Rewarding Learning

Centre Number

Candidate Number

General Certificate of Secondary Education
2017–2018

Double Award Science: Chemistry

GSD51

Unit C2
Foundation Tier

[GSD51]

TUESDAY 13 NOVEMBER 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.
Write your answers in the spaces provided in this question paper.
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 **3(b)**.
A Data Leaflet, which includes a Periodic Table of the Elements, is included in this question paper.

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

Examiner Only	
Marks	Remark

1 This question is about rusting and other similar reactions.

(a) Complete the following definition of oxidation using the correct words from the list below.

hydrogen **carbon** **oxygen** **water**

addition **oxidation** **evaporation**

Oxidation is the addition of _____ or the

removal of _____ from a substance.

Reduction is the opposite of _____. [3]

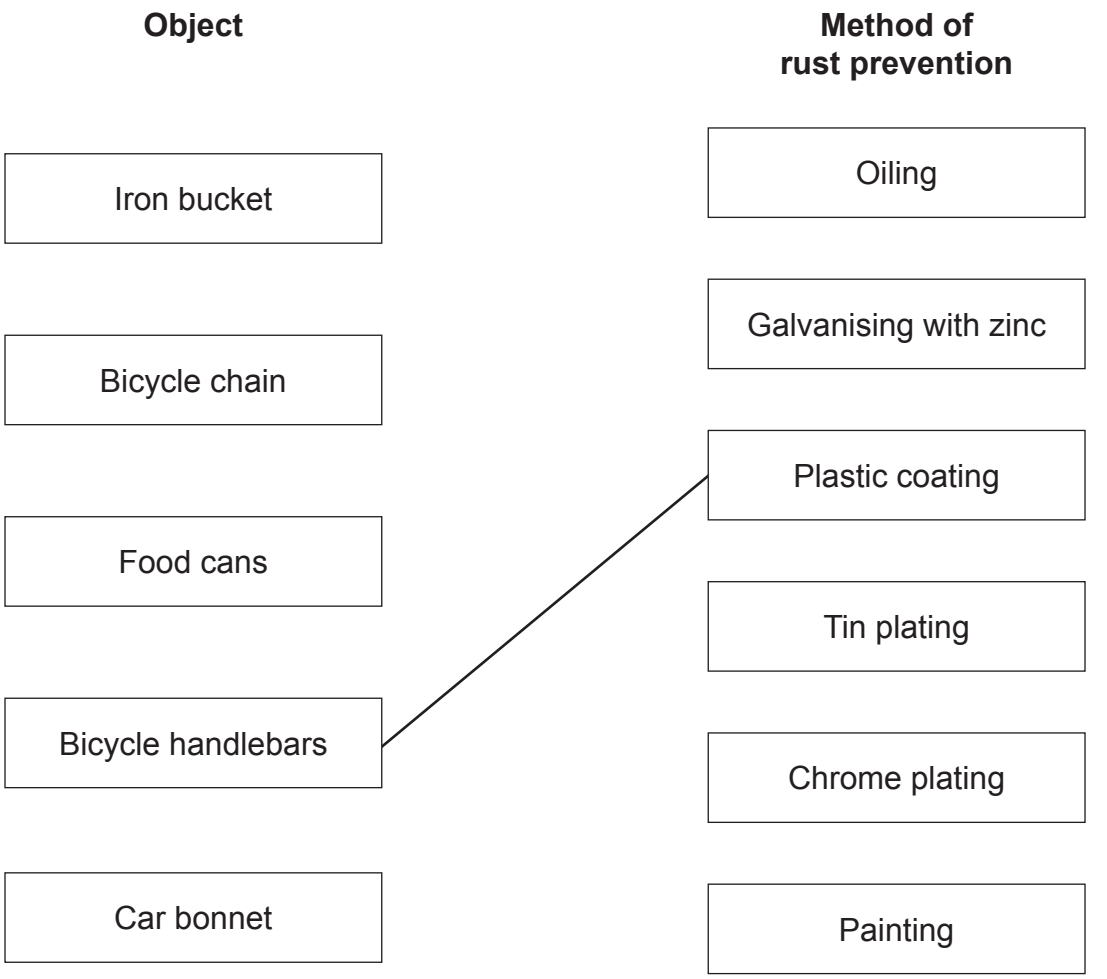
(b) Identify the following reactions as oxidation or reduction by placing a tick (✓) in the correct column.

