

## Organic chemistry II (alkanoic acids and alkanols)

- Ethylbutanoate
  - $\text{CH}_3\text{CH}_2\text{CH}_2$
  - Esters
- $-\text{CH}-\text{CH}-\text{CH}_2-\text{CH}-\text{CH}_2-\text{CH}-\text{CH}_2-\text{CH}$
  - Polyphenyl/ ethane
- Plastics may contain chlorine or fluorine compounds apart from hydrogen and carbon when burnt, fluorine and chlorine compounds are released into the air destroying Ozone layer
- $(\text{NH}_4)_2\text{CO}_3(\text{s}) \quad 2\text{NH}_3(\text{g}) + \text{CO}_2(\text{g}) + \text{H}_2\text{O}(\text{l})$
- The first amount of soap precipitates  $\text{Ca}^{2+}(\text{aq})$  and  $\text{Mg}^{2+}(\text{aq})$  ions and softens water.

Then additional soap dissolves oil from the fabric.



b) 0.00005 mol.  $P = 0.515$  g of monomer.

$$= 1.0 \text{ mole of poly mer} = \frac{1 \times 0.515}{0.0005} = 10300 \text{ g}$$

$$\begin{aligned} \text{RFM} (\text{C}_4\text{H}_9\text{NO}_2)n &= 48 + 9 + 32 = 103 \\ &= (\text{C}_4\text{H}_9\text{NO}_2) = 10300 \\ 103n &= 10300 \\ n &= 100 \text{ molecules} \end{aligned}$$

- Agent A – magnesium salt formed is soluble hence doesn't form scum
- (a) Styrene/Phenylethene

(b) Addition polymerization

(c) – can be made into different shapes easily

- are cheaper
  - are not corroded by acids, alkalis or air
  - are stronger and long lasting
  - are water-proof
- Any 1 correct

- Add water to the mixture and shake where ethanol dissolves in water while pentane is immiscible.

\*MAT

- Transfer the mixture in a separating funnel and allow it to settle when pentane floats on top of water-ethanol mixture.

\*MAT

- *n on the tap to collect water-ethanol mixture while pentane remains in the separating funnel.*
- u - Separate ethanol from water by fractional distillation based on the differences in boiling points.*
- 10. (a) *Is 100% ethanol/is pure ethanol without water in it*  
(b) *30°C and yeast*

P 1

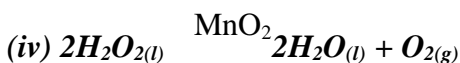
11. (ii)  $R = \frac{D_2}{D_1}$   
 $= \frac{43}{40.5}$

$$180 - 150$$

$$= \frac{25}{30}$$

$$= 0.0833 \text{ cm}^3/\text{s}$$

(ii) 57seconds



(b) (i) To oxidize  $\text{H}_2$  produced to water

(ii) Z

(iii)  $Q = It$

$$= 0.1 \times 30 \times 60$$

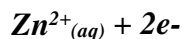
$$= 180\text{C}$$

$$96500\text{c} = 1\text{F}$$

$$180\text{cc} = \frac{180 \times 1}{96500}$$

$$= 0.001865\text{F}$$

$$\text{Zn}_{(s)} \rightarrow \text{Zn}^{2+}_{(aq)} + 2e^-$$



$$2\text{F} = 65\text{g}$$

$$0.001865\text{F} = \frac{0.001865 \times 65}{2}$$

$$= 0.0606\text{g of Zn was consumed}$$

12. (a) (i) Ethylethanoate.

(ii) 2 – bromobut – 1 – ene

(b) (i) P –  $\text{CH}_3\text{COOCH}_2\text{CH}_3$

S –  $\text{CH}_3\text{CHONa}$

(ii) I. Step I -Type – dehydration.

Reagent – Concentrated sulphur acid.

