



Rewarding Learning

General Certificate of Secondary Education
2019

Centre Number

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Candidate Number

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GCSE Chemistry

Unit 2

Foundation Tier



[GCM21]

GCM21

WEDNESDAY 12 JUNE, 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 six** questions.

INFORMATION FOR CANDIDATES

The total mark for this paper is 80.

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(d)**.

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

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1 Iron is extracted from its ore in the Blast Furnace. The extraction involves redox reactions.

(a) (i) Name the ore from which iron is extracted in the Blast Furnace.

_____ [1]

(ii) Apart from iron ore, name one other substance added to the Blast Furnace.

_____ [1]

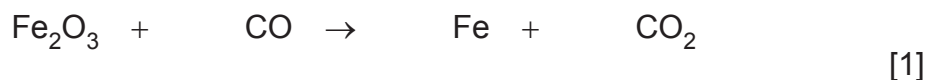
(b) (i) Name the reducing agent in the Blast Furnace and write balanced symbol equations to show the formation of this compound.

Name _____

Equations

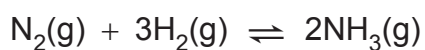
_____ [6]

(ii) Balance the symbol equation below for the production of iron in the Blast Furnace.



- 2** Ammonia is manufactured in the Haber Process. An iron catalyst is used in this process to increase the rate of the reaction.

The balanced symbol equation for the reversible reaction in the Haber Process is:



- (a) (i)** Explain how a catalyst increases the rate of a chemical reaction.

[2]

- (ii)** State two conditions which can be altered to change the direction of a reversible reaction.

1. _____

2. _____

[2]



(b) A dynamic equilibrium is achieved in the reaction between nitrogen and hydrogen in the Haber Process.

Complete the following table by placing a tick (✓) in the correct column.

Statement	True	False
Dynamic equilibrium occurs in a closed system.		
Dynamic equilibrium occurs when the rates of the forward and reverse reactions are equal.		
Dynamic equilibrium occurs when the rate of the forward reaction is greater than the rate of the reverse reaction.		
At equilibrium the amount of reactants is always equal to the amount of products.		
At equilibrium the amounts of reactants and products remain constant.		

[5]

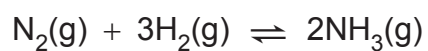
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(c) In the Haber Process the forward reaction is exothermic.

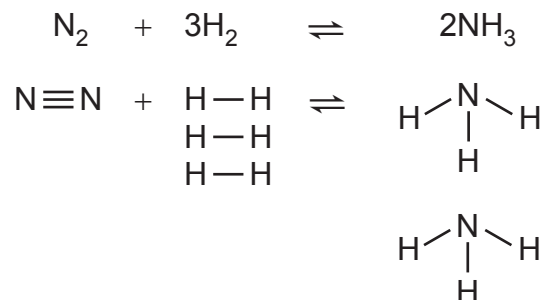


(i) Explain, in terms of bonds, why this reaction is exothermic.

[3]



- (ii) The covalent bonds which are present in the reactants and products are shown below the equation. Use these bonds and the bond energies given in the table to calculate the energy change for the forward reaction.



Bond	Bond Energy/kJ
$\text{N} \equiv \text{N}$	916
$\text{H}-\text{H}$	436
$\text{N}-\text{H}$	386

Energy change = _____ kJ [4]

- (iii) Using your answer to (c)(ii) suggest a value for the energy change of the reverse reaction.

_____ [1]

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20GCM2107

3 Alkenes are hydrocarbons which may be produced by cracking.

(a) (i) State the meaning of the term hydrocarbon.

_____ [1]

(ii) Write the general formula of the alkenes.

_____ [1]

(b) Write a balanced symbol equation for the complete combustion of C_4H_8 forming carbon dioxide and water.

_____ [3]

(c) Propene may be produced from the cracking of the hydrocarbon C_7H_{16} . One other product is formed in this reaction.

(i) Write a balanced symbol equation for the cracking of C_7H_{16} .

_____ [2]

(ii) Name the other product formed in this reaction.

_____ [1]

(iii) Suggest why high temperatures are required for cracking reactions.

