

Organic chemistry 1

1.
 - a) *Bromine decolorized immediately in ethane gas* ✓1
 - b) *Temperature between 150°C - 250°C or temperature of 180°C*
 - c) *Carbon (IV) oxide or CO_{2(g)}* ✓

2.
 - (a) *Butane*
 - (b) *Manufactures of cooking fats and margarine*

3. (a)

(b)

P 1

4. a) Existence of cpds with the same molecular formula but different structural formula/arrangement of atoms

b)

<i>n</i> – butane/ $P^{1/2}$	2 – butane/ $P^{1/2}$	
<i>l</i> – butane/ But-1-ene	But-2-ene	2 - methyl prop-1-ene

5. a) 2.5

b) Q Group 1 $P^{1/2}$, Period 4 $P^{1/2}$
R Group 2 $P^{1/2}$, Period 3 $P^{1/2}$

6. a)

$$\begin{array}{ccccccc} & & H & & H & & H & & H \\ & & | & & | & & | & & | \\ W- & H & C - & C = & C & & C - & H \\ & & | & & & & | & & \\ & & H & & & & H & & \end{array}$$

7. a) To produce simpler hydrocarbons of industrial importance e.g. ethane which is widely used

b) Elevated temperature / high temperature 900 C

Catalyst

c) HC - C CH₃

8. a) Reagent concentrated sulphuric acid

Condition temperature 180° C

9. a) H₂ CHCL CHCLCH₂CH₃

Name: 2, 3 dichloropentane

b) i) Structural Formula

$$\begin{array}{ccc} H & & H & & H \\ | & & | & & | \\ H - C = C - C = C - C - H \end{array}$$

H - C = C - C = C - C - H

$$\begin{array}{ccc} H & & H & & H \\ | & & | & & | \\ H - C = C - C = C - C - H \end{array}$$

ii) IUPAC name

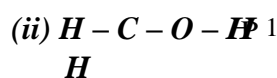
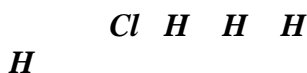
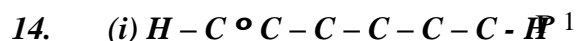
pent - 1,3 - diene

10. *Isotopes are atoms of the same element with same atomic number but different mass numbers while isomers are compounds with the same molecular formula but different structural formula*
11. *Addition polymerization. ✓¹*
12. *(a) When gases combine they do so in volume which bear a simple ratio to one another and to the product if gaseous under standard temperature and pressure*
13. $CH_4 + 2O_{2(g)} \rightarrow CO_{2(g)} + 2H_2O_{(l)}$

$$\begin{aligned} \text{Volume of } O_2 &= \frac{10\text{cm}^3 \times 20\text{cm}^3}{100} \times 150 \\ &= 30\text{cm}^3 \end{aligned}$$

$$\begin{aligned} \text{Remaining volume of } O_2 &= 30 - 20 = 10\text{cm}^3 \\ \text{Total volume of the gases} &= 20 + 10 + 10 \\ &= 40\text{cm}^3 \end{aligned}$$

H H H H



15.

$$\begin{aligned} T_2 &= \frac{690 \times 15 \times 259}{650 \times 105} \\ &= 39.3\text{K} \\ &= -233.7^\circ \text{C} \end{aligned}$$



- 17 (a) i) Fractional Column.
 ii) fractional distillation.
 iii) different boiling points.

IV I A II F III B

- b) G – road making or water proofing
 C jet fuel or cooking and lighting.

18. (i) ethyne
 (ii) Alkynes – because it has triple bond between the two carbon atoms
 (iii) Water is calcium carbide
 (iv) - Colourless, odourless
 -less denser than air
 - Insoluble in water but soluble in organic solvents
 (v) Hydrogenation
 (vi) Halogenations

(vii)

(viii) Carbon^P(IV) Oxide

(ix) Nitrogen I Oxide (N_2O)

19. (a) (i) Gas /vapour

(ii) B - It has the second lowest boiling^P point thus second lowest molecular mass

