



Rewarding Learning

General Certificate of Secondary Education
2019

Centre Number

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Candidate Number

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Double Award Science: Chemistry

Unit C2



Foundation Tier

[GDW51]

GDW51

WEDNESDAY 12 JUNE 2019, MORNING

TIME

1 hour 15 minutes.

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 black ink only. **Do not write with a gel pen.**

Answer **all nine** 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 **8(a)(ii)**.

A Data Leaflet, which includes a Periodic Table of the Elements, is included in this question paper.

11617



20GDW5101

1 This question is about gas chemistry.

(a) The air is a mixture of gases. One of the gases in air is nitrogen.

(i) What percentage of the air is nitrogen?

Circle the correct answer.

21%

0.04%

78%

1%

[1]

(ii) From the list below, circle **two** correct physical properties of nitrogen.

tasteless

colourless

high boiling point

pungent smell

[2]

(b) Listed below are four gases. Draw a line from each gas to its most appropriate use.

Gas	Use
nitrogen	clean fuel
hydrogen	coolant
oxygen	disinfectant
carbon dioxide	fizzy drinks
	welding

[4]





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20GDW5103

2 This question is about metals and the reactivity series.

(a) Six of the metals from the reactivity series are listed below:

aluminium	copper	iron
magnesium	potassium	zinc

(i) Which **one** of the metals listed above will **not** react with cold water or steam?

_____ [1]

(ii) Which **one** of the metals listed above will produce a bright white light when it burns in air?

_____ [1]

(iii) What gas is produced when a metal reacts with steam?

Circle the correct answer.

carbon dioxide hydrogen oxygen nitrogen [1]

(iv) Put the metals aluminium, copper, iron, magnesium, potassium and zinc in order of their reactivity, **most reactive first**.

_____	most reactive	
_____	↓	

_____	least reactive	[2]



(v) Name two of the metals from the list in **part (a)** which are extracted from their ores by chemical reduction.

_____ and _____ [2]

(b) Complete the word equation for the displacement reaction which occurs between magnesium and zinc sulfate.

magnesium + zinc sulfate \longrightarrow _____ + _____ [1]

(c) A student wanted to find out the order of reactivity of four metals labelled A, B, C and D.

She carried out a series of displacement reactions and found out that:

- metal C displaced metal B but not metal D.
- metal B displaced metal A.

Which of the following correctly shows the order of reactivity of the four metals starting with the most reactive?

Circle the correct answer.

ABCD **DCBA** **CBDA** **BADC** [1]



3 (a) Listed below are five elements that will react with oxygen to form oxides.

carbon **copper** **iron** **magnesium** **sulfur**

(i) Which two elements will form acidic oxides?

_____ and _____ [1]

(ii) Which element will form a white oxide?

_____ [1]

(iii) Which elements will form oxides which are solid at room temperature?

_____ [1]

(b) (i) Describe what is observed when carbon dioxide is bubbled through a solution of calcium hydroxide (limewater) until carbon dioxide is in excess.

_____ [2]

(ii) Name a calcium compound which is formed when carbon dioxide is bubbled through a solution of calcium hydroxide (limewater).

Circle the correct answer.

calcium **calcium** **calcium** **calcium**
oxide **hydride** **chloride** **carbonate** [1]



- 4 (a) A chemical reaction happens when small pieces of calcium are added to a beaker of water. Place a tick (✓) beside each of the **three** correct observations for this reaction.

Observation	Tick (✓)
calcium burns with a lilac flame	
calcium sinks and rises	
calcium melts into a sphere	
a white solid forms	
bubbles of gas form	
the reaction is very slow	

[3]

- (b) (i) Iron is a very important metal for the building of bridges and other structures. Iron is produced in a blast furnace by reacting iron(III) oxide with carbon monoxide.

Write a word equation for the extraction of iron from iron(III) oxide.

_____ [2]

- (ii) Which **one** of the following physical properties of iron is the most important in its use as a building material for bridges?

Circle the correct answer.

**high melting
point**

strength

**conductor of
electricity**

shiny

[1]



5 This question is about the homologous series of alkanes and the fractions in crude oil.

(a) In the table below tick (✓) the **three** correct properties of the molecules in the homologous series of alkanes.

Property of the homologous series of alkanes	Tick (✓)
they show a gradation in their physical properties	
they differ by a CH ₃ group	
they are all colourless liquids	
they have similar chemical properties	
they have the same general formula	

[3]

(b) Crude oil can be separated into fractions which have many uses.

Five of these fractions are listed below:

petrol **naphtha** **kerosene** **diesel** **fuel oils**

(i) Which two fractions, from the list, are used as fuels for cars?

_____ and _____ [1]

(ii) Which fraction, from the list, is used to manufacture chemicals and plastics?

_____ [1]



(iii) Name the fraction, **not** given in the list, which is used to surface roads and roofs.

_____ [1]

(iv) Which chemical technique is used to separate the fractions in crude oil?

