



Rewarding Learning

General Certificate of Secondary Education
2017–2018

Centre Number

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Candidate Number

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Double Award Science: Chemistry

Unit C2
Higher Tier

[GSD52]

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 Questions **3(a)** and **9(a)**.

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	
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1 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 \rightarrow _____ + _____ [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]

(iv) Name a metal which does **not** react with steam or water.

_____ [1]

Examiner Only	
Marks	Remark

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

(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

- 3 (a) 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]

- (b) When limestone is broken down using heat, bonds are broken and new bonds are made. What energy change occurs when a chemical bond is made?

[1]

Examiner Only	
Marks	Remark

4 This question is about hard water and soft water.

(a) 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]

(b) Explain in terms of the ions present, how hard water, containing dissolved calcium ions, can be softened using sodium carbonate.

[3]

Examiner Only

Marks

Remark

5 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, N = 14, O = 16, S = 32, Ag = 108)

(i) silver nitrate AgNO_3

_____ [1]

(ii) ammonium sulfate $(\text{NH}_4)_2\text{SO}_4$

_____ [1]

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

A mole of a substance is _____

_____ [2]

(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) Scale is important in industrial chemistry. How many moles are there in 51 kg of aluminium oxide?
Show your working out.

_____ [2]

Examiner Only	
Marks	Remark

(d) The final part of this question is about concentrations of solution, the effect that dilution or mixing has on the concentration of a solution and the number of moles in the solution.

(i) If 600 cm^3 of water is added to 400 cm^3 of a 2 mol/dm^3 solution of sulfuric acid, what happens to the **concentration** of acid in the solution? Tick (✓) the correct answer.

It stays the same

It becomes 40% of its original value

It becomes 60% of its original value

[1]

(ii) If 600 cm^3 of water is added to 400 cm^3 of a 2 mol/dm^3 solution of sulfuric acid, what happens to the **number of moles** of acid in the solution? Tick (✓) the correct answer.

It stays the same

It becomes 40% of its original value

It becomes 60% of its original value

[1]

(iii) 0.5 dm^3 of a 2 mol/dm^3 solution of sulfuric acid is added to another 0.5 dm^3 of a 2 mol/dm^3 solution of sulfuric acid. What is the **concentration** of the new 1 dm^3 solution? Tick (✓) the correct answer.

1 mol/dm^3

2 mol/dm^3

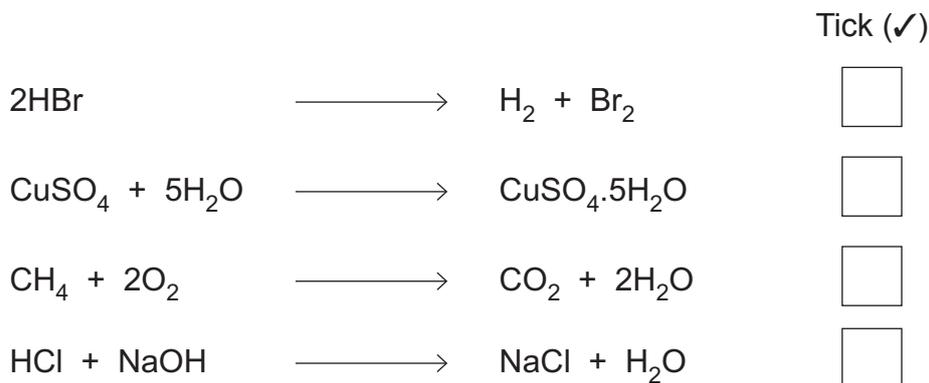
4 mol/dm^3

[1]

Examiner Only	
Marks	Remark

6 This question is about oxidation, reduction and redox reactions.

- (a) Listed below are four chemical equations. Place a tick (✓) beside the **two** equations that show oxidation reactions.



[2]

- (b) The reaction of lead nitrate solution and aluminium powder can be represented by the two half equations shown below.



Explain in terms of electron transfer the oxidation and reduction reactions that are happening.

[2]

- (c) The manufacture of iron can be represented by the following chemical equation.



Using your knowledge and the equation, identify what is being oxidised **and** what is being reduced.

being oxidised: _____

being reduced: _____ [2]

Examiner Only

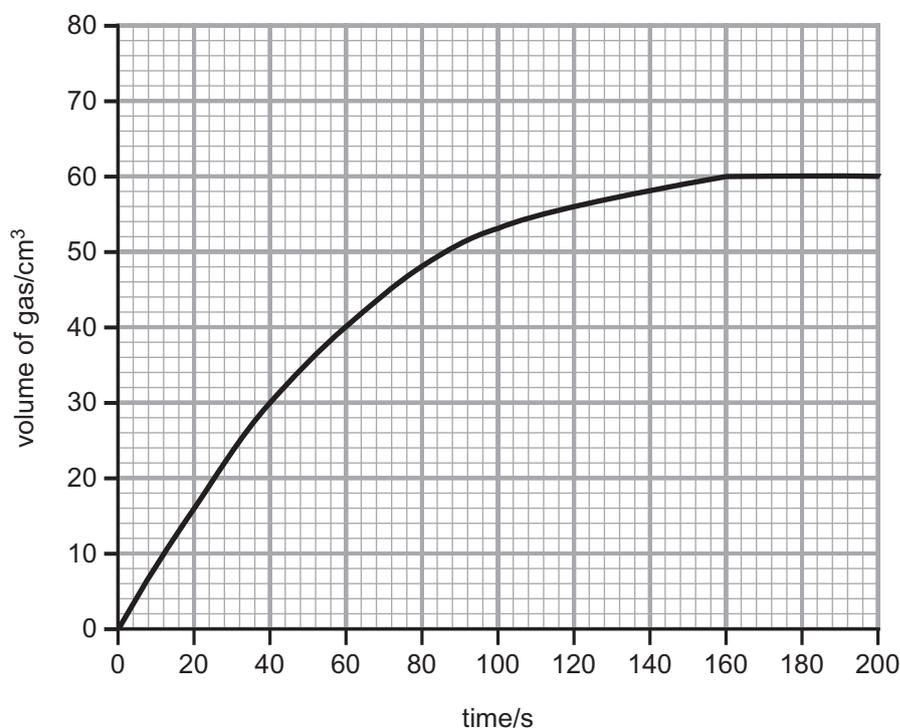
Marks	Remark

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

- (a) 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]

Examiner Only

Marks Remark

- (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]

- (b) Use collision theory to explain why increasing the temperature and increasing the concentration will increase the rate of a reaction.

- (i) Increasing the temperature of the reaction mixture.

[3]

- (ii) Increasing the concentration of an acid.

[2]

- (c) Two students are reacting sulfuric acid with an excess of powdered magnesium to form hydrogen gas.

Student A uses 500 cm³ of 0.5 mol/dm³ sulfuric acid.

Student B uses 250 cm³ of 1.0 mol/dm³ sulfuric acid.

What difference, if any, will there be between the reactions carried out by student A and student B? Your answer should refer to both the rate of the reaction and the volume of hydrogen gas produced.

rate of reaction: _____

volume of hydrogen gas: _____

_____ [2]

Examiner Only

Marks Remark

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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

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chemistry
double award
single award