(iii) C is impure since it boils over^P a range of temperature

P 1

P 1

- (iv) It is boiled heated and the vapour of the components condense at different temperatures
 (v) - Liquid air
 - Crude oil
20. (a) (i) Gas /vapour
 (ii) B - It has the second lowest boiling point thus second lowest molecular mass
 (iii) C is impure since it boils over a range of temperature
 (iv) It is boiled heated and the vapour of the components condense at different temperatures
 (v) - Liquid air
 - Crude oil
21. a) i) Bitumen it has the highest boiling point
 ii) Fractional distillation; during distillation petrol would distill off at 175C, while diesel will distill at 350C
 iii) Each component is a mixture of hydrocarbons which have different boiling points
 iv) Methane, CH_4 , Ethane C_2H_6 propane, C_3H_8 , Butane C_4H_{10}
- b) i) Burning in limited amount of air will produce carbon monoxide (carbon (II) Oxide) which is poisonous
 ii) Manufacture of Tar used in road tarmacking sealing of leakages on roofs
22. A. (i) Calcium carbide – CaC_2
 (ii) Over water method
 (iii) $CaC_{2(s)} + 2H_2O_{(s)} + 2H_2O_{(l)} \quad Ca(OH)_{2(aq)} + C_2H_{2(g)}$
 (iv) $C_2H_2 + 2I_2 \quad C_2H_2I_2$
 (v) The reaction is highly exothermic hence sand helps to absorb excess heat.
- B. (i) A reaction in which an organic acid reacts with an alcohol to form a sweet smelling compound called ester.
 (ii) $CH_3COOCH_3 + H_2O \quad CH_3COOH + CH_3OH$
 (iii) Hydrolysis
- C (i) F – Aluminium oxide – Al_2O_3
 N – C_6H_{14} – Hexane
 (ii) Cracking
- D. A fuel
23. i) Cracking of crude oil fractions. ✓/1
 ii) Temp – 400 – 500°C
 Pressure – 200 – 500 atmospheric
 Any 2 = 1
 Catalyst – Finely divided iron.
 iii) $4NH_3(g) + 5O_2(g) \quad 4NO(g) + 6H_2O(l)$
 iv) - Manufacture of nitrate fertilizers. ✓/1

- *Manufacture of explosives.*
 - *Purification of metals.*
 - b) - *Red browngas $\sqrt{1}$ with pungent irritating smell due to reduction of HNO_3 to NO_2*
 - *Blue $\sqrt{1}$ solution due to formation of $Cu (NO_3)_2$*
24. (a) (i) *2-bromo propene or 2- bromo prop-i-ene*
(ii) *Pent-i-ene*
- (b) (i) *Changes form orange to Green*
(ii) *Effervescence//bubbles of gas produced*

(c) **Step I**

- Fermentation of glucose

Glucose broken down in absence of oxygen using enzymes

- Dehydration of ethanol; using concentrated sulphuric (VI) acid and high temperature of 170°C

Step II

- Dehydration of ethanol; using concentrated sulphuric (VI) acid and high temperature of 170°C

(d) **Compound A**

(e) – release chlorine gas which destroy ozone layer

- Chlorine gas combines with vapour in atmosphere to form acid rain which destroy vegetation

- Chlorine gas can cause respiratory diseases

25. (a) (i) 2,2 – dimethyl pentane

(b) I carbon IV oxide.

II Hydrogen gas.

III Propane.

(ii) I Hydrogenation.

II Neutralization

III substitution

(iii) $\text{CH}_3\text{CH}_2\text{CH}_2\text{OH} + 902 \text{ (g)} \quad 6 \text{ CO}_2 \text{ (g)} + 8 \text{ H}_2\text{O (l)}$

(iv) Condition Presence of U.u light

Reagents – Chlorine gas

(v) $\text{CH}_3\text{CH}_2\text{COOH} + \text{NaOH} \quad \text{CH}_3\text{CH}_2\text{COONa} + \text{H}_2\text{O (c)}$

Mole ratio :

74 tones of acid

96 tones of salt

21.9

$\frac{21.9 \times 96}{74} = 28.4 \text{ tones}$

Or $\frac{21.9}{74} = 0.29 \text{ moles of salt}$

74

$= 0.29 \times 96 = 28.4 \text{ tones}$

(iv) I H CH

C C

H H n

(ii) use in making – Plastic crates plastic boxes plastic ropes

(c) I (i) soap detergent

(ii) Soap less detergent

II Soap less Detergent - non biodegradable.

