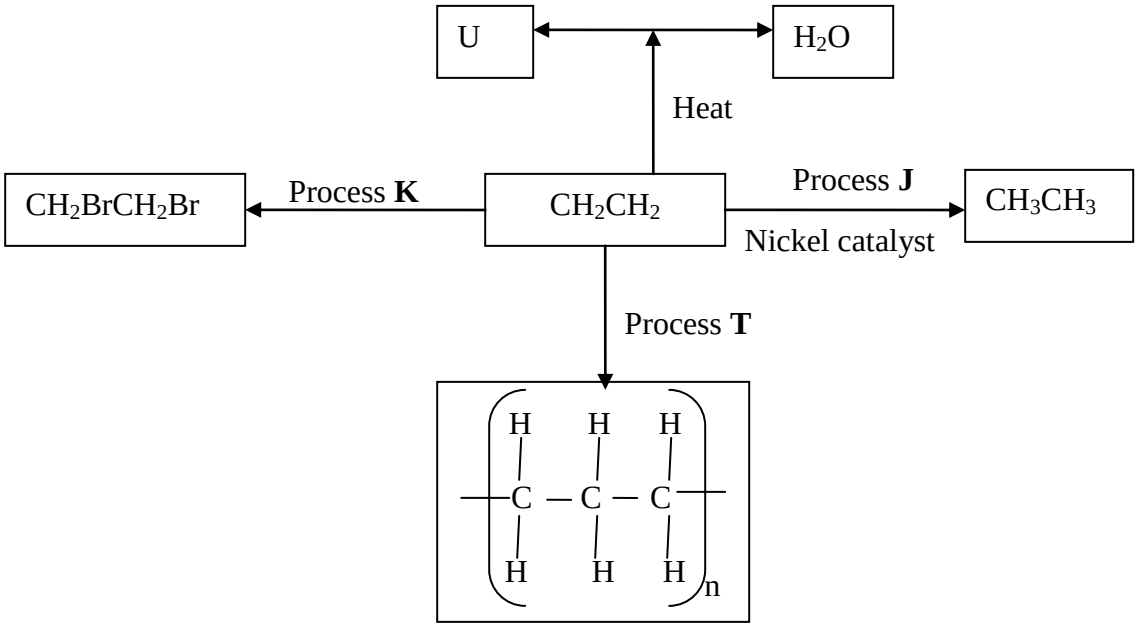
Organic chemistry 1

1. Use the flow chart below to answer the questions that follow:



(a) What observation would be made in process **K**?
(b) Name another conditions necessary for process **J** to take place
(c) Give the name of substance **V**

2. But-z-ene undergoes hydrogenation according to the equation given below

$$CH_3CH = CHCH_{3\ (g)} + H_{2(g)} \longrightarrow CH_3CH_2CH_2CH_{3(g)}$$

(a) Name the product formed when but-z-ene reacts with hydrogen gas
(b) State **one** industrial use of hydrogenation

3. Write the structures of the following compounds:-
(a) But—2-yne
(b) 2,2-dimethylpropane

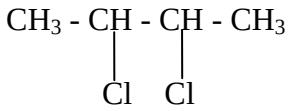
4. a)What is meant by Isomerism?
b) Draw and name **two** Isomers of butane.

5. Study the information in the table below and answer the questions that follow:

Ion	No. of protons	No. of electrons
P^{3-}	7	10
Q^{+}	19	18
R^{2+}	12	10

a) Write the electron arrangement of element P.
b) Give the group and period to which elements Q and R respectively.
Q ……
R ……

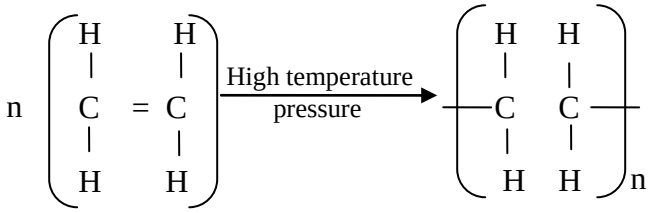
6. Compound W reacted with chlorine to form compound **X** only. The structural formula of **X** is shown below:



