



General Certificate of Secondary Education
2018

Centre Number

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Candidate Number

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Double Award Science: Chemistry

Unit C2

Foundation Tier

MV18

[GSD51]

WEDNESDAY 13 JUNE 2018, MORNING

Time

1 hour 15 minutes, plus your additional time allowance.

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 on blank pages.

Complete in black ink only.

Answer **all nine** questions.

Information for Candidates

The total mark for this paper is 90.

Figures in brackets printed at the end of each question 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. [3 marks]

Object

Method of rust prevention

Nail

Painting

Car bonnet

Oiling

Bicycle chain

Galvanising

Plastic coating

(b) Complete the definition of rusting using words from the list below. [3 marks]

water

magnesium

acid

zinc

hydrogen

air

iron

nitrogen

Rusting is the reaction of the metal _____ with _____ and _____

(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 [2 marks]

melting ice to give water

burning a fuel

reacting an acid with an alkali

turning carbon monoxide (CO) into carbon dioxide (CO₂)

(ii) Which element can be **removed** in an oxidation reaction?

Circle the correct answer. [1 mark]

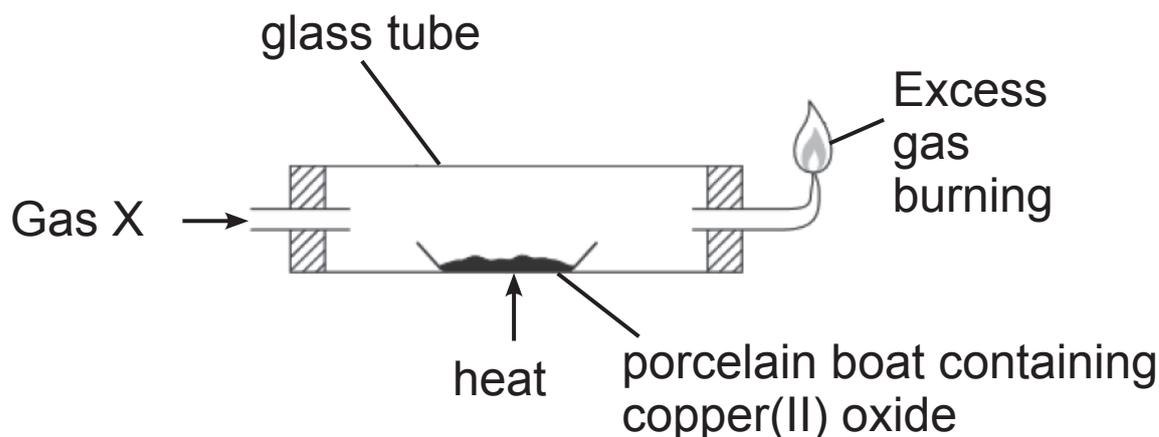
hydrogen

nitrogen

oxygen

(d) Describe the test for oxygen gas. [2 marks]

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



- (i) Name the gas X used in this reduction reaction.
[1 mark]
-

- (ii) What is the colour of copper(II) oxide? Circle the correct answer. [1 mark]

