Double Award Science:
Chemistry OLD SPECIFIACTION 2017

Unit C2

Foundation Tier

[GSD51]

General Certificate of Secondary Education

1 hour 15 minutes.

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.

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

Question	Marks	Actual
1	10	
2	13	
3	9	
4	12	
5	12	
6	11	
7	12	
8	3	
9	8	
TOTAL	**90**	

1. Exothermic reactions give out heat and endothermic reactions take in heat.

(a) 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**
Displacement of silver metal from silver nitrate solution by magnesium metal	Exothermic
Rehydration of white copper(II) sulfate crystals	
Neutralisation of sodium hydroxide with nitric acid	
Thermal decomposition of calcium carbonate	

[3]

(b) For each of the reactions choose the **most** appropriate word from the list below to describe the type of reaction. Each word can be used only once.

Combustion **Neutralisation** **Dehydration**

Photosynthesis **Thermal Decomposition** **Redox**

Reaction	**Type**
ethanoic acid + sodium hydroxide → sodium ethanoate + water	
propane + oxygen → carbon dioxide + water	
lead oxide + heat → lead + carbon dioxide	
copper oxide + hydrogen → copper + water	

[4]

(c) Explain in terms of bonds broken and bonds made why the rusting of iron is **exothermic** with reference to the word equation below:

iron + water + oxygen → hydrated iron (III) oxide

_____

_____

_____

_____

[3]

2.This question is about the reaction of metals with oxygen and water.

(a) Below are a list of metals. Match the metal to the observation made. One is done for you and is scored out.

Potassium **Sodium** **~~Calcium~~** **Magnesium**

Aluminium **Zinc** **Iron** **Copper**

OBSERVATION	**METAL**
When it reacts with cold water limewater is formed which is alkaline.	Calcium
Burns in air with a bright white light.	
Does not react with cold water but reacts with steam, glowing with a red heat to form a black solid.	
Does not react with cold water but reacts with steam, to form a yellow solid, which becomes white on cooling.	
Does not react with cold water or steam but forms a black solid when heated in air.	
Is the most reactive metal in this group.	
Burns with a golden yellow flame in air forming a white solid.	
Only reacts with steam when it has been powdered due to the oxide layer on the surface.	

(b) In the table below tick (✓) **four** observations that can be made when calcium reacts with water.

OBSERVATION	**TICK**
The metal moves about on the surface of the water.	
The metal sinks to the bottom and rises again.	
A yellow flame is seen.	
The colourless solution produced may eventually turn milky.	
Heat is produced.	
Bubbles of gas are produced.	

[4]

(c) Complete the word equation for the reaction of calcium with water.

calcium + water →

[2]

3. Limestone taken from the ground by quarrying is used in the construction agency.

(a) How is limestone rock formed?

_____

_____

[1]

(b) Circle the correct formula for Limestone.

$CaCO_3$ **$CaSO_4$** **$MgCO_3$** **$MgSO_4$**

[1]

(c) Give three uses for limestone in the construction industry.

(i) _____

(ii) _____

(iii) _____

[3]

(d) Limestone can be decomposed by heating in a limekiln.

(i) Two products are formed. One is calcium oxide. What is the name of the second product?

_____ [1]

(ii) Explain why one of the products, calcium oxide might be useful to farmers?

_____

_____

_____

_____

[2]

(e) When carbon dioxide in rainwater falls on limestone it dissolves forming hard water. The water formed in this process is called temporary hard water.

(i) What is the name of the substance that causes temporary hard water?

_____ [1]

4. The atmosphere of early earth was very different to the atmosphere we have on earth today.

(a) The change in the proportion of several atmospheric gases is shown in the table. Give reasons for the change shown. One reason has been given for you.

Gas	**Change in atmospheric gas proportion.**	**Reason**
Nitrogen	Increased	Bacteria converted ammonia to nitrogen
Carbon Dioxide	Decreased	
Water Vapour	Decreased	
Oxygen	Increased	

[3]

(b) Four statements about the atmospheric gas carbon dioxide gas 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.

It is lighter than air.	true	(false)
It very soluble in water.	true	false
In the solid state is called ‘dry ice.	true	false
It sublimes.	true	false

[3]

(c) Carbon Dioxide is classed as a greenhouse gas.