(a) Give the structural formula and name of compound **W**

(b) Name compound **X** ……

7. In petrol chemical industries, long chain alkanes are broken down in to simpler substances in a process called cracking
   a) Why is cracking necessary?
   b) State the **two** conditions required in cracking
   c) Draw the structure of 1-chloro-2, 2-dimethylpropane
8. In a reaction an alcohol **K** was converted to hex-1-ene
   a) Name reagent and condition necessary for the reaction in **6 (a)** above to occur
9. (a) Give the IUPAC systematic names of compounds **Q** and **R**
   Q: $CH_2CHClCHlCH_2CH_3$
   R: $CH_3CHClCH_2ClCH_3$
   (b) The organic compounds **Q** and **R** in **(b)** above, are formed when one mole of hydrocarbon **N** reacts with two moles of hydrogen chloride gas;
   (i) Structural formula of **N**
   (ii) The IUPAC systematic name of **N**
10. Distinguish between the isotopes and isomers
11. Polymerisation of ethene takes place as shown in the equation below

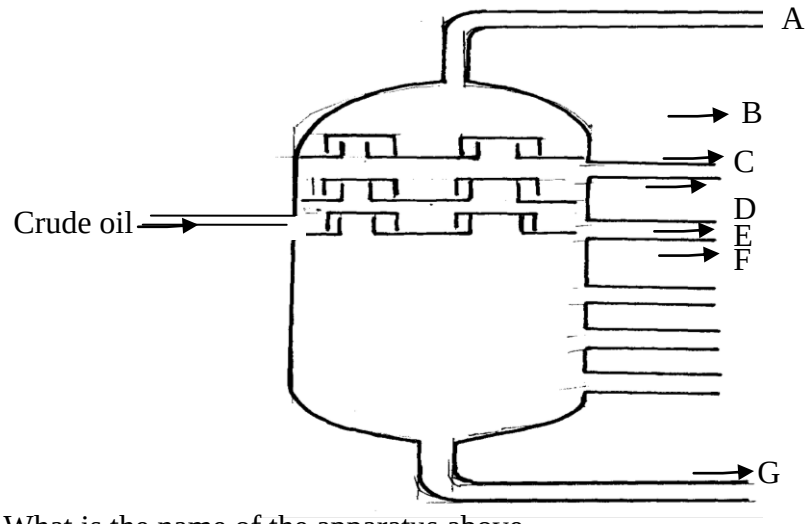


Name the type of polymerisation undergone by ethene in the reaction above

12. (a) State Gay Lussac's law
13. $10cm^3$ of methane (CH_4) gas is exploded with $150cm^3$ of air containing 20% oxygen and 80% nitrogen. The products were allowed to cool to room temperature. What will be the total volume of the gases at the end of the reaction?

14. Give the open structures of:-
    (i) 3-chlorohex-l-yne
    (ii) CH_3OH
15. A fixed mass of gas occupies $105cm^3$ at -14ºC and 650mmHg pressure. At what temperature in degrees Celsius will it have a volume of $15cm^3$ if the pressure is adjusted to 690mmHg pressure?
16. Write an equation for the reaction that takes place between ethene and concentrated Sulphuric (VI) acid

17. Petroleum (crude oil) is a mixture of several compounds which are separated in a Changamwe refinery by means of apparatus as shown below:



(a) (i) What is the name of the apparatus above

(ii) What is the name of the process which is used in separation of crude oil

(iii) What physical property of compounds in the mixture does the separation depend

(iv) Use the letter **A** to **G** to describe where the following could be formed:.

I. The fraction that represents gases

II. The fraction that represents the largest molecules

III. The fraction that represents liquids with the lowest boiling points

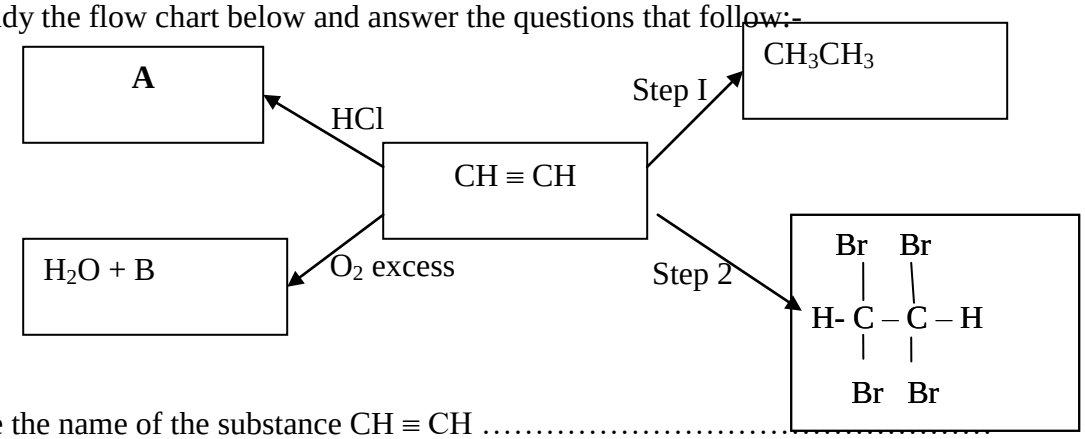
(b) State the use of product produce at

G……

C…….

