MASENO SCHOOL

JULY/AUGUST MOCK - 2024

233/2 – CHEMISTRY Paper 2 (THEORY)

EST.1906

Name …………………………..…………………… Index Number………........………......……..

Class …………………..……… Date ……………….…………Signature……...………...….……………..

INSTRUCTIONS

- *Write your name and index number in the spaces provided.*
- *Answer **all** questions in the spaces provided*
- *Mathematical tables and silent electronic calculators **may** be used for calculations.*
- *All workings **must** be clearly shown where necessary.*
- *Candidates should check the question paper to ascertain all the pages are printed as indicated and no questions are missing.*

For Examiners Use Only

Questions	Maximum Score	Score
1	10	
2	12	
3	13	
4	10	
5	11	
6	11	
7	13	
TOTAL	**80**	

1. The grid below represents part of the periodic table. Study it and answer the questions that follow. Letters are not the actual symbols of the elements.

								B
				P	R		S	
			V			X	Y	
Z	M							

(i) Select a letter that represents the most reactive non-metal. Explain (2 marks)

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(ii) Select a letter that represents an element that forms an ion with a charge of 2⁻ (1 mark)

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(iii) Select an alkaline earth metal (1 mark)

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(iv) Identify the least reactive element. (1 mark)

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(v) What is the formula of the compound formed when **M** reacts with **P**? (1 mark)

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(vi) What type of chemical bond exists in a compound formed when **R** and **S** react? (1 mark)

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(vii) Write electron configuration of element V. (1 mark)

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(viii) Compare the atomic and ionic radius of element **Y**. Explain. (2 marks)

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2.   (I) Use the table below to answer the questions that follow.

Substance	Formula
A	$CH_3(CH_2)_2OH$
B	C_2H_5COOH
C	CH_3CHCH_2
D	$CH_3CH_2CH_3$
E	CH_3CCH

(a)   Explain how one would differentiate between substance **D** and **E** in the laboratory. (2 marks)

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(b)   What is the name of the process involved when substance **D** reacts with chlorine? Give the

condition required for the process.

Process - …………………………………………………………………………..   (1 mark)

Condition -   …………………………………………………………………………   (1 mark)
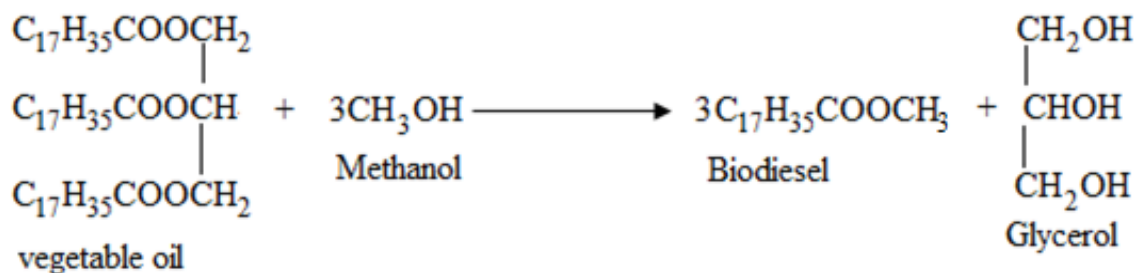
(c)   Select **two** substances from the table that could be reacted to form a pleasant smelling

substance.   (1 mark)

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(II) *Biodiesel* is made from a vegetable oil by the following reaction.

i. What kind of compounds are vegetable oil and biodiesel?   (1 mark)

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ii. What other product is made from vegetable oil by heating it with aqueous sodium hydroxide.   (1 mark)

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iii. What observation is made when acidified potassium permanganate is added to vegetable oil.   .   (1 mark)

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(III) In the preparation of soap, *1.26g* of a natural fat having the structure shown below was refluxed with *10cm³* of *1.0M* sodium hydroxide for one hour. The reaction mixture was cooled and unreacted alkali titrated with **4.0cm³ of 1.0M** hydrochloric acid.

(i) Complete the equation for complete hydrolysis of the fat in the structure drawn below.