_____ [1]



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4 Calcium nitrate and calcium chloride are compounds often used in commercial treatments for garden plants.

(a) Calcium nitrate may be formed from the reaction of nitric acid with calcium hydroxide solution. An experiment was carried out during which nitric acid was slowly added from a burette to 25.0 cm³ of calcium hydroxide solution in a conical flask.

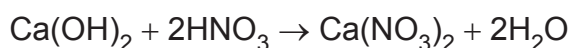
(i) An indicator was added to the conical flask to show when the reaction was complete. Name a suitable indicator which could have been used in this experiment.

_____ [1]

(ii) Name a piece of apparatus which was used to accurately measure 25.0 cm³ of calcium hydroxide solution.

_____ [1]

(iii) The balanced symbol equation for the reaction is:



Calculate the atom economy when calcium nitrate is made using this reaction.

Show your working out.

Atom economy = _____ % [3]

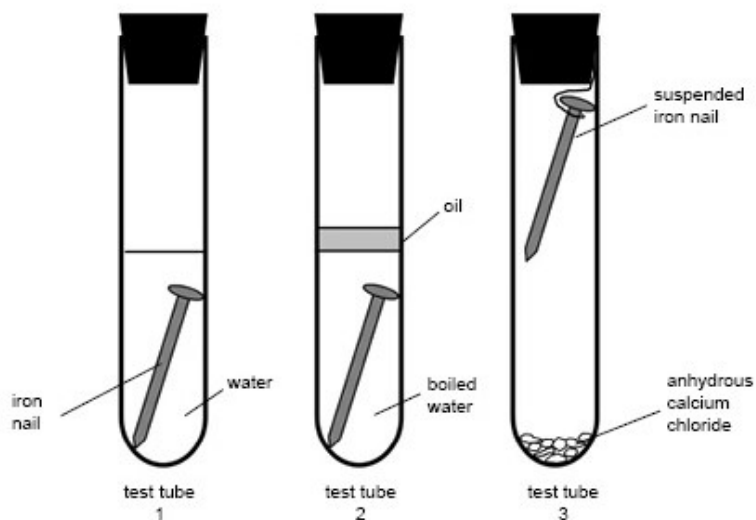
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(b) Anhydrous calcium chloride is used in an experiment to investigate rusting as shown below. An iron nail is placed in three different test tubes (1, 2, and 3) under different conditions. The test tubes were left for one week.



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(i) In which test tube(s) would rusting have occurred after one week?

_____ [1]

(ii) What is the purpose of the oil in test tube 2?

_____ [1]

(iii) What is the purpose of the anhydrous calcium chloride in test tube 3?

_____ [1]



(iv) Describe the appearance of rust.

_____ [2]

(v) What is the chemical name for rust?

_____ [1]

(vi) State one method of preventing the formation of rust.

_____ [1]

[Turn over

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(iii) Suggest why this electrolysis experiment needs to be carried out in a fume cupboard.

_____ [1]

(iv) What name is given to the positive electrode?

_____ [1]

(c) Complete the table to give details of the electrolysis of molten lead(II) bromide.

	Negative electrode	Positive electrode
Observations at the electrode	silvery grey liquid formed	
Name of electrolysis product		

[4]



6 Oxygen and nitrogen are the most abundant gases found in the atmosphere.

(a) (i) State the colour of oxygen gas.

_____ [1]

(ii) State one use for oxygen gas.

_____ [1]

(b) Oxygen gas reacts with both metals and non-metals to form oxides. Complete the following table giving information about the reaction of oxygen gas with the elements magnesium and sulfur.

	Magnesium	Sulfur
Observations during reaction with oxygen	white flame	
Appearance of product after reaction with oxygen		colourless gas
Nature of oxide formed (acidic or basic)		

[5]



(c) (i) State the percentage composition of nitrogen gas in the atmosphere.

_____ [1]

(ii) Explain why nitrogen gas is unreactive.

_____ [2]

(iii) Apart from nitrogen and oxygen, name two other gases which are present in the atmosphere.

1. _____
2. _____ [2]

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Question Number	Marks
1	
2	
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Total Marks	
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Examiner Number

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