233/2
CHEMISTRY
PAPER 2
THEORY
Time: 2 hours

PRECIOUS BLOOD SCHOOL
MOCK EXAM

INSTRUCTIONS TO CANDIDATES

1. *Answer **ALL** the questions in the spaces provided.*
2. *Mathematical tables and silet electronic calculators may be used.*
3. *All working **MUST** be clearly shown where necessary.*

For Examiner's use only

Question	Maximum Score	Candidate's score
1 - 29	80	

This paper consists of 7 printed pages.

Candidates should check the question paper to ensure that all the pages are printed as indicated and that no questions are missing.

SECTION I (50 marks)

Answer **all** *questions in this section*

1. The table below shows elements with their atomic numbers, mass numbers and their melting points. Study it and answer the questions that follow. Letters do not represent actual symbols of the elements.

Element	B	C	D	E	F	G	H	I	J	K
Atomic no.	7	8	19	15	2	9	6	16	12	11
Atomic mass	14	16	39	31	4	19	12	32	24	23
Melting point	-	-	637	44	-272	-223	Vary	113	669	98

(a) Select two elements with oxidation state -2. (2 marks)

_____

(b) Which element represents:

(i) The most powerful oxidising agent? (1 mark)

_____

(ii) The most powerful reducing agent? (1 mark)

(c) Which element has the highest ionization energy? (1 mark)
Explain

_____

(d) Select two elements, when reacted form a compound that conducts electricity in molten and aqueous state. (1 mark)

_____

(e) Select two elements when reacted form a compound that dissolves in water to form acidic solution. (1 mark)

_____

(f) Using dot (.) and cross (x) diagram, show the bond between B and J. (2 marks)

_____

_____

(g) Explain why the M.P. of K is higher than that of D. (2 marks)

_____

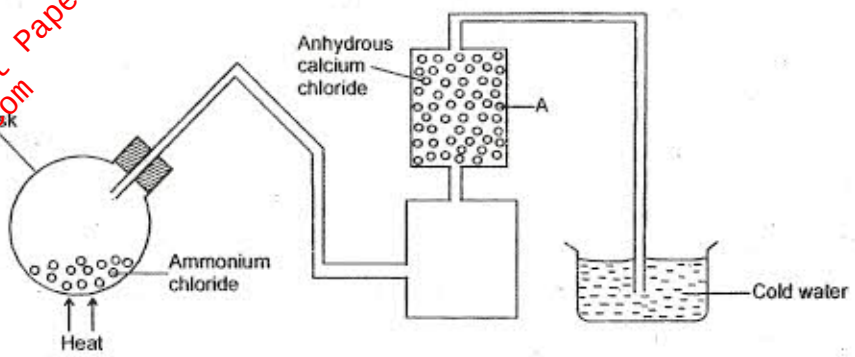
_____

(h) Explain how a solid mixture of the sulphate of D and lead (II) sulphate can be separated. (3 marks)

_____

_____

2. Florence, a form 3E student was asked to show her classmates how to prepare a solution of ammonia gas in water and she set up the apparatus below.



(a) (i) State three mistakes which she made in her experiment. (3 marks)

_____

_____

_____

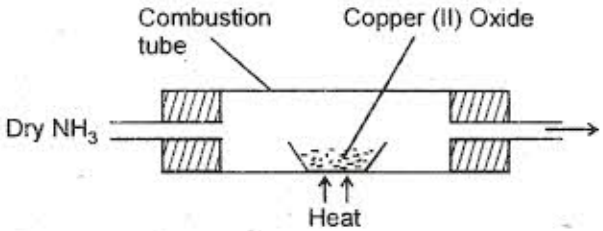
(ii) Name part A (1 mark)

_____

(iii) Write equation for the reaction taking place in the flask. (1 mark)

_____

(b) Dry ammonia was passed through hot copper (II) oxide as shown in the diagram.



(i) What observation would be made in the combustion tube? (1 mark)

_____

(ii) Write an equation to show the reaction that produced the observation made in b (i).

_____

(1 mark)

(c) Ammonia gas can be reacted with a certain reagent to produce ammonia sulphate which is a fertilizer.

(i) Write an equation to show how the fertilizer would be formed. (1 mark)

_____

(ii) Calculate the percentage by mass of nitrogen in the fertilizer. (3 marks)

_____

_____

_____

(d) State and explain the observation made when ammonia solution is added to copper ions till in excess. (2 marks)

3. (a) In the space below, draw a diagram showing how molar heat of combustion of methane gas can be determined. (3 marks)

(b) Write an equation showing how methane burns in air. (1 mark)

(c) A form four student performed the above experiment and obtained the following results.