(c) Draw apparatus for the separation of the product produce at **D** and water

18. Study the flow chart below and answer the questions that follow:-



(i) Give the name of the substance CH ≡ CH ……

(ii) To which group of hydrocarbons does the substance in (i) above belong?

(iii) Give **two** reagents that can be used to prepare the substance named in (i) above

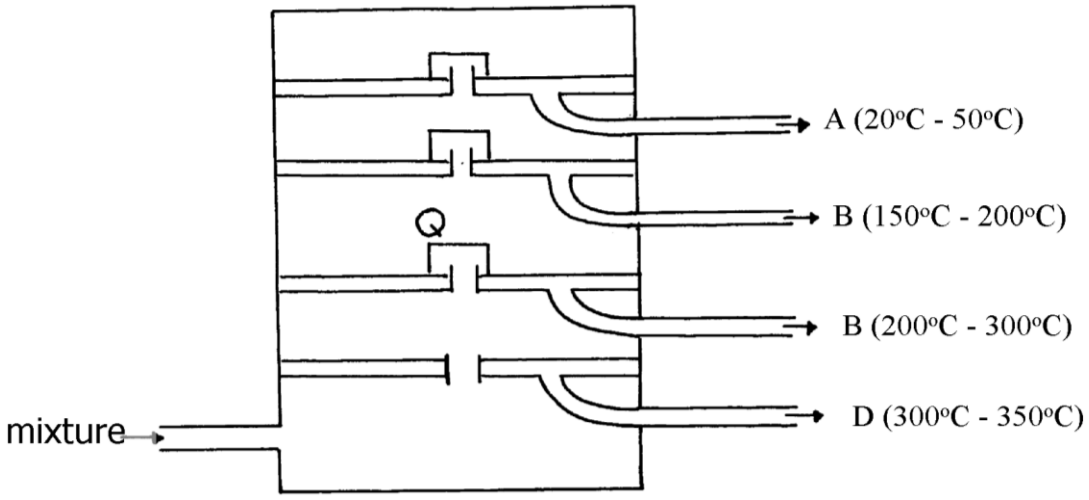
(iv) State **two** physical properties of the substances in (i) above

(v) Give the names to the process in step I and 2

(vi) Write an equation to show how substance **A** is formed

(iv) Identify substance **B** ……

19. The diagram below represents a large-scale fractional distillation plant used to separate the components **A, B, C** and **D** in a mixture



(a) The components have the following average relative molecular masses not necessarily in that order; 282, 184, 44 and 128.

(a) (i) What is the physical state of **B** at the position marked **Q**?

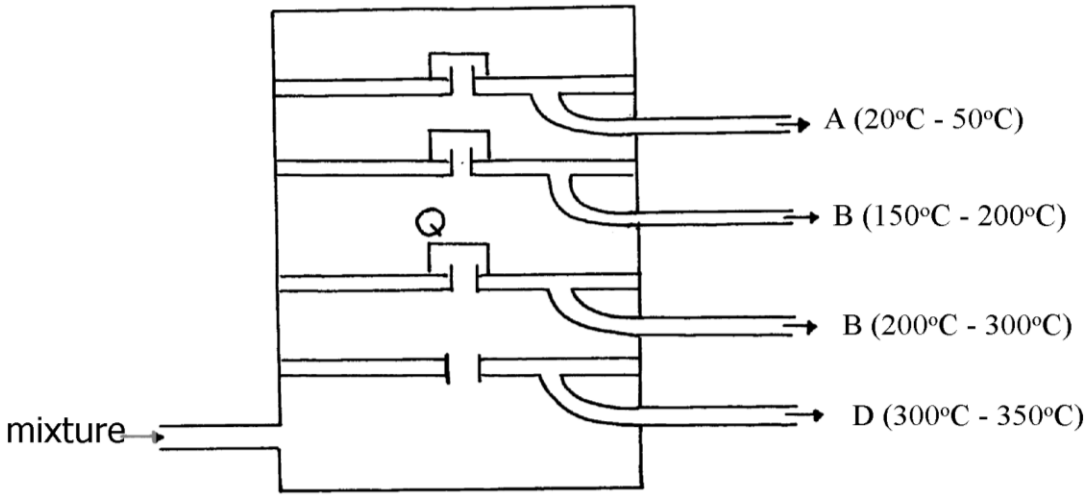
(ii) Which component has an average relative molecular mass of 128? Explain