Description of reaction	Oxidation	Reduction
Burning coal on a fire		
An iron bridge rusting		
The reaction of copper(II) oxide with hydrogen		

[3]

(c) The rusting of iron can lead to some materials becoming unusable or unsightly.
Various methods can be used to prevent rusting.
Use lines to connect each object to a correct method of rust prevention. **Each method should be used no more than once.**
One has been done for you.

Examiner Only	
Marks	Remark



[4]

Examiner Only	
Marks	Remark

2 This question is about rates of reaction and factors that affect rate.

(a) A reaction was carried out between magnesium and dilute sulfuric acid.
State whether the following changes would increase, decrease or have no effect on the **rate** of the reaction.

Change made	Effect on rate (increase/decrease/none)
Decreasing the temperature	
Increasing the concentration of the acid	
Breaking the magnesium into smaller pieces	
Increasing the volume of the acid	

[4]

(b) The sentence below is not complete.

The rate of a chemical reaction tells you …

Which one of the four statements (1, 2, 3 or 4) below is needed to complete the sentence?
Put a tick (✓) in the correct box.

1 the mass of reactants needed. ☐

2 which products are formed. ☐

3 how to carry out the reaction. ☐

4 the speed at which the reaction happens. ☐

[1]

(c) Explain briefly why a catalyst can be used more than once.

A catalyst can be used more than once because _____

_____

_____ [1]

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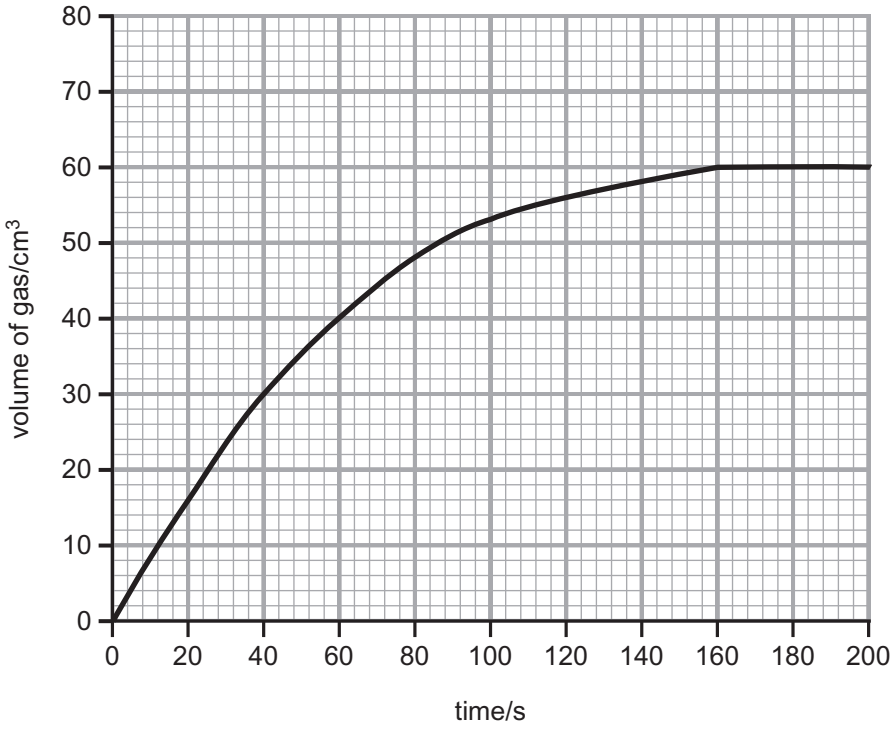
(Questions continue overleaf)

Examiner Only	
Marks	Remark

(d) A group of students were investigating how surface area affects the rate of the reaction between excess dilute hydrochloric acid and 0.25 g of calcium carbonate lumps.

They collected the following results for the reaction carried out at 20 °C and presented the information in the graph below.

Time/s	0	20	40	60	80	100	120	140	160	180	200
Volume of gas/cm^3	0	16	30	40	48	54	56	58	60	60	60



Use the graph and your knowledge to answer the following questions.

(i) What volume of gas was formed in the first 50 seconds?

_____ [1]

(ii) How many seconds did it take for all of the solid to react?

_____ [1]

(iii) The students repeated the experiment using 0.25 g of **powdered** calcium carbonate.