Circle the correct answer.

filtration

fractional distillation

simple distillation

chromatography

[1]



6 This question is about the structure of some organic compounds and combustion reactions.

(a) Complete the table below by filling in the blank spaces.

Name	Molecular formula	Structural formula	Physical state at room temperature
methane		$\begin{array}{c} \text{H} \\ \\ \text{H}-\text{C}-\text{H} \\ \\ \text{H} \end{array}$	
	C_2H_4		gas

[4]

(b) Name the two products formed by the complete combustion of methane.

_____ and _____ [1]

(c) (i) The toxic gas carbon monoxide is formed during incomplete combustion of fuels.

What effect does carbon monoxide have on blood which causes it to be toxic to humans?

_____ [2]

(ii) Combustion of fuels containing sulfur leads to the formation of acid rain. Give three different effects of acid rain.

1. _____
2. _____
3. _____ [3]





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20GDW5111

7 (a) The following equation is for a dehydration reaction.



(i) Give the formula of the substance in the equation above which contains water of crystallisation.

_____ [1]

(ii) Give the formula of the substance in the equation above which is anhydrous.

_____ [1]

(iii) Which statement **A**, **B** or **C** describes how this dehydration reaction could be carried out?

- A** Heat a sample of $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$ in a boiling tube with damp mineral wool.
- B** Heat a sample of $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$ in an evaporating basin until constant mass.
- C** Place a sample of $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$ in a beaker and add excess distilled water.

_____ [1]



(b) Calculate the relative formula mass (M_r) of each of the following substances.

(relative atomic masses: H = 1, C = 12, O = 16, Na = 23)

(i) sodium carbonate Na_2CO_3

_____ [1]

(ii) hydrated sodium carbonate $\text{Na}_2\text{CO}_3 \cdot 10\text{H}_2\text{O}$

_____ [1]

[Turn over



8 (a) Electrolysis is used in the industrial extraction of aluminium from alumina using graphite electrodes.

(i) Name the ore which is purified to make alumina.

_____ [1]

(ii) Describe the industrial extraction of aluminium.

Your answer should include descriptions and explanations as appropriate of:

- what is added to the alumina and why
- the reaction that happens at the **cathode**
- how the aluminium is removed
- why the anode needs to be replaced periodically

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

What is added to the alumina and why:

The reaction that happens at the cathode:



How the aluminium is removed:

Why the anode needs to be replaced periodically:

[6]

(iii) Explain why it is better to recycle aluminium rather than extracting it from its ore.

[3]

(b) Electrolysis can be used to decompose molten salts such as sodium bromide.

Complete the table to show the products formed, at the cathode and anode, when molten sodium bromide is decomposed using electrolysis.

Electrode	Product formed
cathode	
anode	

[2]

[Turn over



9 (a) Some chemical reactions are described as exothermic and some are endothermic.

(i) **Three** of the examples below represent exothermic reactions. Identify the **exothermic** reactions by putting ticks (✓) in the correct boxes.

burning wood

photosynthesis

neutralising hydrochloric acid with sodium hydroxide

thermal decomposition of calcium carbonate

reacting magnesium with oxygen

[2]

(ii) A student held a boiling tube containing some water in his hand. He added a solid to the water, stirred the mixture and then said "This is an endothermic reaction".

How did the student know that the reaction was endothermic?

[1]



(b) Some chemical reactions are described as reversible.

(i) What is meant by the term **reversible reaction**?

[1]

(ii) Hydrogen can react with bromine to form hydrogen bromide in a reversible reaction.

Write the balanced symbol equation for this **reversible** reaction.

[4]

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Question Number	Marks
1	
2	
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8	
9	

Total Marks	
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Examiner Number

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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
Butanoate	$\text{C}_3\text{H}_7\text{COO}^-$
Carbonate	CO_3^{2-}
Dichromate	$\text{Cr}_2\text{O}_7^{2-}$
Ethanoate	CH_3COO^-
Hydrogencarbonate	HCO_3^-
Hydroxide	OH^-
Methanoate	HCOO^-
Nitrate	NO_3^-
Propanoate	$\text{C}_2\text{H}_5\text{COO}^-$
Sulfate	SO_4^{2-}
Sulfite	SO_3^{2-}

New
Specification

Data Leaflet

Including the Periodic Table of the Elements

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

 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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 chemistry

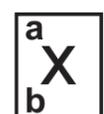
THE PERIODIC TABLE OF ELEMENTS

Group

																		0
																		4
																		He Helium
1	2											3	4	5	6	7		
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	98 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	266 Sg Seaborgium 106	264 Bh Bohrium 107	277 Hs Hassium 108	268 Mt Meitnerium 109	271 Ds Darmstadtium 110	272 Rg Roentgenium 111	285 Cn Copernicium 112							

* 58 – 71 Lanthanum series

† 90 – 103 Actinium series



a = relative atomic mass (approx)

x = atomic symbol

b = atomic number

140 Ce Cerium 58	141 Pr Praseodymium 59	144 Nd Neodymium 60	145 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