Rewarding Learning

Centre Number

Candidate Number

General Certificate of Secondary Education
2018

Double Award Science: Chemistry

Unit C2

Foundation Tier

[GSD51]

GSD51

WEDNESDAY 13 JUNE 2018, 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 90.
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 **6**.
A Data Leaflet, which includes a Periodic Table of the Elements, is included in this question paper.

1 This question is about oxidation, reduction and rusting.

(a) Each of the objects listed below is protected from rusting by a different method. Draw a line from each object to the most suitable method of rust prevention.

Object	Method of rust prevention
Nail	Painting
Car bonnet	Oiling
Bicycle chain	Galvanising
	Plastic coating

[3]

(b) Complete the definition of rusting using words from the list below.

water **magnesium** **acid** **zinc**

hydrogen **air** **iron** **nitrogen**

Rusting is the reaction of the metal _____ with _____

and _____ [3]

(c) Rusting is an example of an oxidation reaction.

(i) Two of the reactions below are also oxidation reactions.
Identify the two oxidation reactions by putting ticks (✔) in the correct boxes

melting ice to give water	☐
burning a fuel	☐
reacting an acid with an alkali	☐
turning carbon monoxide (CO) into carbon dioxide (CO_2)	☐

[2]

(ii) Which element can be **removed** in an oxidation reaction?
Circle the correct answer.

hydrogen **nitrogen** **oxygen** [1]

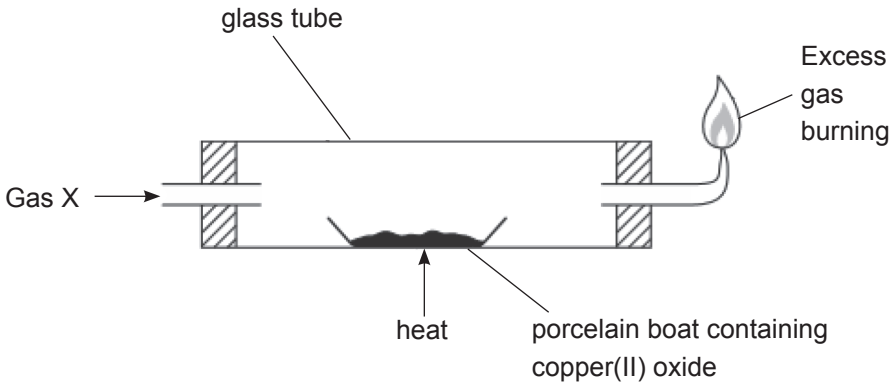
(d) Describe the test for oxygen gas.

_____

_____ [2]

[Turn over

(e) Copper(II) oxide can be reduced using the apparatus shown below.



(i) Name the gas X used in this reduction reaction.

_____ [1]

(ii) What is the colour of copper(II) oxide? Circle the correct answer.

blue **black** **red/pink** **white** [1]

(iii) During this reaction a colourless liquid may condense on the inside of the glass tube.

What is the name of this colourless liquid?

_____ [1]

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(Questions continue overleaf)

2 **(a)** Complete the reactivity series below by placing the metals aluminium, iron and calcium in their correct positions.

sodium	Most reactive
	↓
magnesium	
zinc	
copper	Least reactive

[2]

(b) Sodium reacts with water. In the table below tick (✔) **three** observations that can be made when sodium reacts with water.

Observation	**Tick (✔)**
sodium burns with a lilac flame.	
the reaction is very fast.	
a silver ball is formed.	
sodium sinks to the bottom and rises.	
sodium moves about the surface.	

[3]

(c) If a strip of magnesium is heated in a Bunsen flame it reacts with air. Describe three things you would observe during this experiment.

1. _____

2. _____

3. _____

[3]

(d) When excess zinc metal is added to copper(II) sulfate solution the solution changes colour.

(i) What colour change is observed in the solution?

from _____ to _____ [2]

(ii) Why does the solution change colour? _____

_____ [1]

[Turn over

3 Water can be described as being soft, having temporary hardness or having permanent hardness.

(a) Describe **how** you would carry out a test to show that a sample of water was soft.

_____

_____

_____ [2]

(b) The table below contains some statements about temporary and permanent hardness which may be true or false. Complete the table.

Statement	Temporary hardness True or False?	Permanent hardness True or False?
forms a scale in kettles	True	
can be removed on boiling		
is good for teeth and bones		True

[2]

(c) **(i)** Name one of the ions which is present in hard water.

_____ [1]

(ii) Give two disadvantages, linked to cost, that arise from living in a hard water area.