On the same axes draw the curve you would expect to get for the reaction carried out using 0.25 g of powdered calcium carbonate. You should assume that all other variables were kept the same as in the original experiment. [2]

Examiner Only	
Marks	Remark

Examiner Only	
Marks	Remark

3 **(a)** Exothermic processes give out heat and endothermic processes take in heat.

(i) Complete the table to show which of the processes are exothermic and which are endothermic. One has been done for you.

Process	Exothermic or Endothermic
photosynthesis	endothermic
burning wood	
melting ice cubes	
neutralising acid with alkali	
making chemical bonds	

[4]

(ii) When limestone (calcium carbonate) is heated it breaks down into two simpler substances.

calcium carbonate $\longrightarrow$ calcium oxide + carbon dioxide

Which **two** words are used to describe this type of reaction?

_____ [2]

(b) A new limestone quarry is to be created on the outskirts of a scenic village.
The limestone will be blasted from the quarry rock and then taken in dumper trucks to a nearby crushing plant. The crushed limestone will then be carried in heavy lorries for use in various parts of the country.

Describe the advantages and disadvantages, to the local village people, of having a quarry situated near to where they live.

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

Advantages:

Disadvantages:

[6]

Examiner Only	
Marks	Remark

Examiner Only	
Marks	Remark

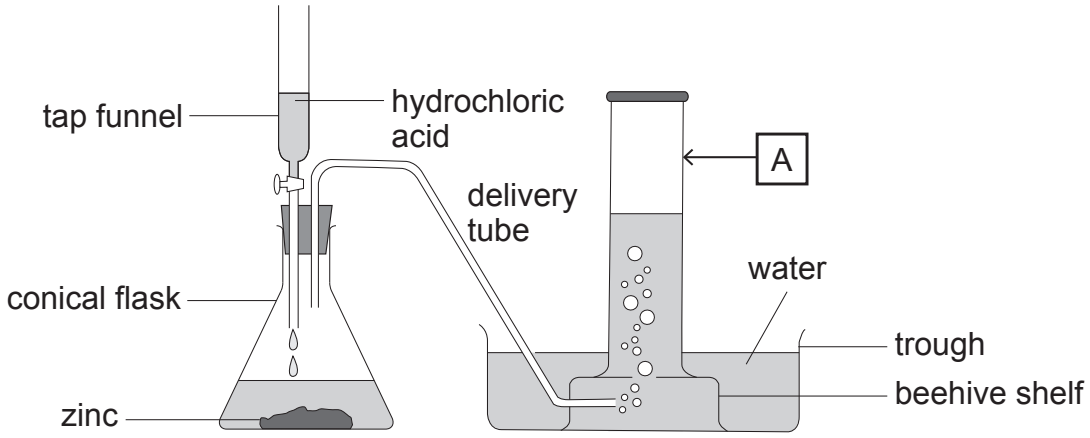
4 The following question is about non-metals and their compounds.

(a) Each of the tests listed below are used to identify a particular substance.
Complete the table with the name of the correct substance that the test is used for.

Description of test	Name of substance
Anhydrous copper(II) sulfate turns from white to blue	
Glowing splint relights	
Limewater turns from colourless to milky	
Lighted splint causes a "popping" sound	

[4]

(b) The following diagram shows the apparatus used to collect the gas that forms when zinc reacts with excess hydrochloric acid.



(i) Name the gas produced in the reaction between zinc and hydrochloric acid.

_____ [1]

(ii) Name the piece of apparatus labelled A.

_____ [1]

(iii) What happens to the water level in apparatus A as the zinc and hydrochloric acid react?

_____ [1]

Examiner Only

Marks	Remark

(c) When heated, carbon reacts with oxygen to form carbon dioxide or carbon monoxide.

(i) What is the **full** name given to the reaction in which carbon reacts with a **limited** supply of oxygen forming carbon monoxide?
Circle the correct answer.

combustion **incomplete combustion** **complete combustion**

[1]

(ii) What is the chemical formula of the gas carbon monoxide?

_____ [1]

(iii) Many homes with fires and boilers are now fitted with carbon monoxide detectors to make them safer.
Why is carbon monoxide more dangerous than carbon dioxide?

_____ [1]

(d) Carbon dioxide is dissolved in water to make it fizzy.

(i) Complete the symbol equation for the reaction between carbon dioxide and water.