(1 mark)

$$R\text{——}COOCH_2$$
$$R\text{——}COOCH$$
$$R\text{——}COOCH_2$$
(Fat)
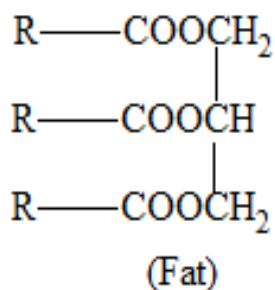
(ii) Explain why the mixture of sodium and sodium hydroxide refluxed for one hour.   (1 mark)

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(iii) Calculate the relative formula mass of fat. (2 marks)

3.   a) What is meant by molar heat of neutralization? (1 mark)

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b) In an experiment to determine the molar heat of neutralization, *50cm³ of 1M* hydrochloric acid was neutralized by adding *10cm³* portions of dilute sodium hydroxide. During an experiment, the data in the table below was obtained.

Volume of sodium hydroxide (cm³)	0	10	20	30	40	50	60
Temperature of mixture (ºC)	25.0	27.0	29.0	31.0	31.0	30.0	29.0

i) On the grid provided, plot a graph of temperature (y-axis) against volume of sodium hydroxide (x-axis) added. (3 marks)
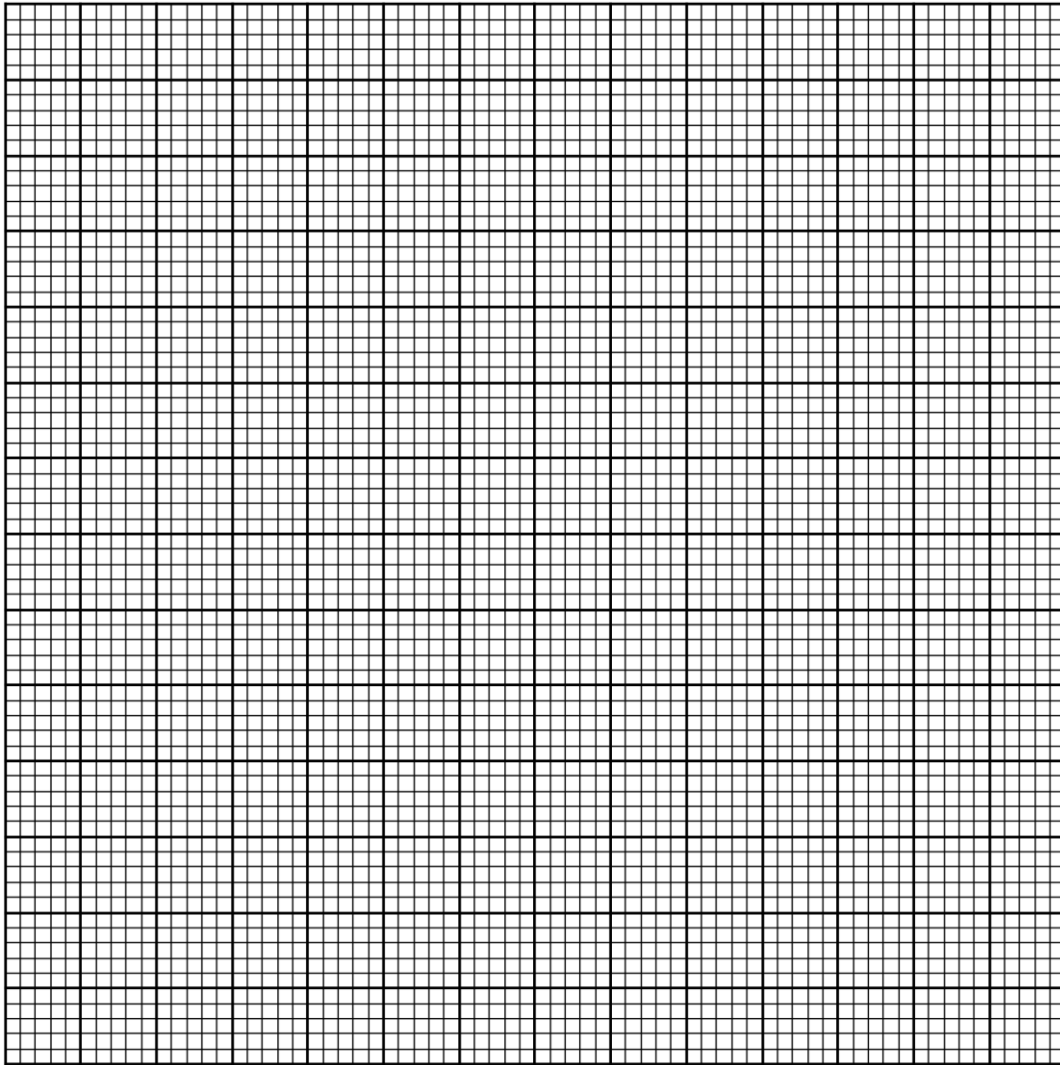
ii) From the graph, determine;