blue

black

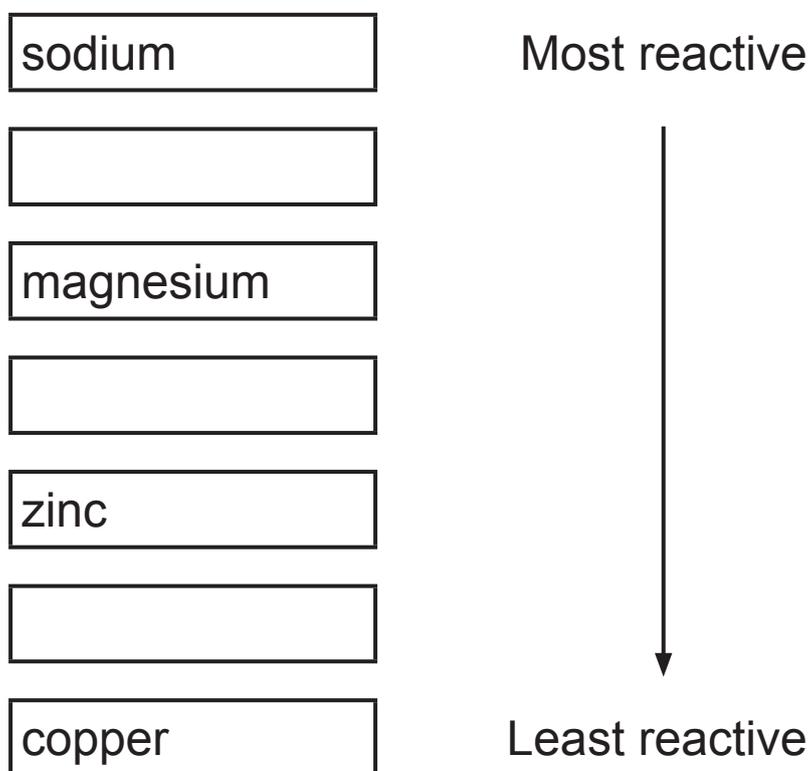
red/pink

white

- (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 mark]

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



- (b) Sodium reacts with water. In the table below tick (✓) **three** observations that can be made when sodium reacts with water. [3 marks]

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.	

(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. [3 marks]

1. _____
2. _____
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? [2 marks]

from _____ to _____

(ii) Why does the solution change colour? [1 mark]

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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 marks]

(b) The table below contains some statements about temporary and permanent hardness which may be true or false. Complete the table. [2 marks]

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

(c) (i) Name one of the ions which is present in hard water. [1 mark]

(ii) Give two disadvantages, linked to cost, that arise from living in a hard water area. [2 marks]

1. _____

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. [3 marks]

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

- (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. [2 marks]

calcium carbonate → +

- (ii) From the list below, circle the name given to this type of chemical reaction. [1 mark]

neutralisation

electrolysis

thermal decomposition

oxidation

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

neutralising acidity in soil

making fireworks

making fertilisers

making building materials

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. [3 marks]

1. _____

2. _____

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**. [2 marks]

1. _____

2. _____

(ii) Write a balanced symbol equation for the reaction of iron and sulfur. [2 marks]

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

(i) What colour is the flame when sulfur burns in oxygen? [1 mark]

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

Circle the correct answer. [1 mark]

odourless

pungent

pleasant

sweet

(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 marks]

(ii) Describe two other methods of acid rain prevention. [2 marks]

1. _____

2. _____

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.

[6 marks]

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

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 mark]

(ii) sodium sulfite Na_2SO_3 [1 mark]

(iii) ammonium carbonate $(\text{NH}_4)_2\text{CO}_3$ [1 mark]

- (b) Complete the sentence below to show the relationship between relative formula mass and moles. [2 marks]

The relative formula mass of a substance _____

- (c) Hydrated copper(II) sulfate, $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$, has a relative formula mass of 250.

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

- (ii) If all of the water was removed from hydrated copper(II) sulfate, what would the relative formula mass be? Circle the correct answer. [1 mark]

245

240

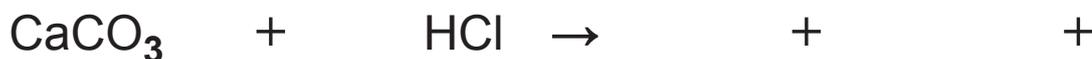
232

160

64

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.