1. _____

2. _____ [2]

4 **(a)** Endothermic processes take in heat. Complete the table below to show if the processes are endothermic or not. The first one has been done for you.

Process	Endothermic Yes / No
photosynthesis	Yes
burning natural gas	
neutralising acid with alkali	
water turning into steam	

[3]

(b) Calcium carbonate (limestone) can be broken down by heating.

(i) Complete the word equation to show the products formed when calcium carbonate is heated.

calcium carbonate $\longrightarrow$ +

[2]

(ii) From the list below, circle the name given to this type of chemical reaction.

neutralisation **electrolysis** **thermal decomposition** **oxidation**

[1]

(c) This part of the question is about the uses of limestone. From the list below circle two uses of limestone.

neutralising acidity in soil **making fireworks**

making fertilisers **making building materials**

[2]

[Turn over

5 This question is about the element sulfur and its compounds.

Sulfur is a poor conductor of heat.

(a) List three other physical properties of sulfur.

1. _____

2. _____

3. _____ [3]

(b) Heating a mixture of iron and sulfur in a boiling tube causes a chemical reaction to start.

(i) Describe two observations that can be made **after the heating has been stopped**.

1. _____

2. _____ [2]

(ii) Write a balanced symbol equation for the reaction of iron and sulfur.

_____ [2]

(c) Sulfur burns in oxygen to form sulfur dioxide.

(i) What colour is the flame when sulfur burns in oxygen?

_____ [1]

(ii) Which **one** of the following words best describes the smell of sulfur dioxide?

Circle the correct answer.

odourless **pungent** **pleasant** **sweet** [1]

(d) Acid rain is a major environmental issue worldwide.

(i) Coal burning power stations are one of the main sources of acid rain. Many of these power stations use chemical sprays in the chimneys to try to reduce or prevent acid rain pollution.

How do these chemical sprays reduce or prevent acid rain?

_____

_____ [2]

(ii) Describe two other methods of acid rain prevention.

1. _____

2. _____ [2]

[Turn over

6 This question is about carbon dioxide and its role in global warming.

Describe:

- The physical properties of carbon dioxide
- The reaction of carbon dioxide with water and with limewater
- The role of carbon dioxide in global warming and the effects of global warming.

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

The physical properties of carbon dioxide

The reaction of carbon dioxide with water and with limewater

The role of carbon dioxide in global warming and the effects of global warming

[6]

7 This question is about relative formula masses, moles and relative atomic masses.

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

(relative atomic masses: H = 1, C = 12, N = 14, O = 16, Na = 23, S = 32)

(i) methanoic acid HCOOH

_____ [1]

(ii) sodium sulfite Na_2SO_3

_____ [1]

(iii) ammonium carbonate $(NH_4)_2CO_3$

_____ [1]

(b) Complete the sentence below to show the relationship between relative formula mass and moles.

The relative formula mass of a substance _____

_____ [2]

(c) Hydrated copper(II) sulfate, $CuSO_4.5H_2O$, has a relative formula mass of 250.

(i) How many moles would there be in 1 kg of hydrated copper(II) sulfate?

_____ [1]

(ii) If all of the water was removed from hydrated copper(II) sulfate, what would the relative formula mass be? Circle the correct answer.

245 240 232 160 64 [1]

[Turn over

8 The rate of the reaction between calcium carbonate and hydrochloric acid can be studied by recording the volume of gas produced at different times.