    I)   Volume of sodium hydroxide which completely neutralizes $50cm^3$ of 1M hydrochloric acid. (1 mark)

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    II)   Change in temperature ΔT, when complete neutralization occurred. (1 mark)

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III) Calculate:

(i) The heat change ΔH, when complete neutralization occurred. (2 marks)
(Specific heat capacity = 4.2J/g/K, density of solution = $1g/cm^3$)

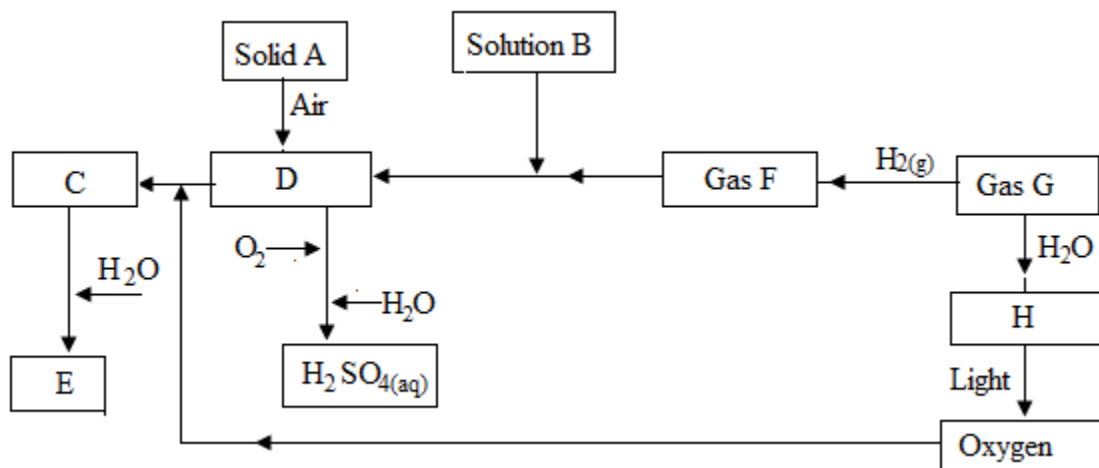(ii) Molar heat of neutralization of hydrochloric acid with sodium hydroxide. (2 marks)

III) Draw an energy level diagram for the reaction that occurred. (2 marks)

IV) How would the value of molar heat differ if *50cm³ of 1M* ethanoic acid was used instead of 1M hydrochloric acid? Give a reason. (1 mark)

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4. Study the flow chart below and answer the questions that follow.

i. Identify substances:

A ……………………………………………………………………………. (1 mark)

B …………………………………………………………………………….. (1 mark)

C ……………………………………………………………………………. (1 mark)

D ……………………………………………………………………………. (1 mark)

E ……………………………………………………………………………. (1 mark)

F ……………………………………………………………………………. (1 mark)

ii. State two observations that would be made when *gas F* and *solution B* react. (2 marks)

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iii. Write a chemical equation for the reaction between gas G and water. (1 mark)

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iv. Name a *catalyst* to be used for the formation of substance C. (1 mark)