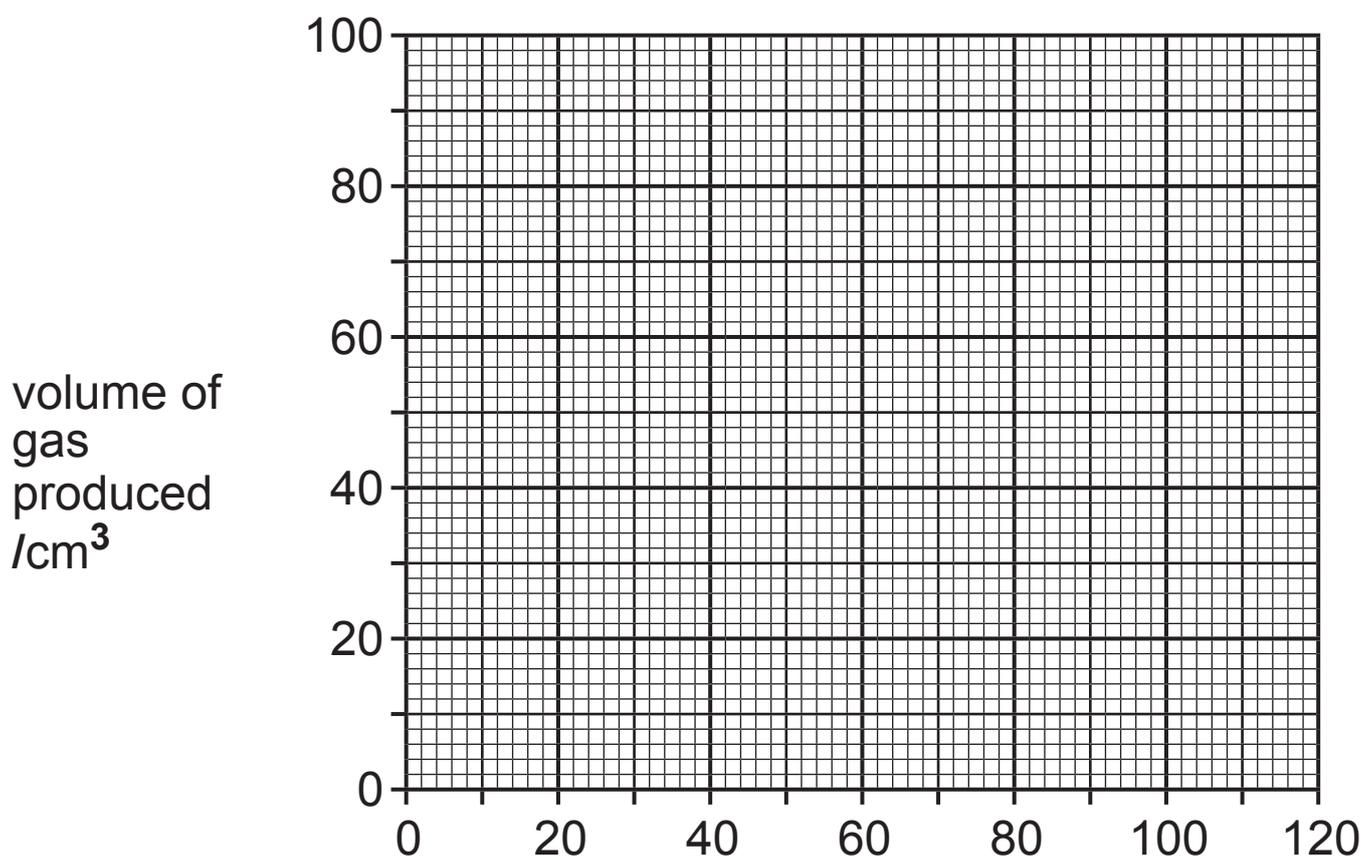
(a) Complete and balance the symbol equation below:
[2 marks]



(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 marks]



(c) (i) Why was the volume of gas produced after 120 seconds the same as the volume produced after 100 seconds? [1 mark]

(ii) What volume of gas was produced between 40 seconds and 50 seconds? [1 mark]

(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 mark]

(ii) cooling down the hydrochloric acid before adding it to the calcium carbonate [1 mark]

(iii) diluting the hydrochloric acid with water before adding it to the calcium carbonate. [1 mark]

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 marks]

(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 marks]

(c) Complete the table below by filling in the blank spaces. [4 marks]

Name	Molecular formula	Structural formula	Physical state at room temperature
ethene	C_2H_4		
		$ \begin{array}{ccccc} & H & H & H & \\ & & & & \\ H & -C & -C & -C & -H \\ & & & & \\ & H & H & H & \end{array} $	gas

(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 mark]

(ii) What name is given to the type of reaction used to make polythene? [2 marks]

(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. [2 marks]

1. _____

2. _____

THIS IS THE END OF THE QUESTION PAPER

For Examiner's use only	
Question Number	Marks
1	
2	
3	
4	
5	
6	
7	
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
Carbonate	CO_3^{2-}
Dichromate	$\text{Cr}_2\text{O}_7^{2-}$
Ethanoate	CH_3COO^-
Hydrogen carbonate	HCO_3^-
Hydroxide	OH^-
Methanoate	HCOO^-
Nitrate	NO_3^-
Sulfate	SO_4^{2-}
Sulfite	SO_3^{2-}

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.

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

Contents	Page
Periodic Table of the Elements	2–3
Symbols of Selected Ions	4
Solubility of Common Salts	4

gcse . science

chemistry double award single award



THE PERIODIC TABLE OF ELEMENTS

Group

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

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

a	x
b	

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

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