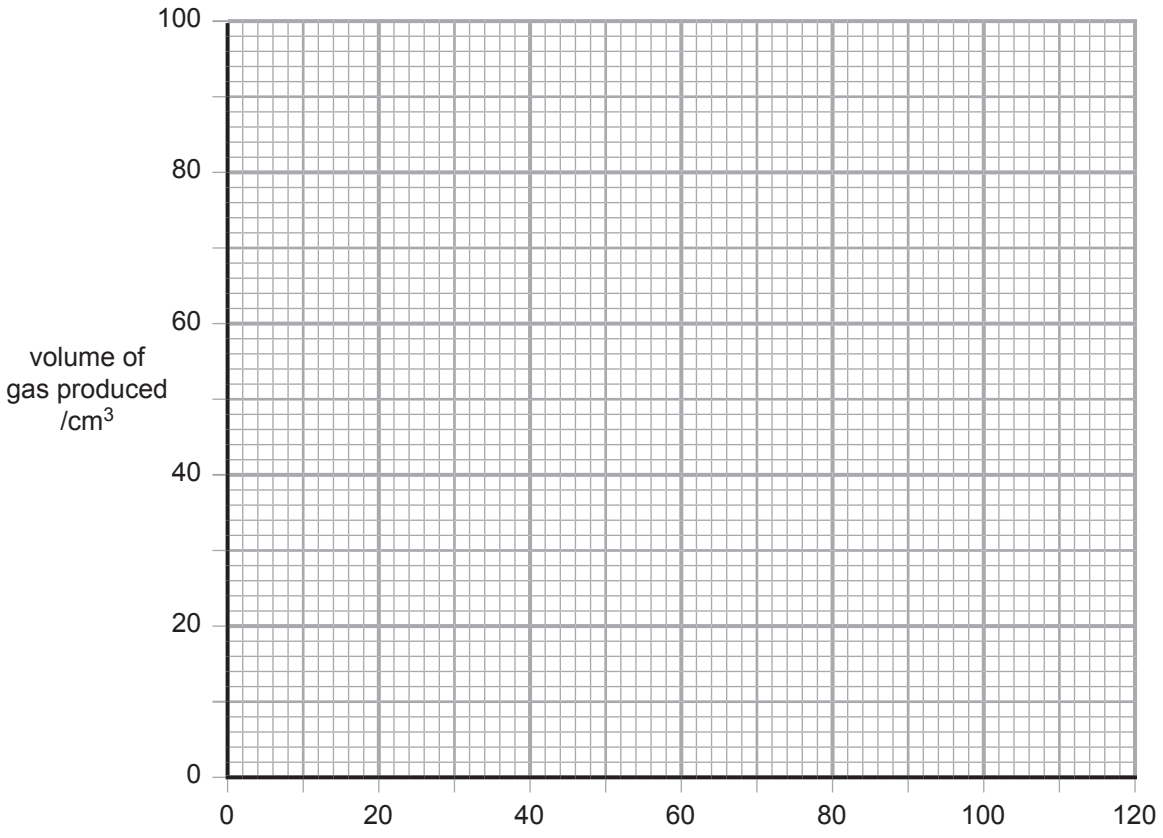
(a) Complete and balance the symbol equation below:

$CaCO_3$ + HCl $\longrightarrow$ + + [2]

(b) A group of students, investigating the rate at which gas was produced, obtained the following results:

Time /s	0	10	20	40	60	80	100	120
Volume of gas produced /cm^3	0	22	39	62	79	88	92	92

On the grid below, label the x-axis and plot a graph to show how the volume of gas produced changes with time.



[4]

(c) **(i)** Why was the volume of gas produced after 120 seconds the same as the volume produced after 100 seconds?

_____

_____ [1]

(ii) What volume of gas was produced between 40 seconds and 50 seconds?

_____ [1]

(d) Changing the conditions of the reaction between calcium carbonate and hydrochloric acid may affect the rate of the reaction.

For each of the situations below state if the rate would increase, decrease or stay the same.

(i) using powdered calcium carbonate instead of lumps

_____ [1]

(ii) cooling down the hydrochloric acid before adding it to the calcium carbonate

_____ [1]

(iii) diluting the hydrochloric acid with water before adding it to the calcium carbonate.

_____ [1]

[Turn over

9 This question is about crude oil and organic compounds.

(a) Crude oil is a mixture of different hydrocarbons.

What is meant by the term hydrocarbon?

_____

_____ [2]

(b) During the process of fractional distillation, crude oil enters the bottom of a fractionating column as a hot gaseous mixture.

Explain **how** and **why** the hydrocarbons in crude oil separate into different fractions, such as petrol and diesel oil.

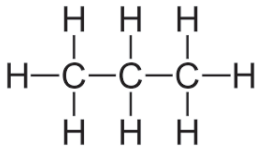
_____

_____

_____

_____ [2]

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

Name	Molecular formula	Structural formula	Physical state at room temperature
ethene	C_2H_4		
			gas

[4]

(d) Polythene and polyvinyl chloride (PVC) are two of the world's most important plastics. They are both long chain molecules which are made up of lots of smaller molecules (monomers) chemically joined together.

(i) Name the monomer used to make polythene.

_____ [1]

(ii) What name is given to the type of reaction used to make polythene?

_____ [2]

(e) Ethanoic acid is found in vinegar and it will react with some metals such as magnesium.

Describe two things that you would observe happening when some magnesium is added to a beaker containing ethanoic acid.

1. _____

2. _____ [2]

THIS IS THE END OF THE QUESTION PAPER

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

Examiner Number

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

Rewarding Learning

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
single award

Rewarding Learning

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						

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

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

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