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5.   a) Below is an experimental preparation of substance C.
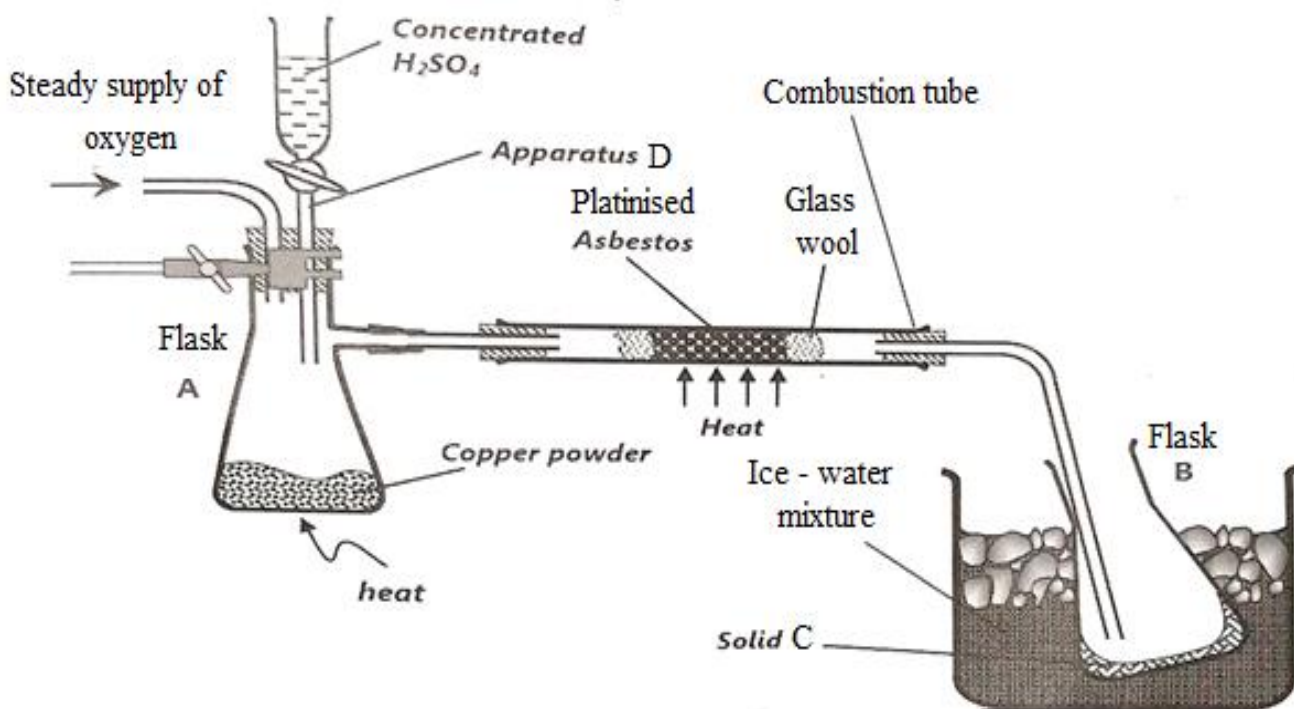
i)   Write an equation for the reaction taking place in flask A.   (1 mark)

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ii)   Should concentrated sulphuric (VI) acid be replaced with dilute solution, the preparation will most likely fail. What is the role of concentrated Sulphuric (VI) acid in the above preparation?

(1 mark)

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iii)   Suggest an improvement that can be made in the combustion tube to make the preparation more efficient and safer.   (1 mark)

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iv)   Name substance C prepared in this reaction.   (1 mark)

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v)   State any **one** industrial use of substance C.   (1 mark)

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b) Using an equation explain the observation that would be made when concentrated Sulphuric (VI) acid is added to glass beaker containing table sugar. (2 marks)

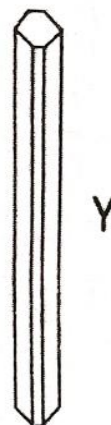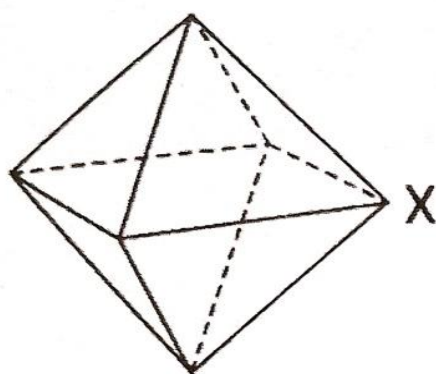……

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c) The diagrams below represent two allotropes of sulphur.

i) What are allotropes? (1 mark)

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ii) Name the two allotropes labeled **X** and **Y**. (1 mark)

X …………………………………………………Y……………………………………………

iii) Briefly explain how plastic sulphur is formed. (2 marks)

