



Rewarding Learning

General Certificate of Secondary Education
2019

Centre Number

--	--	--	--	--

Candidate Number

--	--	--	--	--

Double Award Science: Chemistry

Unit C2



Higher Tier

[GDW52]

GDW52

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 eight** questions.

INFORMATION FOR CANDIDATES

The total mark for this paper is 80.

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 **7(a)(ii)**.

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



1 This question is about gas chemistry.

(a) The atmosphere is a mixture of gases. Two of these gases are nitrogen and oxygen.

(i) Approximately what percentage of the air is **not** nitrogen or oxygen?

_____ [1]

(ii) Which element is the third most abundant gas in the atmosphere?

_____ [1]

(b) Nitrogen is a very unreactive gas, but under extreme conditions it will react with hydrogen to form ammonia.

(i) What makes nitrogen such an unreactive element?

_____ [1]

(ii) Describe the test for ammonia gas.

_____ [3]



- (c) (i) Oxygen gas can be prepared by the catalytic decomposition of hydrogen peroxide (H_2O_2). Complete the balanced symbol equation for this reaction.



- (ii) When sulfur burns in oxygen, what colour is the flame?

Circle the correct answer.

white **orange** **blue** **yellow** **red** [1]

- (iii) When sulfur burns in oxygen, is the oxide formed acidic, basic or neutral?

_____ [1]

- (iv) When iron burns in oxygen, is the oxide formed acidic, basic or neutral?

_____ [1]

[Turn over]



2 This question is about metals and the reactivity series.

- (a) A chemical reaction happens when small pieces of calcium are added to a beaker of water.

State **four** observations you would make for this reaction.

1. _____
2. _____
3. _____
4. _____ [4]

- (b) Write a balanced symbol equation for the displacement reaction which occurs between magnesium and zinc(II) sulfate.

_____ [2]

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

He 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]





BLANK PAGE

DO NOT WRITE ON THIS PAGE

(Questions continue overleaf)

11618

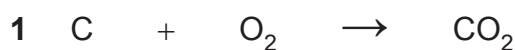
[Turn over



20GDW5205

3 This part of the question is about the extraction of iron from its ore haematite.

(a) Given below are five equations for reactions which occur during the extraction of iron from its ore.



(i) Balance equation **3**.



(ii) Explain why equation **2** can be described as a redox reaction.

[3]

(iii) Equations **4** and **5** occur so that acidic impurities can be removed. What is the name of the main acidic impurity?

[1]

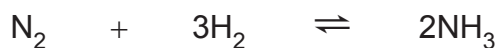
(iv) What is the chemical or common name for CaSiO_3 and how is it removed from the blast furnace?

Name: _____

Method of removal: _____ [2]



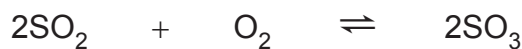
- (b) The reaction between hydrogen gas and nitrogen gas to produce ammonia gas is described as a reversible reaction.



Give two reaction conditions which could be changed to alter the direction of this reaction.

1. _____
2. _____ [2]

- (c) When sulfur dioxide and oxygen react to produce sulfur trioxide, the reaction can reach a dynamic equilibrium.



Explain what is meant by a **dynamic equilibrium**.

- _____
- _____
- _____ [2]



4 (a) Name three things that all homologous series of organic molecules have in common:

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

(b) 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]

(c) (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
oxide**

**calcium
hydride**

**calcium
chloride**

**calcium
carbonate**

[1]



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

1. _____

2. _____

3. _____ [3]

[Turn over

11618



20GDW5209

5 This question is about alkenes, alcohols and polymers.

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

Name	Molecular formula	Structural formula	Physical state at room temperature
but-1-ene		$\begin{array}{ccccccc} & \text{H} & \text{H} & \text{H} & \text{H} & & \\ & & & & & & \\ \text{C} & = & \text{C} & - & \text{C} & - & \text{C} & - & \text{H} \\ & & & & & & \\ & \text{H} & & \text{H} & \text{H} & & \end{array}$	
propan-1-ol			liquid

[4]

(b) (i) What is the molecular formula of the product from the reaction between ethene and hydrogen?