Mass of water	=	100g
Initial temperature of water	=	20.7°C
Final temperature of water	=	51.1°C
Initial mass of burner	=	27.26g
Final mass of burner	=	26.92g
Specific heat capacity of water	=	4.2kJ/kg/k

(i) What is the mass of methane burnt? (1 mark)

(ii) What is the temperature rise? (1 mark)

(iii) Calculate the molar heat of combustion of methane. (4 marks)

(iv) Sketch an energy level diagram for the heat of combustion of methane and show the energy change. (2 marks)

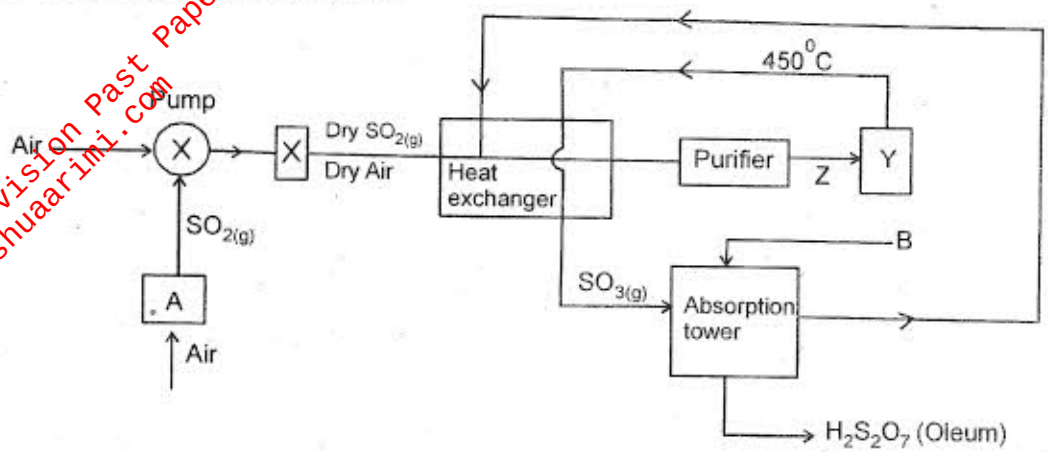
(v) The table below shows the heat of combustion of some alkanes.

Alkane	ΔH(KJ MO1^{-1})
C_2H_6	-1560
C_3H_8	-2220
C_4H_{10}	-2880
C_5H_{12}	____
C_6H_{14}	-4200

(a) Predict the ΔH value for C_5H_{12}. (1 mark)

(b) Explain the trend (1 mark)

4. The flow chart below shows how sulphuric acid is manufactured by the contact process. Study it and answer the questions that follow.



(a) Name two raw materials in A. (2 marks)

(b) What reagent is used in X? (1 mark)

(c) What impurities are removed in the purifier and why is it necessary to filter? (2 marks)

(d) Write the equation for the reaction that takes place in chambers.

(i) Y (1 mark)

(ii) Absorption tower (1 mark)

(e) Describe what happens in the heat exchanger. (1 mark)

(f) State the identity of B (1 mark)

(g) (i) Explain why $S0_3(g)$ is absorbed in substance B before dilution and not dissolved directly in water. (1 mark)

(ii) Name a suitable catalyst for this reaction. (1 mark)

(h) State and explain the observation made when concentrated sulphuric acid is added to:

(i) Blue copper (II) sulphate. (2 marks)

(ii) Sucrose (2 marks)

(i) Explain why concentrated sulphuric acid is used as both a drying agent and a dehydrating agent. (1 mark)

(j) Explain how sulphuric acid is obtained after Oleum. (2 marks)

5. The table below gives information about the first five members of the homologous series of carboxylic acids.

Name of acid	Formula	Relative molecular mass	Melting point (^{0}C)	Boiling point (^{0}C)
Methanoic acid	HCO_2H	46	8.4	101
Ethanoic acid	$CH_3 C0_2H$	60	17	118
Propanoic acid	$C_2H_5CO_2H$	74	-22	141
Butanoic acid	$C_3H_7CO_2H$	88	-8	164
Pentanoic acid				

(a) (i) Predict the formula and the relative molecular mass for pentanoic acid.

(ii) Explain why its easier to predict the B.P. of pentanoic acid then the M.P. (2 marks)

(b) Draw the displayed formula for propanoic acid. (1 mark)

(c) Analysis of an organic acid isolated from red ants shows that it contains 0.060g of carbon, 0.010g of hydrogen and 0.16g of oxygen. Calculate the empirical formula for this acid. (3 marks)

(d) Ethanoic acid reacts with magnesium oxide.
Name the products formed and write a balanced equation for the reaction. (2 marks)

(e) (i) Describe how ethanoic acid can be converted to ethyl ethanoate. (3 marks)

(ii) What name is given to the above reaction, e(i)? (1 mark)

(iii) State the conditions necessary for the reaction in e(i) above. (2 marks)

6. Study the standard electrode potential for the elements given below and answer the questions that follow. The letters do not represent the actual symbols of the element:

$Q_{2(g)} + 2e^- \rightleftharpoons 2Q^-_{(aq)}$	+ 2.87
$R_{2(g)} + 2e^- \rightleftharpoons 2R^-_{(aq)}$	+ 1.36
$S^{2+}_{(aq)} + 2e^- \rightleftharpoons S_{(s)}$	+ 1.23
$2T^+_{(aq)} + 2e \rightleftharpoons T_{2(g)}$	0.00
$U^{2+}_{(aq)} + 2e^- \rightleftharpoons U_{(s)}$	- 0.13
$V^{2+}_{(aq)} + 2e^- \rightleftharpoons V_{(s)}$	- 0.76

(i) What is the Eθ value of the weakest reducing agents? (1 mark)

(ii) Which element is likely to be hydrogen? Give a reason for your answer.

(iii) Draw a diagram for the cell that would be obtained when the half cell of the elements S and V are combined. (2 marks)

(iv) Calculate the e.m.f. of the electrochemical cell in a (iii) above. (1 mark)