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6.   a) The set-up **below** was used to prepare and collect gas **R.** During the experiment cleaned
      magnesium ribbon was strongly heated before heating the wet glass wool.
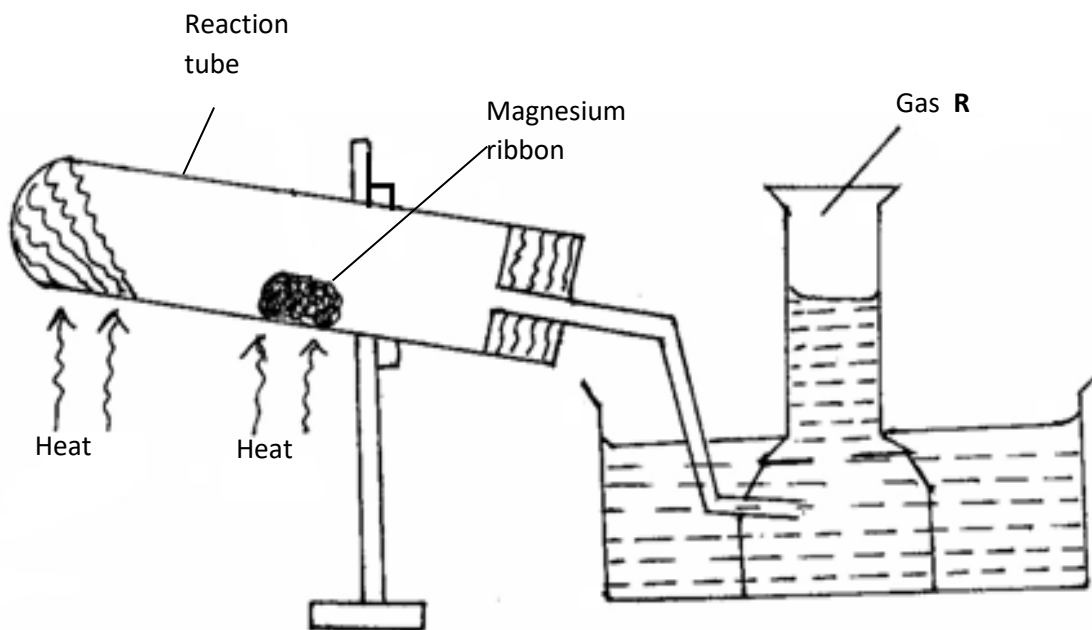
(i)   Name gas **R**   (1 mark)

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(ii)   State **one** observation that would be noted in the reaction tube.   (1 mark)

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(iii) Write the equation for the reaction in the reaction tube.   (1 mark)

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(iv)   State **one** industrial use of the solid product formed in the reaction tube. (1 mark)

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(v)   What precaution should be taken at the end of experiment?   (1 mark)

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(vi)   At the end of the experiment 96.0cm³ of gas R were collected at 10°C and 1 atmosphere pressure. (Mg = 24, M.G.V = 22.4 at s.t.p).

Determine the volume gas R would occupy at s.t.p?   (2 marks)

b) A few drops of freshly prepared iron (II) sulphate solution were added to potassium nitrate solution in a test tube. Concentrated Sulphuric (VI) acid was then carefully added to the mixture and allowed to settle.

     i)   State the observation that was made.   (1 mark)

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     ii)   What name is given to the experiment described above?   (1 mark)

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c) When fuels burn in the internal combustion engines at high temperatures, one of the products formed is nitrogen (II) oxide.
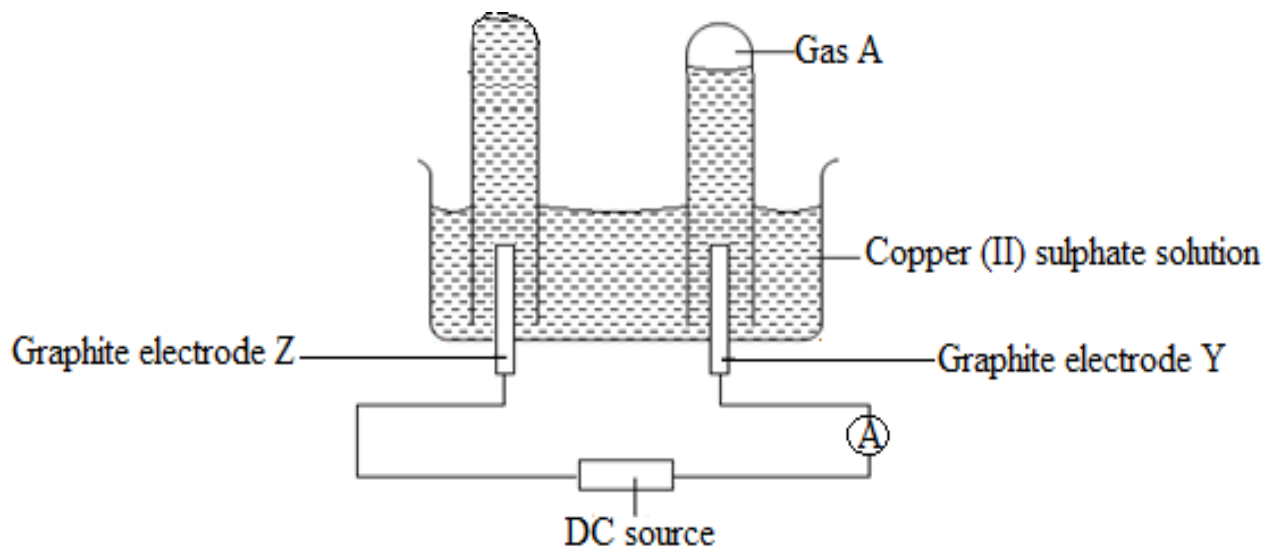
     i)   Explain why nitrogen (II) oxide is not formed at room temperature.   (1 mark)