$CO_2 + H_2O \longrightarrow$ [1]

(ii) What colour will be observed if universal indicator is added to water containing dissolved carbon dioxide?
Circle the correct colour.

blue **green** **orange**

[1]

(e) Sulfur will burn in oxygen to form the gas sulfur dioxide.

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

_____ [1]

(ii) What word can be used to describe the smell of the gas sulfur dioxide?
Circle the correct answer.

odourless **pungent** **sweet** **toxic**

[1]

Examiner Only	
Marks	Remark

5 This question is about the reactivity series of metals.

(a) (i) Describe three things you would observe when potassium metal reacts with cold water.

1. _____

_____

2. _____

_____

3. _____

_____ [3]

(ii) Name the solution formed when potassium reacts with water.

_____ [1]

(b) Iron does not react readily with cold water but does react with steam.

(i) Complete the word equation for the reaction of iron with steam.

iron + steam ⟶ + [2]

(ii) What colour is the solid product from the reaction of iron with steam?
Circle the correct answer:

black **white** **blue** **yellow** [1]

(iii) Name one other metal which reacts with steam but not with cold water.

_____ [1]

(c) Magnesium ribbon burns in air. The product is magnesium oxide.

Examiner Only	
Marks	Remark

(i) Describe how you would safely carry out this experiment in the laboratory.

_____

_____

_____

_____

_____ [2]

(ii) State two things you would see when magnesium ribbon burns in air.

1. _____

2. _____ [2]

Examiner Only	
Marks	Remark

6 This question is about hard water and soft water.

(a) From the list below circle the two ions which cause hardness in water.

Al^{3+} Ca^{2+} SO_4^{2-} Cl^- Mg^{2+} Na^+

[2]

(b) Complete the table below to show if hard water and soft water will form a lather when shaken with **detergent**.

Type of water	Effect of detergent, lather or no lather
hard water	
soft water	

[2]

(c) Water can be described as soft water, temporary hard water or permanent hard water.

(i) Describe an experiment to show that a sample of water is soft water.

_____

_____

_____ [2]

(ii) Describe an experiment to show that a sample of **hard** water is temporary hard water.

_____

_____

_____

_____

_____ [3]

Examiner Only	
Marks	Remark

7 This question is about relative formula masses and using and understanding the term mole.

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

(relative atomic masses: H =1, C = 12, N = 14, O = 16, S = 32, Ag = 108)

(i) ethane C_2H_6

_____ [1]

(ii) silver nitrate $AgNO_3$

_____ [1]

(iii) ammonium sulfate $(NH_4)_2SO_4$

_____ [1]

(b) What do you understand by the term “a mole of a substance”?

A mole of a substance is _____

_____

_____ [2]

Examiner Only	
Marks	Remark

(c) The relative formula mass of aluminium oxide is 102.

(i) What is the mass of 0.40 moles of aluminium oxide?

_____ g [1]

(ii) How many moles are in 255 grams of aluminium oxide?

_____ [1]

(iii) Scale is important in industrial chemistry. How many moles are there in 102 kg of aluminium oxide? Circle the correct answer.

1 **100** **1000** **10 000**

[1]

8 This question is about nitrogen gas and ammonia gas.

Examiner Only	
Marks	Remark

(a) **(i)** Give two physical properties of nitrogen gas.

1. _____

2. _____ [2]

(ii) Nitrogen gas can be used to make ammonia. Give one other use of nitrogen gas.

_____ [1]

(b) Ammonia is produced from nitrogen and hydrogen gas in the Haber process.

(i) Name the catalyst used in the Haber process.

_____ [1]

(ii) What temperature is used in the Haber process?

_____ °C [1]

(iii) Give two uses of ammonia.

1. _____

2. _____ [2]

Examiner Only	
Marks	Remark

9 **(a)** Fossil fuels contain carbon and are non-renewable.
From the list below, circle **three** fossil fuels.

oxygen	**wood**	**oil**
coal	**peat**	**hydrogen**

[3]

(b) Methane is an alkane with the formula CH_4.

(i) What is the formula of the alkane, butane?
Circle the correct answer.

C_4H_6	**C_4H_8**	**C_4H_{10}**	**C_4H_{12}**

[1]

(ii) What is the name of the substance which has the formula C_2H_4?
Circle the correct answer.

methene	**ethene**	**propene**	**ethane**

[1]

(iii) Write a balanced symbol equation for the complete combustion of methane.

_____ [3]

THIS IS THE END OF THE QUESTION PAPER

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