(iii) State with a reason whether **C** is pure or impure

(iv) Explain how the mixture is separated into its components

(v) Name **two** naturally occurring mixtures that are separated using this process

20. The diagram below represents a large-scale fractional distillation plant used to separate the components **A, B, C** and **D** in a mixture



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(a) (i) What is the physical state of **B** at the position marked **Q**?

(ii) Which component has an average relative molecular mass of 128? Explain

(iii) State with a reason whether **C** is pure or impure

(iv) Explain how the mixture is separated into its components

(v) Name **two** naturally occurring mixtures that are separated using this process

21. a) The table below gives information about the major constituents of crude oil. Study it and answer the questions that follow:

Constituent	**Boiling point ^{o}C**
Gases	Below 40
Petrol	40-175
Kerosene	175-250
Diesel	250-350
Lubricating oil	350-400

Bitumen	Above 400

i) Which of the constituents of crude has molecules with the highest number of carbon atoms? Explain

ii) Name the process you would use to separate a mixture of petrol and diesel and explain how the separation takes place

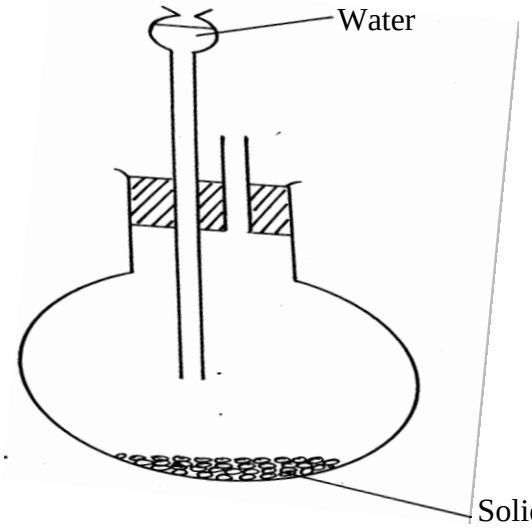
iii) Explain why the constituents of crude oil do not have a sharp boiling point

iv) Name the gas that is likely to be a constituent of crude oil and write its formula

b) i) What condition could cause a poisonous gas to be formed when kerosene is burnt. Explain

ii) Give **one** use of bitumen

22. (a) The set-up below was used to prepare ethyne gas



(i) Identify solid **E**

(ii) Complete the diagram to show how the gas can be collected

(iii) Write an equation to show how the gas is formed

(iv) Complete the equation below:)

$C_2H_2 + 2I_2 \longrightarrow$

(v) What is the role of sand in the experiment?

(b) (i) Explain the meaning of esterification

(ii) Complete the equation below :

$CH_3COOCH_3 + H_2O$

(iii) What type of reaction is occurring above

(c) Given the reaction:

$C_8H_{18} \xrightarrow{\text{Solid } \mathbf{F}} N + C_2H_4$

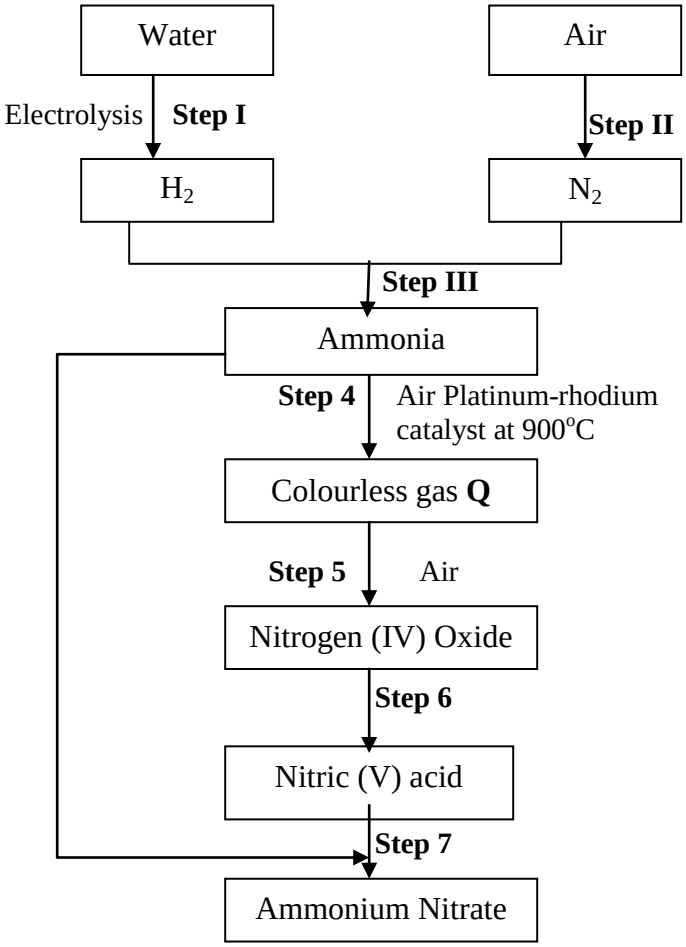
(i) Identify substance:

F…… **N**……

(ii) Name the process represented above?

(d) Give **one** use of substance **N**

23.



(i) Name another source of hydrogen apart from electrolysis of water

(ii) What conditions are necessary for **step III** to occur?

(iii) Write the equation for the formation of colourless gas **Q**

(iv) Give **one** use of nitric (V) acid

(b) State and explain the observations that would be made if a sample of copper metal is heated with concentrated nitric (V) acid

24. (a) Give the systematic names of the following compounds:-

(i) $CH_2 = C(Br) - CH_3$ .....

(ii) $CH_3CH_2CH_2C \equiv CH$ .....

(b) State the observations made when buton-l-ol reacts with:-

(i) Acidified potassium dichromate (VI) solution

(ii) Potassium metal

(c) Ethanol obtained from glucose can be converted to ethene as shown below:-

$$C_6H_{12}O_6 \xrightarrow{\textbf{Step I}} C_2H_5OH \xrightarrow{\textbf{Step II}} C\,H_2 = CH_2$$

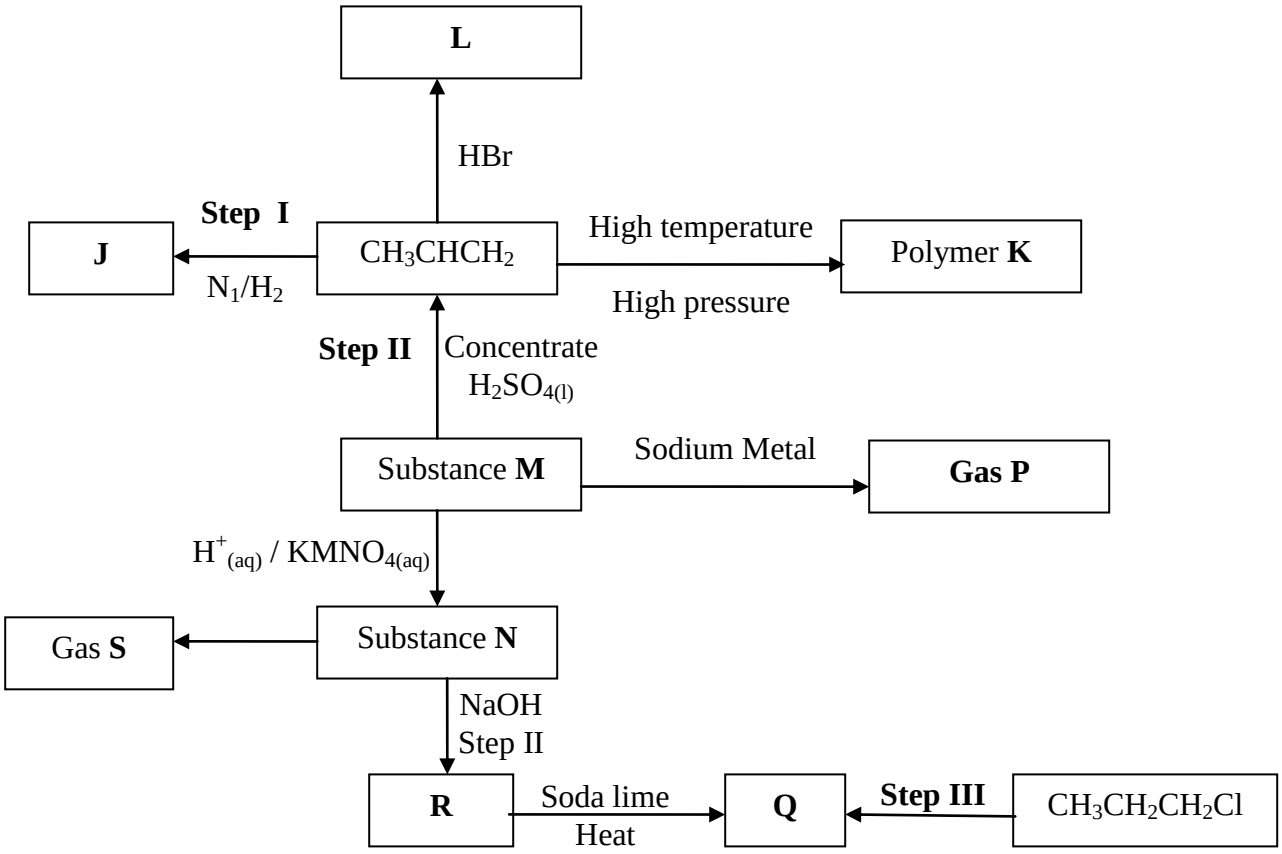
Name and describe the processes that take place in steps **I** and **II**

