



General Certificate of Secondary Education  
2017

Centre Number

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Candidate Number

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# Double Award Science: Chemistry

Unit C2

Foundation Tier



[GSD51]

\*GSD51\*

## WEDNESDAY 14 JUNE 2017, 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(b)(ii)**.

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

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\*20GSD5101\*

1 This part of the question is about combustion.

(a) Complete the definition of combustion by putting a circle around the correct word from each box.

Combustion is the reaction of

fuels
water
gases

with

carbon dioxide
oxygen
hydrogen

to form

oxides
carbonates
salts

and release energy. [3]

(b) This part of the question is about the burning of sulfur in air.

Describe **two** safety precautions that should be taken when sulfur is burned.

1. \_\_\_\_\_
2. \_\_\_\_\_ [2]

(c) Complete each of the statements below by putting a circle round the correct answer.

(i) The colour of sulfur is:

**green**                      **yellow**                      **black** [1]

(ii) The flame colour when sulfur burns in air is:

**blue**                      **white**                      **orange** [1]

(iii) The substance formed when sulfur burns in air is a:

**colourless liquid**                      **pale yellow gas**                      **colourless gas** [1]



(d) Copper also reacts when heated in the air.

(i) Name the compound formed when copper is heated in the air.

\_\_\_\_\_ [1]

(ii) Four statements about the reaction that happens when copper is heated in the air are given. The statements are either true or false.

Use a circle to show whether each statement is true or false.  
One has been done for you.

Copper is a silver solid	true	<input checked="" type="radio"/> false	
The product formed is a solid	true	<input type="radio"/> false	
The product formed is black	true	<input type="radio"/> false	
The reaction produces a bright white light	true	<input type="radio"/> false	[3]



2 This question is mainly about nitrogen gas.

- (a) (i) The atmosphere contains a mixture of gases. What proportion of the atmosphere is made up of nitrogen?  
Circle the correct answer.

about 55%                      about 80%                      about 90%                      [1]

- (ii) What is the second most plentiful gas present in the atmosphere?

\_\_\_\_\_ [1]

- (b) (i) Listed below are some properties of gases. Circle the **three** properties which apply to nitrogen gas.

pungent smell                      colourless                      burns readily  
very unreactive                      pale green                      no smell                      [3]

- (ii) What is the formula of nitrogen gas? Circle the correct answer.

$N_2$                       N                       $N_3$                       [1]

- (c) Give two uses of nitrogen.

1. \_\_\_\_\_

2. \_\_\_\_\_ [2]



- 3 (a) In certain parts of Northern Ireland the water can be described as being hard. Complete the sentences below to show how hard water can be identified.

Hard water can be identified by adding \_\_\_\_\_ to the water.

If the water is hard a \_\_\_\_\_ will be produced. [2]

- (b) Detergents are commonly used in homes for cleaning dishes.

Fill in the missing word or words to complete the sentences about the effect of detergents on soft and hard water.

Soft water will \_\_\_\_\_ a lather with detergent.

Hard water will \_\_\_\_\_ a lather with detergent. [2]

- (c) The following is a list of some of the effects of hard water. Tick (✓) **two** effects which would be **advantages** if you lived in a hard water area.

Effect of hard water	Advantage
good for teeth and bones	
blocks hot water pipes	
tastes nice	
wastes soap	

[2]

- (d) Name one of the **ions** which cause hardness in water.

\_\_\_\_\_ [1]

- (e) What is the difference between temporary and permanent hardness in water?

\_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_ [2]

[Turn over



4 (a) This part of the question is about the properties and test for hydrogen gas.

(i) From the list below tick (✓) the **two** physical properties which are true for hydrogen gas.

sweet smell

brown colour

less dense than air

very soluble in water

colourless

[2]

