SECTIONA: Attempt all questions (70 marks)

Q1. Identify the following statement by <u>true</u> or <u>false / 10 marks</u>

- a) 2,2-dimethylbutane is an isomer of hexane
- **b)** 1-bromo-2-chloroethylene exhibits three geometrical isomers
- c) All amino acids exist in nature in a chiral form
- **d)** Ethanol and dimethyl ether are isomers
- e) CH₃-NH₂ is a stronger base than ClCH₂-NH₂.
- f) Chloroethanoic acid $CH_2CICOOH$ is a stronger acid than ethanoic acid.
- **g)** 2 -buytne reacts with copper I chloride in the presence of ammonia to give a red precipitate
- **h)** Methanoic acid turns acidified potassium dichromate from orange to green.
- i) Ethanol reacts with sodium carbonate to a colourless gas.
- **j)** 2-methylpropan-2-ol is not oxidized by acidified potassium permanganate....

Q2. Complete with appropriate words (5marks)

- **a)** are isomers that rotate differently in the plane of polarized light.
- **b)**are types of isomers mainly found in alkenes due to the restricted rotation around the carbon-carbon double bond.
- c) is the simplest member of organic compounds
- **d)**is the simplest formula which expresses the ratio of number of atoms of elements present in a molecule.
- e) is a reaction in which two or more compounds or molecules combine to form one compound.

Q3. Choose the best answer (5marks)

a) Which of the following bond is made up of a large number of organic compounds?

- a) Metallic bond
- b) Dipolar bond
- c) Ionic bond
- d) Covalent bond
- **b)** An alkene K (C_6H_{12}) reacts with HBr to give compound L. L was heated with NaOH to give a compound M. M is oxidised to N($C_6H_{12}O$). N reacts with Tollen's reagent to give silver mirror. Given that N forms optical

isomers. Identify N. a. 2-methylpentanal b. 3-methylpentan-2-one. c. 3-methylpentanal d. hexanal

- c) 3-bromo-3-methylhexane reacts with sodium hydroxide in the presence of ethanol and heat to give different products. Which product cannot be formed a. 4-methylhex-3-ene b. 3-methylhex-2-ene c. 2-ethylpent-1-ene d. 4-methylhex-2-ene
- d) Compound X, C₄H₈O₂, has an unbranched carbon chain. An aqueous solution of X has an approximate pH of 3. Compound Y, C₃H₈O, is a secondary alcohol. X and Y are reacted together in the presence of a little concentrated sulphuric acid to form Z as the major organic product. What is the structural formula of **Z**?

A (CH₃)2CHCO2CH₂CH₂CH₃; B CH₃(CH₂)2CO2CH(CH₃)2; C CH3(CH₂)2CO2(CH₂)2CH₃

D (CH₃)2CHCO2CH(CH₃)2

e) An unknown organic compound reacts with sodium to give a combustible gas as one product but does not give a yellow precipitate with alkaline aqueous iodine. What is a possible identity of the unknown organic compound?

A) Propanal;; B) propan-2-ol C) Propan-1-ol; D) propanone

Q4. Most of air pollutants in our environment include the so-called CFCs.

a) Write CFCs abbreviation in full words. (1 marks)

b) Suggest one use of CFCs. (1 marks)

c) Describe the environmental effects caused by CFCs and suggest the ways these effects can be avoided. (2 marks)

d) (i)Write the chemical formula for ozone molecule. (1 marks)

(ii) State one beneficial presence of the ozone layer. (2 marks)

Q5. methane CH_4 reacts with Cl_2 in the presence of sunlight to form a mixture of products including CH_3Cl which is formed as shown in an equation below:

$CH_4 + Cl_2 \rightarrow CH_3Cl + HCl.$

Write the equations for the following stages in the mechanism of reaction

a) Equation for the initiation stage. (1 marks)

b) Equations for the propagation stage. (2 marks)

c) Equations for the termination stage. (3 marks)

d) Explain why some traces of chloroethane can be found in this reaction. (**2markss**)

Q6. Given alanine amino acid. CH3CHNH₂COOH

a. i. Give the structure of the dipeptide of alanine. (1marks)

ii. Give the name of a natural polymer with the same linkage group as the above structure. (**1marks**)

b. Explain why alanine shows optical isomerism and show its optical isomers.

c. i. Define the term zwitterion and give the zwitterion of alanine. (2marks)

ii. Give the structural formulae for the zwitterion of alanine in basic and acid conditions. (**2marks**)

d. Explain how alanine may behave as a buffer. (1marks)

Q7. (a) Write 3 structural formula of alcohol isomers of C5H₁₁OH. (3 marks) (b) Identify the structural formula of C5H₁₁OH isomer that presents optical stereoisomerism. (1 mark)

(c) Identify the structural formula of $C_5H_{11}OH$ isomer that reacts with ZnCl₂ in HCl acid (Lucas test) to produce turbidity in less than 20 seconds. (1 mark) (d) Identify the structural formula of $C_5H_{11}OH$ isomer that reacts with $K_2Cr_2O_7$ in H_2SO_4 solution to produce an aldehyde. (1 mark)

Q8. The scheme below shows several reactions starting with propanol. Study the scheme and answer the questions which follow.