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     ii)   Describe how formation of nitrogen (II) oxide in the internal combustion engines leads to gaseous pollution.   (1 mark)

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7.   a) The set up below is for the electrolysis of copper (II) sulphate solution using graphite rods as electrodes. Study it and answer the questions that follow.

i)   Identify gas A.   (1 mark)

    ……………………………………………………………………………………………………

ii)   Describe how you can obtain the mass of the solid deposited at electrode X.   (2 marks)

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iii)   State two changes that occur in the electrolyte after the experiment.   (2 marks)

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b) A current of **1.5A** was passed through the solution of copper (II) sulphate for **50** minutes.

. (**M.G.V. r.t.p. = 24000cm³, IF = 96500C**).

   i.   Determine the quantity of electricity used.   (1 mark)

    ii.   Calculate the volume of the gas produced at the anode.   (2 marks)

c) Below are standard electrode potentials of some elements.

		E^o (V)
Mg^{2+} (aq) + 2e⁻ ⇌ Mg (s)		-2.36
Zn^{2+} (aq) + 2e⁻ ⇌ Zn (s)		-0.76
$2H^+$ (aq) + 2e⁻ ⇌ H_2 (g)		0.00
Ag^+ (aq) + e⁻ ⇌ Ag (s)		+0.79
Cu^{2+} (aq) + 2e⁻ ⇌ Cu (s)		-0.34

Draw a well labeled diagram for the electrochemical cell obtained by joining hydrogen and zinc half cells.   (3 marks)

d) Carbon (IV) oxide from a generator was passed into a $20cm^3$ of lime water and conductivity of the solution determined as shown below.
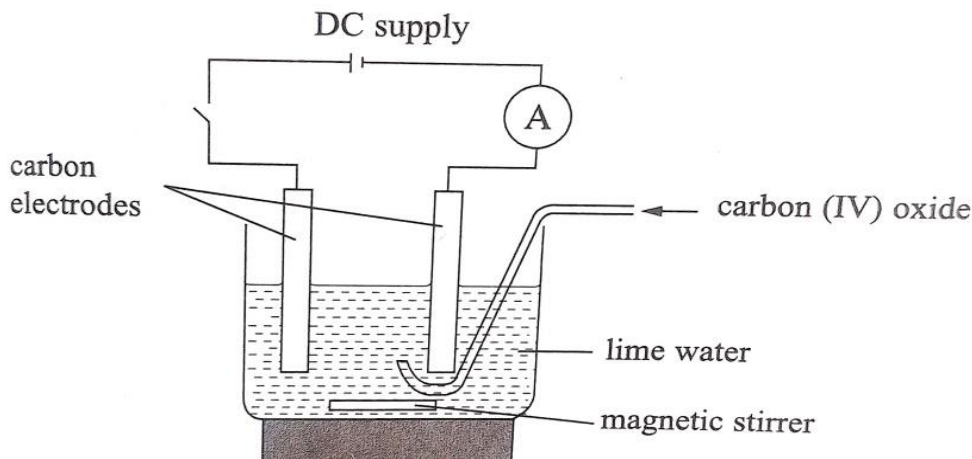
The conductivity of the solution decreased then after some time it started increasing, but did not reach the initial conductivity of lime water. Explain these observations. (2 marks)

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