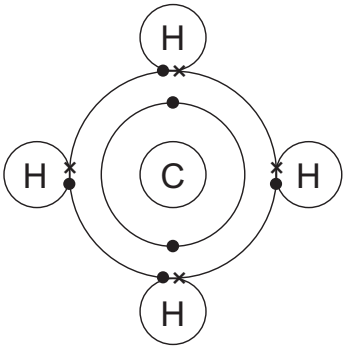
[3]

(ii) Explain why oxygen gas is described as diatomic.

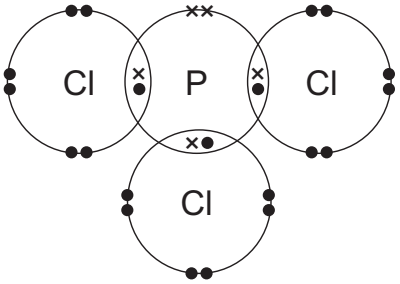
_____ [1]

(d) The diagrams below show the electronic arrangements of three molecules.

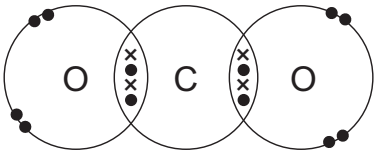
Examiner Only	
Marks	Remark



A



B



C

(i) Which molecule A, B or C does not have any lone pairs of electrons?

_____ [1]

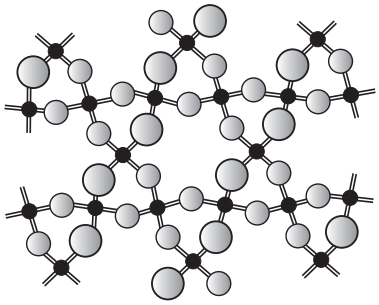
(ii) Which molecule A, B or C has multiple bonds between the atoms?

_____ [1]

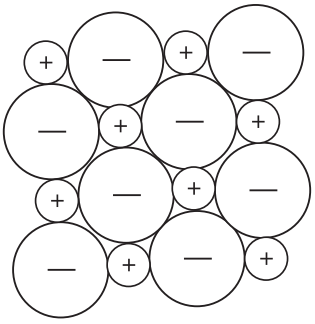
(iii) In the space below draw a dot and cross diagram to show the bonding in ammonia (NH_3). Only outer electrons are needed.

[2]

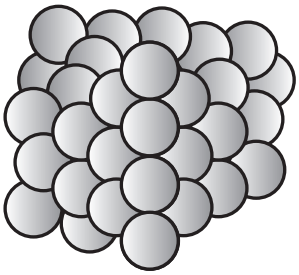
5 The diagrams below show the structures of five different substances.



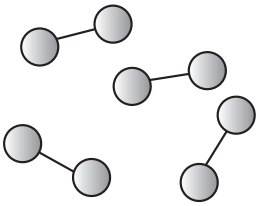
Substance A



Substance B



Substance C



Substance D

Substance E

(a) Which substance A, B, C, D, or E has a metallic structure?
Explain your reasoning.

Substance _____

Explanation _____

_____ [2]

(b) Which two substances, A, B, C, D, or E can be described as having giant covalent structures?

_____ and _____ [1]

(c) Which two substances A, B, C, D, or E have structures which would conduct electricity when molten?

_____ and _____ [1]

(d) Which substance A, B, C, D, or E could represent iodine?

_____ [1]

(e) Which substance A, B, C, D, or E has a structure which means that it is extremely hard and could be used in cutting tools?

_____ [1]

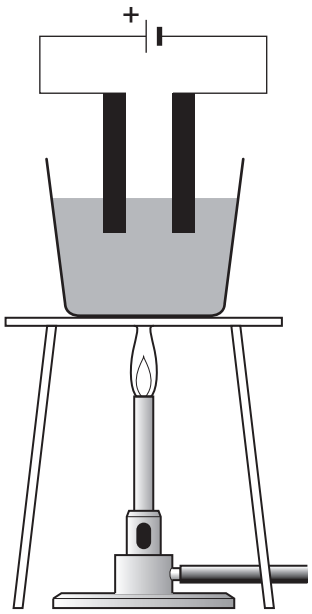
Examiner Only

Marks	Remark

Examiner Only

Marks	Remark

6 **(a)** The diagram below shows how lead(II) bromide can be electrolysed. Label the diagram, making sure that you have named each electrode separately.



[4]

(b) The table below gives some information about reactions taking place during the electrolysis of some molten halide salts.

(i) Complete the gaps in the table.

halide salt	anode observations	cathode observations	product at anode	product at cathode
lithium iodide	purple gas	silvery beads		
lead(II) bromide			bromine	lead metal
	brown fumes	silvery beads		potassium metal
sodium chloride		silvery beads	chlorine	

[4]

(ii) Write a half equation for the reaction taking place at the **anode** during the electrolysis of molten lead(II) bromide.

_____ [3]

Examiner Only

Marks	Remark

7 **(a)** The table below gives information about the **five** halogens, fluorine, chlorine, bromine, iodine and astatine.

(i) Complete the table by identifying each halogen and writing its **symbol** in the correct space in the table.
CLUE – the black solid is astatine.

state at room temperature	colour	halogen symbol
liquid	red–brown	
solid	grey/black	
gas	pale yellow	
solid	black	
gas	greenish–yellow	

[3]

(ii) Which halogen, fluorine, chlorine, bromine, iodine or astatine is the least reactive?

_____ [1]

(b) When chlorine gas is bubbled into a solution of potassium iodide a colour change takes place.

(i) Describe and explain this colour change.

colour change from _____ to _____

explanation _____

_____ [3]

(ii) Write a balanced symbol equation for the reaction between chlorine and potassium iodide.

_____ [3]

THIS IS THE END OF THE QUESTION PAPER

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.

Contents **Page**

gcse

science

chemistry
double award
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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