CH₃CH₂COOCH₂CH₃

- a) Name the gas R.
- b) State the type of reaction producing Q.
- c) Name and draw the structural formula of compound Q. (2 marks)
- d) Sate the observation made for the reaction producing CH₂Br-CH₂Br CH₃ (1 marks)
- e) What conditions and reagents are necessary to convert S to CH₃CH₂COOCH₂CH₃.

(1marks)

f) Write an equation for the reaction that takes place during the formation of propane.
(2 marks)

Q9. Alkane **C** has a relative molecular mass of **170** and occurs in the kerosene fraction obtained by the fractional distillation of petroleum.

- (a) Write the general formula for the homologous series of alkanes. (**1marks**)
- (b) Deduce the molecular formula of alkane C. (C=12, H=1) (2marks)

(1 mark)

(1 mark)

(c) Give one use of kerosene fraction.

(**1marks)**

- (d) Give one fraction which is obtained higher up the fractionating column than kerosene and explain why it is obtained higher up. (**1marks**)
- (e) What is the difference between leaded petrol and unleaded petrol?Which one can you prefer to use and why. (2marks)

Q10. The diagram below shows the variation of vapor pressure with temperature for a pure substance.



- a) On the diagram, indicate the different phases of the substance (**3marks**)
- b) State what is observed at point O. (1 marks)
- c) High pressure was applied at constant temperature to a phase at Q. Describe the change that takes place. (1.5 marks)
- d) The temperature of the phase at point R was increased at constant pressure. State what was observed. **(1.5 marks)**

SECTION B: Attempt any three (3) questions only. (30 marks)

Q1	1. The	e table	below	gives i	information	n about t	he major	constituents	of	crude
oil.	Study	y it an	d answ	er the	questions	that follo	ow.			

Constituent	Boiling point			
	(OC)			
Gases	Below 40			
Petrol	40-175			
Kerosene	175-250			
Diesel oil	250-350			
Lubricating oil	350-400			
Bitumen.	Above 400			

a) Which one of the constituents of crude oil has molecules with the lowest number of carbon atoms?

(1 mark)

- b) Name the process you would use to separate a mixture of petrol and diesel and explain how the separation takes place. **(2marks)**
- c) Name one gas produced by complete combustion of Kerosene and its effect on the environment. **(3 marks)**
- d) What condition could cause a poisonous gas to be formed when Kerosene is burnt? Name the poisonous gas and its effect. (3 marks)
- e) Give one use of bitumen (1marks)

Q12. a. An alkene **A** (C_6H_{12}) gave two compounds **B** and **C** with molecular formular (C_3H_6O) on ozonolysis. Warming compounds **B** and **C** with fehlings solution B gives a red precipitate but **C** shows no reaction. Identify the structures of **A**, **B** and **C**. (**3marks**)

b. Compound **P** is an iodoalkane. Warming **P** with an alkali forms **Q**, which is oxidized to **R** by acidified potassium dichromate (VI). **R** does not react with fehling solutions but reacts with Brady's reagent. Boiling **P** with alcoholic potassium hydroxide gives **S**. Ozonolysis of **S** followed by hydrolysis gives **T** (HCHO) and **U** (C_3H_6O).

By using equations identify the structures and names of P, Q, R, S, T, U. (**7marks**)

Q13. The two compounds **V** and **W** are isomers with the molecular formula C_4H_8O , and show the following properties and reactions:

Both compounds react with sodium metal, and both decolorise bromine water. Compound **V** forms a yellow precipitate with alkaline aqueous iodine, whereas compound **W** does not. When reacted with cold **KMnO**₄(aq), both **V** and **W** produce the same neutral compound X, $C_4H_{10}O_3$. Both V and W exist as pairs of stereoisomers.

(a) Suggest which functional groups are responsible for the reactions with:

- (i) Sodium (1 marks)
- (ii) Bromine water (1 marks)
- (iii) Alkaline aqueous iodine. (1 marks)
- (b) Suggest the structures for V and W. (2marks)

(c) State the type of stereoisomerism shown by the compound V and draw the structures of the stereoisomers. (2marks)

(d) i. Suggest the structure of the neutral compound X (2 marks)

ii. Give the name of the product above. (1mark)

Q14. Consider the following reaction schme.



a. Give the name of the functional groups in A, B, C, D and E.(2.5marks)

b. Give the reagents that converts (**2marks**)

i. B to C ii. B to E iii. C to D

C. Write the equations to the hydrolyisis of C (**0.5mark**)

d. Carry out chemical tests for the fuctional groups in A, B, and E, giving an observation in each case. (**4.5marks**)

Q15. a. i. What name is given to the process of manufacture of soap? (1mark) ii. Give the raw materials used in the manufacture of soap. (1mark) iii. Write an equation leading to the formation of soap. (2marks) iv. Give other substances used in the manufacture of toilet soap. (1mark) v. Give one use of the residue left after manufacture of soap. (1mark) b. Explain why soap does not work effectively in hard water (2mark) c) In terms of advantages and disadvantages; give two (2) differences between soap and detergents. (2 marks)