_____ [1]

(ii) What product is formed when ethene reacts with steam?

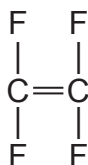
_____ [1]

(iii) What type of reaction occurs when ethene reacts with hydrogen or with steam?

_____ [1]



(c) The structure of the monomer tetrafluoroethene is given below:

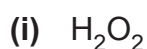


Draw the structure of the polymer polytetrafluoroethene (also known as PTFE).

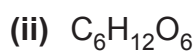
[2]



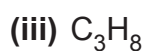
6 (a) Give the empirical formula for each of the following compounds:



_____ [1]



_____ [1]



_____ [1]

(b) A sample of hydrated magnesium sulfate, $\text{MgSO}_4 \cdot x\text{H}_2\text{O}$, was heated to constant mass. Only 48.8% of the original mass remained.

(relative atomic masses: $\text{H} = 1$, $\text{O} = 16$, $\text{Mg} = 24$, $\text{S} = 32$)

(i) Calculate the relative formula mass (M_r) of MgSO_4 .

_____ [1]

(ii) Use your answer to **(b)(i)** and the information given in the question to calculate the relative formula mass (M_r) of $\text{MgSO}_4 \cdot x\text{H}_2\text{O}$.

_____ [2]



(iii) Using your answers to (b)(i) and (b)(ii), calculate the value of x.

_____ [2]

11618

[Turn over



20GDW5213

7 (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) Write a half equation for the reaction that happens at the anode during the industrial extraction of aluminium.

[3]

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

[3]

[Turn over



(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]





BLANK PAGE

DO NOT WRITE ON THIS PAGE

(Questions continue overleaf)

11618

[Turn over



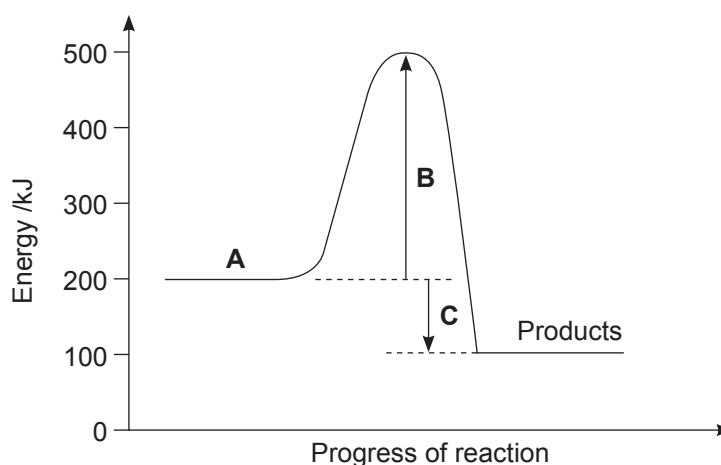
20GDW5217

8 This question is about energy changes during chemical reactions.

(a) Chemical reactions have an activation energy. What is meant by the term **activation energy**?

_____ [2]

(b) A reaction profile diagram is shown below:



(i) What do the labels **A**, **B** and **C** represent?

A = _____
B = _____
C = _____ [3]



- (ii) Does the reaction profile diagram represent an exothermic reaction, an endothermic reaction or both?

_____ [1]

- (iii) From the energies given on the y axis, calculate the energy change for the reaction.

Circle the correct answer.

+500 kJ +300 kJ +100 kJ –100 kJ –400 kJ –500 kJ [1]

- (iv) If a catalyst was added, which of the three energies listed below would get smaller?

Circle the correct answer or answers.

activation energy

energy of reactants

energy of products

[1]

THIS IS THE END OF THE QUESTION PAPER



DO NOT WRITE ON THIS PAGE

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

Total Marks	
-------------	--

Examiner Number

Permission to reproduce all copyright material has been applied for.
In some cases, efforts to contact copyright holders may have been unsuccessful and CCEA
will be happy to rectify any omissions of acknowledgement in future if notified.



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-}

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

gcse examinations chemistry

Group

1	H	Hydrogen	1
---	---	----------	---

† 90 – 103 Actinium series

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