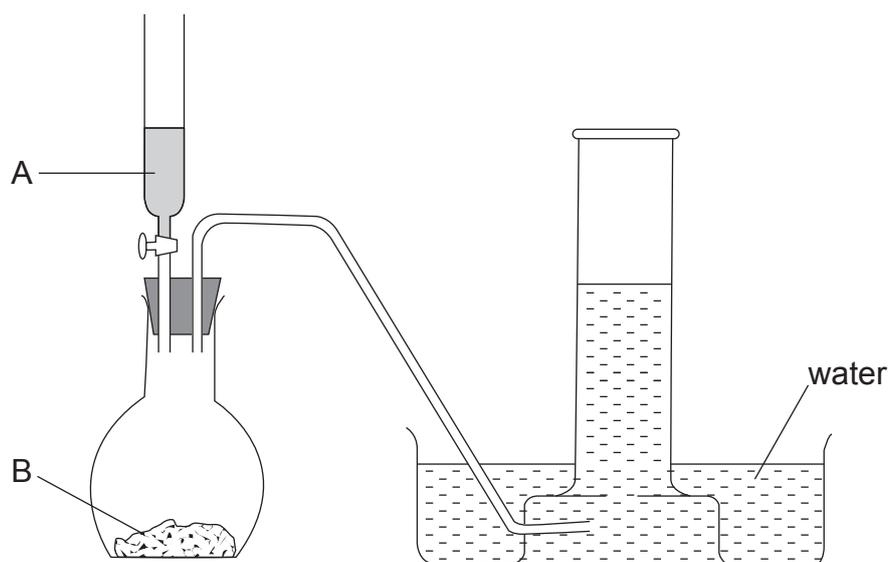
(ii) What happens if a lighted splint is placed in a test tube of hydrogen gas?

\_\_\_\_\_

[1]



(b) Hydrogen gas can be prepared in the laboratory using the apparatus below.



(i) Suggest names for solution A and solid B which can be safely reacted to form hydrogen gas.

solution A \_\_\_\_\_

solid B \_\_\_\_\_ [2]

(ii) Describe how the gas is collected.

\_\_\_\_\_

\_\_\_\_\_ [1]

(iii) Give two uses of hydrogen gas.

1. \_\_\_\_\_

2. \_\_\_\_\_ [2]

[Turn over



5 This question is about the reactions and reactivity of different Group 2 metals.

(a) Calcium reacts when added to cold water. Give four observations you would make when calcium is added to cold water.

1. \_\_\_\_\_
2. \_\_\_\_\_
3. \_\_\_\_\_
4. \_\_\_\_\_ [4]

(b) Magnesium does not react with cold water but it will react with steam. Complete the word equation for the reaction of magnesium with steam.

magnesium + steam → \_\_\_\_\_ + \_\_\_\_\_ [2]

(c) Give three observations you would expect if a small piece of strontium metal was placed in a large beaker of water.

1. \_\_\_\_\_
2. \_\_\_\_\_
3. \_\_\_\_\_ [3]





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\*20GSD5109\*

6 This question is about copper carbonate and calcium carbonate (limestone).

(a) When copper carbonate is heated strongly it undergoes thermal decomposition.

(i) What colour is copper carbonate? Circle the correct answer.

**white**                      **blue**                      **green**                      **black**                      [1]

(ii) Complete the word equation for the thermal decomposition of copper carbonate.

copper carbonate    →                      +                      [2]

(b) Limestone has many important uses and is obtained by quarrying.

(i) Give one important use of limestone.

\_\_\_\_\_ [1]



(ii) A large amount of limestone has been found within a mile of a popular seaside town.  
A company wants to open a quarry at the site.  
Some people are strongly in favour of opening the quarry and others are very much against the idea.

Discuss what you believe to be the advantages and disadvantages of opening a quarry near a popular seaside town in order to obtain limestone.

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

Advantages:

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Disadvantages:

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[6]

[Turn over



7 (a) Fossil fuels are non-renewable resources. Name three fossil fuels.

1. \_\_\_\_\_ 2. \_\_\_\_\_ 3. \_\_\_\_\_ [3]

(b) Solar energy can be described as a renewable resource.

(i) What is meant by a **renewable** resource?

\_\_\_\_\_  
\_\_\_\_\_ [1]

(ii) Give one other renewable energy source.

\_\_\_\_\_ [1]

(c) Natural gas contains methane and small amounts of propene. Complete the table below to show the molecular formula, structural formula and physical state at room temperature of both compounds.

Name	Molecular formula	Structural formula	Physical state at room temperature
methane			gas
propene	$C_3H_6$		

[4]



(d) Ethanol is used in alcoholic drinks. Give two other uses of ethanol.