(i) Give one reason for the increase in carbon dioxide in the atmosphere.

_____ [1]

(ii) Give one environmental impact of the greenhouse effect.

_____ [1]

(iii) Give one way to minimise the release of greenhouse gases.

_____ [1]

(d) Magnesium can burn in carbon dioxide. Describe three observations you may see when this occurs:

1. _____

2. _____

3. _____

[3]

5. Iron is extracted from its iron oxide ore by heating it in the blast furnace with coke (carbon).

(a) Give the name for the ore from which iron is extracted.

_____ [1]

(b) Complete the symbol equation below for the reaction of iron (III) oxide with Carbon and ensure that it is balanced.

$Fe_2O_3 + C \rightarrow$

[4]

(c) If ore containing one 1 tonne of iron (III) oxide was placed in the blast furnace. How many moles of iron oxide are available? (iron (III) oxide has the relative formula mass of _____)

_____ moles

[2]

(d) If 300,000 moles of iron metal was extracted each day. How many tonnes of iron was produced? (Iron has the relative atomic mass of _____).

_____ tonnes

[2]

(e) The table shows how metals are obtained from their ores. Complete the table by placing the metals below in the correct position.

Lead **Silver** **Sodium**

EXTRACTION	**METAL**
Electrolysis	
Heat with carbon	
Found in its native state	

[3]

6. This question is about sulphur.

.

(a) Complete the sentences by putting a circle around the correct word from each box.

Sulfur is a

yellow
white
blue
black

brittle solid. It burns with oxygen in the air,

with a

yellow
lilac
green
blue

flame, forming sulfur dioxide which has the formula

SO
SO_2
SO_3
SO_4

.

Sulfur dioxide is a		gas with		.
	yellow		**a sweet odour**	
	colourless		**no odour**	
	brown		**a pungent odour**	
	purple		**a fragrant odour**	

[5]

(b) Discuss the burning of fossils fuels containing sulfur impurities which lead to acid rain. Include in your discussion:

- how sulfur impurities can lead to the formation of acid rain including an equation for sulphur dioxide dissolving in rainwater.
- the impact of acid rain on the environment, and
- make suggestions on how the formation of acid rain from the burning of fossil fuels can be reduced.

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

[6]

7. This question is mainly about ammonia gas.

(a) Listed below are some properties of gases. Circle the **three** properties which apply to ammonia gas.

pungent smell **colourless** **basic**

very insoluble **pale green** **no smell** [3]

(b) Describe the test for ammonia gas.

_____

_____

_____

_____

[3]

(c) Ammonia is manufactured by the Haber process according to the equation below:

$$N_{2(g)} + 3H_{2(g)} \rightleftharpoons 2NH_{3(g)}$$

(i) Which of the two gases is obtained from the atmosphere?

_____ [1]

(ii) Circle the most appropriate temperature used to carry out this process in industry.

45^{o}C 450^{o}C 4500^{o}C -4.5^{o}C

[1]

(iii) Circle the most appropriate pressure used to carry out this process in industry.

2 atm 20 atm 200 atm 2000 atm

[1]

(iii) Circle the typical catalyst used to carry out this process in industry.

aluminium sodium manganese iron

[1]

(c) Only 10% of the reaction gases are converted to ammonia. Tick the most appropriate method of extracting the ammonia from the reactant gases nitrogen and hydrogen.

Let the ammonia sink to the bottom.	
Use chromatography.	
Cool to condense the ammonia first.	
Use fractional distillation.	