26. (i)

But-i-ene Or (accept any 1)

P 1

But-z-ene

P 1

(ii) *Bromine water is decolourised because X is unsaturated or has a (-C = C-) double bond.*

(iii) $C_3H_{8(g)} + 5O_{2(g)} \rightarrow 3CO_{2(g)} + 4H_2O_{(l)}$ P 1

27. a) i) Propane
ii) But-2-yne
- b) i) Polythene
ii) Bubble pass ethane gas in acidified $KMnO_4$ or acidified $K_2Cr_2O_7$
- c) i) C_nH_{2n}
ii) C_5H_{10}
- d) i) Step I – hydrogen
Step II – Hydrogen chloride
Step IV – Sodalime
- ii) $2CH_4(g) + O_2(g) \xrightarrow{\quad\quad\quad} 4CO_2(g) + 2H_2O(l)$
- A fuel
 - Manufacture of methanol
 - Manufacture of methanol

28. i) 2-Methylprop-1-ene 1 mark
ii) Pent-1-yne 1 mark [Total 12 marks]

29. The melting point increases from A to C this is due to increase in number delocalized electron hence increase in the strength of metallic bond.
D forms a giant structure with strong covalent bonds. Hence high melting.
It exhibits allotropy i.e. may exist as two different forms in the same state.
 $C_2(s)$
Noble gases or inert
Used in filament bulbs
Used to produce an inert atmosphere in high temperature metallurgical processes e.g. welding.
C is amphoteric oxide
F acidic it is non-metal oxide.

Ethene



Acidified potassium Manganate(VII) decolorized from a colourless solution



Nickel catalyst

will distill at 350C

which is poisonous

ii) Manufacture of Tar used in road tarmacking sealing of leakages on roofs

30. a) i) Bitumen it has the highest boiling point
ii) Fractional distillation; during distillation petrol would distill off at 175C, while diesel
iii) Each component is a mixture of hydrocarbons which have different boiling points
iv) Methane, CH_4 , Ethane C_2H_6 propane, C_3H_8 , Butane C_4H_{10}
- b) i) Burning in limited amount of air will produce carbon monoxide (carbon (II) Oxide)

31. i) C_nH_{2n} , where $n = \text{No. of carbon atoms}$
 ii) 70
 iii) C_5H_{10} , $CH_3CH=CHCH_2CH_3$
 OR $CH_3CH_2CHCH_2=CH_2$
32. (a) Hydrocarbon. $\sqrt{1}$
 (b) Black specks is carbon
 Colourless gas is steam $\sqrt{1}$
 Hydrocarbon burn in air to form carbon $\sqrt{1/2}$ and water $\sqrt{1/2}$

3

33. $NaCl_{(aq)} + AgNO_{3(aq)} \rightarrow NaNO_{3(aq)} + AgCl_{(s)}$
 Moles of $AgCl = \frac{\text{Mass}}{\text{R.F.M}}$
 $= \frac{2.36}{143.5}$
 $= 0.016446 \text{ moles}$ P $1/2$
 Mole ratio $NaCl : AgCl$
 $1 : 1$ P $1/2$
 Moles of $NaCl = 0.016446 \text{ moles}$
 Mass of $NaCl = \text{RFM} \times \text{moles}$
 $= 58.5 \times 0.016446$
 $= 0.962091 \text{ g}$ P $1/2$
 Mass of solvent (water) = $2.63 - 0.962091$
 $= 1.667909 \text{ g}$ P $1/2$
 1.667909g of water dissolves 0.962091g of $NaCl$
 100g of water dissolves = $\frac{100 \times 0.962091}{1.667909}$
 $= 57.68/100 \text{ g of water}$ P $1/2$

33. $24000 \text{ cm}^3 = 1 \text{ mol}$
 $80 \text{ cm}^3 = \frac{80 \times 1}{2400}$ P 1
 $= 0.00333 \text{ moles}$ P 1

34. (i) $CH_3CH=CHCH_3$ – But-2-ene
 (ii) $CH_3C=CH_2$; 2-methyl 1 prop-1-ene



35. (a) Octane
 or $CH_3CH_2CH_2CH_2CH_2CH_2CH_2CH_3$

36. a) *Existence of same molecular formula but different structural formula* ✓1
b) i)