1. \_\_\_\_\_

2. \_\_\_\_\_ [2]

(e) The drinking of alcohol in excess has a negative effect on people's health and social well-being.

(i) Give two ways in which alcohol can directly damage people's health.

1. \_\_\_\_\_

\_\_\_\_\_

2. \_\_\_\_\_

\_\_\_\_\_ [2]

(ii) Give two ways in which alcohol can have a bad effect on people's social well-being.

1. \_\_\_\_\_

\_\_\_\_\_

2. \_\_\_\_\_

\_\_\_\_\_ [2]

[Turn over

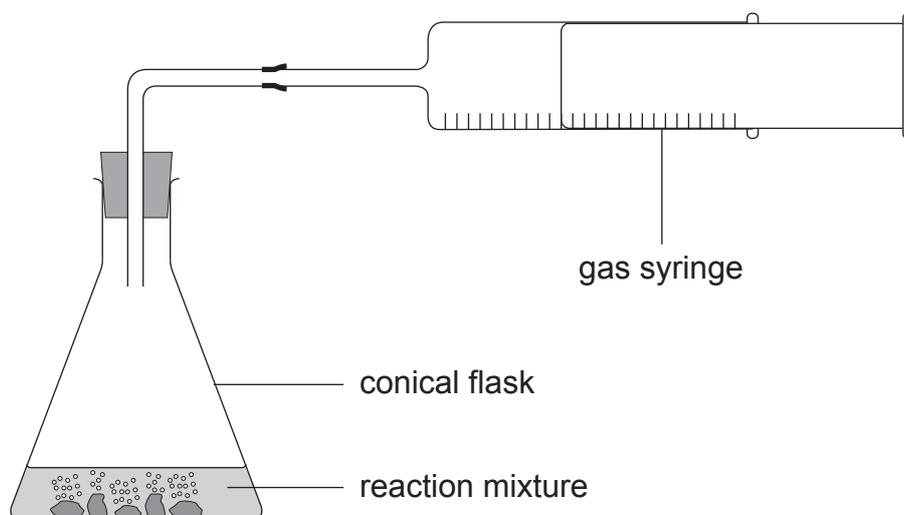


- 8 When a solid catalyst such as manganese(IV) oxide is added to hydrogen peroxide ( $\text{H}_2\text{O}_2$ ) solution the solution decomposes to release oxygen.



The rate of the reaction can be measured by looking at the rate at which oxygen gas is formed.

The reaction is carried out in a **closed** flask which has a gas syringe connected to the top.



- (a) (i) Why is it important to make sure that the flask containing the reactants is **closed** as soon as the catalyst has been added?

\_\_\_\_\_ [1]

- (ii) Why should the oxygen gas be collected in a gas syringe rather than a gas jar?

\_\_\_\_\_ [1]

- (iii) How would you know when the reaction is over?

\_\_\_\_\_ [1]





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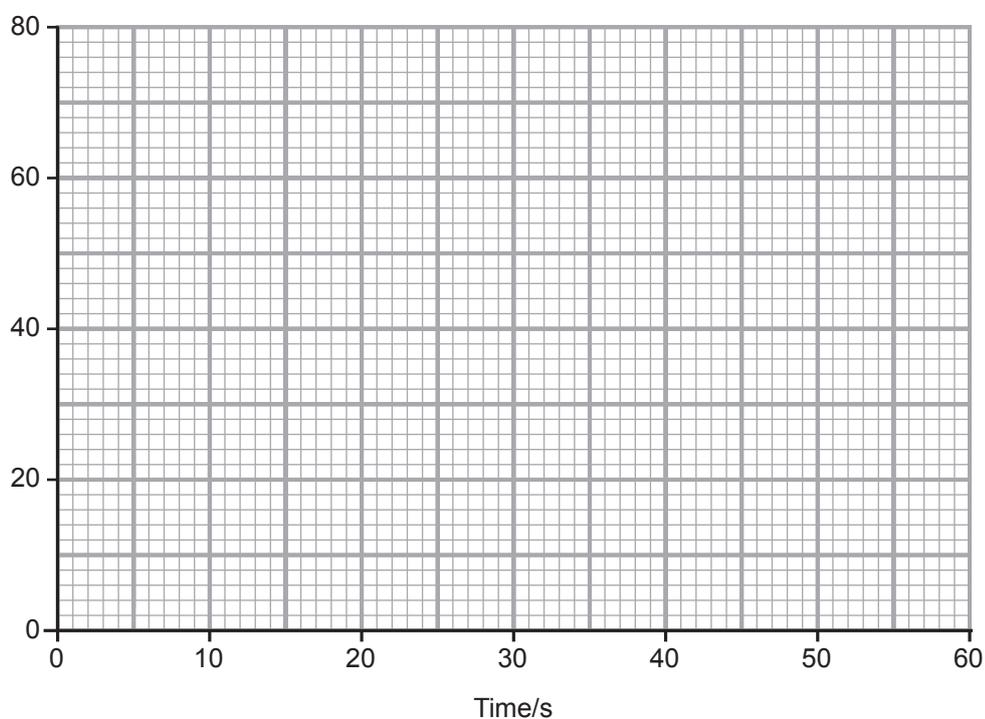
\*20GSD5115\*