(d) Compounds **A** and **B** have the same molecular formula $C_3H_6O_2$. Compound **A** librates Carbon (IV) Oxide on addition of aqueous sodium carbonate while compound **B** does not. Compound **B** has a sweet smell. Draw the possible structures of:-

(e) Give **two** ways how the disposal of polymers such as polychloroethene by burning pollutes the environment

25. (a) Name the following compounds $(CH_3)_3\,C\,CH_2\,CH_2\,CH_3$

Use the flow chart below to answer the questions that follow:-



(b) (i) Name the following :-

I. Gas **S** ……..…… ( )

II. Gas **P** ……

III. **J** …….

(ii) Name the processes involved in the following steps:

I. Step I ……..

II. Step II …….

III. Step III …….

(iii) Write a chemical equation for the complete combustion of substance **M**

(iv) Name the condition and reagent in step III

Condition ……

Reagent …….

(v) Calculate the mass of salt **R** that would be formed by using 21.9 tonnes of **N** when it reacts with excess sodium hydroxide (C= 12.0 H= 1.0 Na = 23)

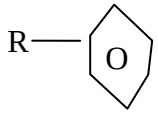
(vi) Draw the structure of polymer **K**

II. State **one** use of the above polymer

…….

(c) (i) Name the class to which the following cleansing agents belong:-

i) $R - COONa^+$ ……

(ii)  – O-SO_3 Na ……

II. Which cleaning agent above is not environmental friendly? Explain

26. The molecular formula of a hydrocarbon is C_6H_{14}. The hydrocarbon can be converted into two other hydrocarbon as shown by the equation below:

$C_6H_{14} \longrightarrow C_2H_6 + \mathbf{X}$

(i) Name and draw the possible structural formula of **X**

(ii) State and explain the observations that would be made if a few drops of bromine water were added to a sample of **X**

(iii) Write an equation for the complete combustion of C_3H_8

27. (a) Give the names of the following

(i) $CH_3CH_2CH_3$

(ii) CH_3CCCH_3

(b) Ethene is used in making polyethene bag in a process called polymerization

(i) Name the type of polymer that is formed when ethane polymerise

(ii) Describe a simple chemical test that can be used to identify ethane gas in the laboratory

(c) Study the information in the table below and answer the questions that follow:-