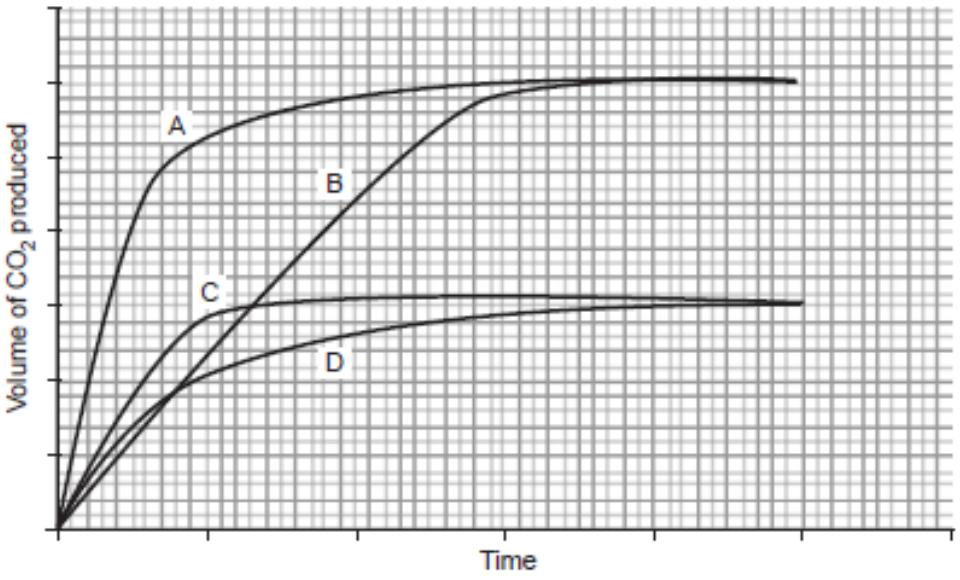
[1]

(e) Ammonia can be reacted with sulphuric acid to make ammonium sulphate. What is the formula for ammonium nitrate? Circle the correct answer.

$(NH_4)_2SO_4$ **NH_3SO_3** **NH_4SO_4**

$NH_4(SO_4)_2$ **$NH_4(SO_4)_2$** [1]

8. The curves below show the volume of carbon dioxide formed by reacting excess marble chips (calcium carbonate) with dilute hydrochloric acid.



The curve labelled D is for the reaction of 50cm^3 of 0.1 mol/dm^3 hydrochloric acid with excess marble chips.

State which curve would be obtained by:

(a) reacting 100 cm^3 of 0.1 mol/dm^3 hydrochloric acid with excess marble chips.

_____ [1]

(b) reacting 50 cm^3 of 0.1 mol/dm^3 hydrochloric acid with excess *powdered* marble chips.

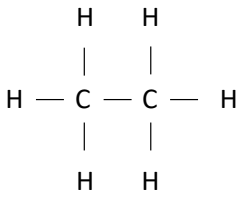
_____ [1]

(c) reacting 50 cm^3 of 0.2 mol/dm^3 hydrochloric acid with excess marble chips.

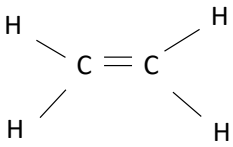
_____ [1]

9. This question is about organic chemistry.

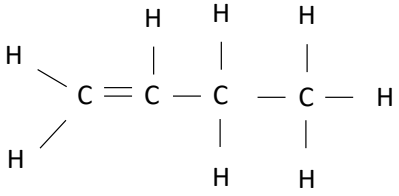
(a) Examine the organic compounds.



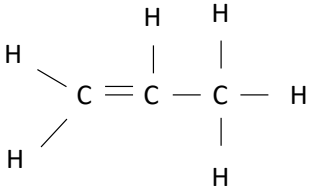
A



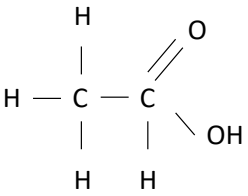
B



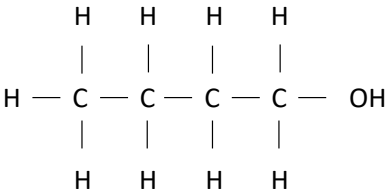
C



D



E



F

(i) Give the letter of **two** of the compounds are **not** hydrocarbons.

_____ [2]

(ii) Give the letter of the compound that has the general formula C_nH_{2n+2}.

_____ [1]

(iii) Give the letter of the compound named butene.

_____ [1]

(iv) Give the letter of the compound which is a monomer of the plastic polyethene.

_____ [1]

(b) Carboxylic acids are weak acids. The following observations were made when ethanoic acid reacted with 3 compounds. Match the compound with the observation.

sodium carbonate	No gas was produced.
sodium hydroxide	Bubbles of gas were produced. This gas turned limewater milky.
magnesium	Bubbles of gas were produced. This gas gave a pop with a lighted splint.

[3]