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

Time/s	0	10	20	30	40	50	60
Volume of gas produced/cm <sup>3</sup>	0	28	45	57	62	64	64

(i) On the grid below:

- label the y-axis;
- plot a graph to show how the volume of oxygen gas produced changes with time.



[4]



(ii) How long did it take for 50 cm<sup>3</sup> of oxygen gas to be produced?

\_\_\_\_\_ s [1]

(iii) Which statement, A, B, C or D describes how the rate of the reaction changed with time?

- A The rate was the same throughout the investigation.
- B The rate was fastest in the first 10 seconds.
- C The rate was fastest between 20 and 30 seconds.
- D The rate was fastest between 50 and 60 seconds.

\_\_\_\_\_ [1]

(iv) What total volume of gas would you expect to have been produced after 100 seconds?

\_\_\_\_\_ cm<sup>3</sup> [1]



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

(a) Complete the definition below:

The relative atomic mass of an atom is \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_ [3]

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

(relative atomic masses: H = 1, N = 14, O = 16, S = 32, K = 39, Ca = 40)

(i) hydrogen peroxide  $\text{H}_2\text{O}_2$

\_\_\_\_\_ [1]

(ii) potassium sulfate  $\text{K}_2\text{SO}_4$

\_\_\_\_\_ [1]

(iii) calcium nitrate  $\text{Ca}(\text{NO}_3)_2$

\_\_\_\_\_ [1]



- (c) (i) The relative formula mass of sodium hydroxide is 40. What is the mass of 0.75 moles of sodium hydroxide?

\_\_\_\_\_ g [1]

- (ii) How many moles are in 240 grams of sodium hydroxide?

\_\_\_\_\_ [1]

- (d) A farmer bought 50 kg of calcium carbonate. The relative formula mass of calcium carbonate is 100. How many moles of calcium carbonate did the farmer buy?

\_\_\_\_\_ [1]

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**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	

<b>Total Marks</b>	
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Examiner Number

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## SYMBOLS OF SELECTED IONS

### Positive ions

Name	Symbol
Ammonium	$\text{NH}_4^+$
Chromium(III)	$\text{Cr}^{3+}$
Copper(II)	$\text{Cu}^{2+}$
Iron(II)	$\text{Fe}^{2+}$
Iron(III)	$\text{Fe}^{3+}$
Lead(II)	$\text{Pb}^{2+}$
Silver	$\text{Ag}^+$
Zinc	$\text{Zn}^{2+}$

### Negative ions

Name	Symbol
Carbonate	$\text{CO}_3^{2-}$
Dichromate	$\text{Cr}_2\text{O}_7^{2-}$
Ethanoate	$\text{CH}_3\text{COO}^-$
Hydrogen carbonate	$\text{HCO}_3^-$
Hydroxide	$\text{OH}^-$
Methanoate	$\text{HCOO}^-$
Nitrate	$\text{NO}_3^-$
Sulfate	$\text{SO}_4^{2-}$
Sulfite	$\text{SO}_3^{2-}$

## 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

<b>Soluble</b>
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

<b>Insoluble</b>
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

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

\* 58 – 71 Lanthanum series

† 90 – 103 Actinium series

$\begin{matrix} a \\ b \end{matrix} x$ 
  
 a = relative atomic mass (approx)
   
 x = atomic symbol
   
 b = atomic number

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