No. of carbon atoms	R.M.M of the Hydrocarbon
2	28
3	42
4	56

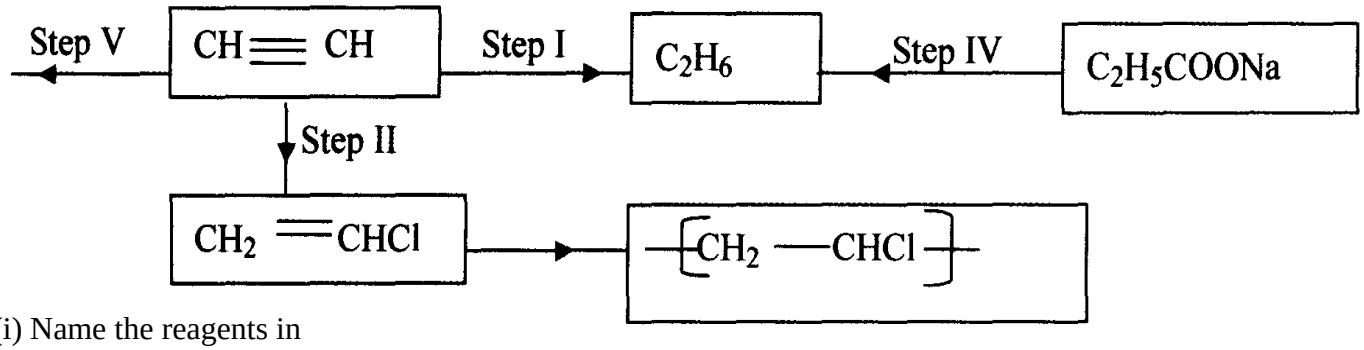
i. Write the general formula of the hydrocarbons in the table above

ii. Determine the molecular of a hydrocarbon with 5 carbon atoms and draw its structural formula

Molecular formula

Structural formula

(d) Study the scheme below and answer the questions that follow



(i) Name the reagents in

Step I ……

Step II ……

Step IV ……

(ii) Write an equation for the complete combustion of CH ≡CH

(iii) Give **two** uses of CH_4

28. Give the systematic names of the following compounds;

i) $CH_3 = C(CH_3)-CH_3$

ii) $CH_3CH_2CH_2C\equiv CH$

29. Study the data given in the following table and answer the questions that follow. The letters are not the actual symbols of elements.

Element	Number of protons	Melting point	Bpt ^oC
A	11	98	890
B	12	650	1110

C	13	60	2470
D	14	1410	2360
E	15	442 590	280
F	16	113 119	445
G	17	-101	-35
H	18	-189	-186

(i) State and explain the trend in melting point in **A B C**
(ii) Explain why the melting point and boiling points of element **D** is the highest
(iii) Explain why the element represented by letter **E** has two melting point values
(iv) Write down the chemical formula between element **C** and sulphate ions
(v) Name the chemical family in which **H** belong and state one use of the element
(vi) What is the nature of the oxide of the elements represented by letters **C** and **F**?

30. a) The table below gives information about the major constituents of crude oil. Study it and answer the questions that follow:

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i) Which of the constituents of crude has molecules with the highest number of carbon atoms? Explain
ii) Name the process you would use to separate a mixture of petrol and diesel and explain how the separation takes place
iii) Explain why the constituents of crude oil do not have a sharp boiling point
iv) Name the gas that is likely to be a constituent of crude oil and write its formula
b) i) What condition could cause a poisonous gas to be formed when kerosene is burnt. Explain
ii) Give **one** use of bitumen

31. Study the information in the table below and answer the questions that follow

Number of carbon atoms per molecule	**Relative molecular mass of the hydrocarbon**
2	28
3	42
4	56

i) Write the general formula of the hydrocarbons in the table
ii) Predict the relative atomic mass of the hydrocarbons with 5 carbon atoms
iii) Determine the relative atomic mass of the hydrocarbon in **(ii)** above and draw its structural formula (H=1.0, C=12.0)

32. Substance "**M**" with a general formula C_2Hy burnt in chlorine gas with a red flame producing a cloud of black specks and colourless gas **G**.
(a) State the collective name for compounds which **'M'** belongs
(b) With reason, state the identity of the black specks and colour gas "**G".**

33. 2.63g of a solution of sodium chloride at 20.0^{o}C was reacted with silver nitrate. After filtration, washing and drying, 2.36g of silver chloride was obtained. Determine the solubility of sodium chloride at 20.0^{o}C . (Na=23, Cl= 35.5, Ag = 108)
(b) Determine the number of moles of carbon (IV) Oxide gas produced when sodium

carbonate reacted with dilute sulphuric (VI) acid (Molar gas volume =24dm^3)

34. Write down all the isomers of but-z-ene and give their IUPAC names

35. (a) A hydrocarbon compound **Z** decolourizes bromine liquid in the presence of light but does not decolourize acidified potassium manganate (VII). Name and draw the structural formula of the eighth member of this homologous series

36. (a) What is meant by **isomerism**?
(b) Draw and name **two** isomers of Butyne