II. Step II- Type – Oxidation

Reagent – acidified potassium magnate VII/ Potassium dichromate (VI)

III. Step III- Type – Hydrogenation

Reagent – Hydrogen

(iii) R – Soda lime

(iv)  $\text{Cl}$



*Teterechloromethane*

(v) *I – U – Polythene/Polyethene*

$$II - 28n = 42000$$

$$n = \frac{42000}{28} = 1500$$

(c) – *It is unsaturated.*

13. a) - *The length of the chain*  
- *Intermolecular forces*

- Cross linking of the molecules (Any two correct = 2 marks)

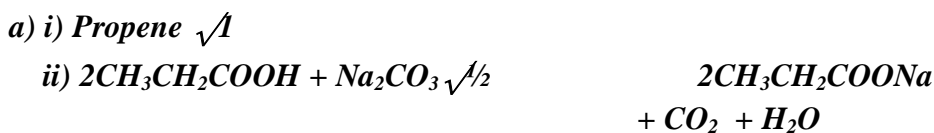
b) Sodium propoxide

- c) i) I – T is ethane  
 II – K is polypropene  
 ii) has a sweet smell  
 iii) Neutralization  
 iv) - Used to make ropes ✓ 1 mark  
 - Used to make crates of bottles  
 - Used as surface for all weather football and hockey pitches (Any correct use)  
 v)  $CH_3CH_2CH_3 + SO_2 \xrightarrow{\quad\quad\quad} 3CO_2 + 4H_2O$   
 (N.B ignore state symbols)

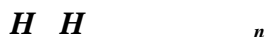
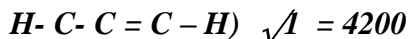
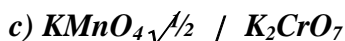
vi) React a small sample of each of the two substances with sodium carbonate separately. Bubbles// efferescence are observed with  $CH_3CH_2COOH$  and no reaction with  $CH_3CH_2CH_2OH$

vii)  $RMM \text{ of monomer} = 42 \checkmark \frac{1}{2}$   
 $42n = 12600$   
 $N = \frac{12600}{42} = 300 \checkmark \frac{1}{2}$

14.



b) Making packing materials ✓1



$42n \checkmark = 4200$

$n = 4200 / 42$

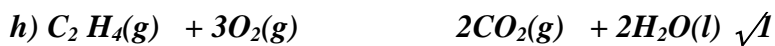
$= 100 \checkmark$

e) Esterification ✓1

f) Conversion of oils to fats. ✓1

g) Propane burns with a clear flame ✓1 while propyne burns with a sooty flame

*✓ because propyne has a higher C : H ratio than propane.*



*1 Vol. 3 vol*

*1 Vol. = 1000 cm<sup>3</sup> ✓*

*Vol of O<sub>2</sub> required = 3 x 1000 cm<sup>3</sup> = 3000 cm<sup>3</sup> ✓*

*Vol of air required =  $\frac{100}{20} \times 3000$  cm<sup>3</sup>*

*= 15,000 cm<sup>3</sup> ✓*

15. (a) (i) Q -  $\text{CH}_3\text{CH}_2\text{COOH}$  (accept name (propanoic acid))  
R -  $\text{CH}_3\text{CH}_2\text{COOH}$  (Propanoic acid)  
P - Hydrogen  
P 1

(ii) *Step I Esterification*

*Step 4 – Oxidation* P 1

(iii)

*Reject*

(iv) *Condition – 180 – 250°* P ½

*reagent – Conc. H<sub>2</sub>SO<sub>4</sub>* P ½

16. (a) (i) *M: Ethan – 1, 2- diol*  
*L: Ethanoic acid*

(ii) *Polymerisation*

*Hydrogenation*

(iii) *Concentrated sulphuric acid*  
*Ethanoic acid*

17. a) i) *Butan – 1 – 01// 1- Butanol// n-Butanol*  
ii) *Propanoic acid*  
iii) *Ethylethanoate*

18. i) *Step I: Hydrogen*  
*Step II: Hydrogen chloride gas// HCL*  
*Step III: Sodium hydroxide/ NaOH/ Sodalime*

ii)  $2C_2H_{2(g)} + 5O_{2(g)} \longrightarrow 4CO_{2(g)} + 2H_2O_{(g)}$

iii) *Environmental pollutant*

*It is not biodegradable/ Not decomposed by bacterial*

19.	i)	<i>Fe</i>	<i>S</i>	<i>O</i>	<i>H<sub>2</sub>O</i>
		20.2/56	11.5/32	23.0/16	45.3/18
		0.36/0.36	0.36/0.36	1.44/0.36	2.52/0.36
		<i>1</i>	<i>1</i>	<i>4</i>	<i>7</i>



*Empirical formula:  $FeSO_4 + H_2O$*

$$\begin{aligned} \text{ii) } 6.95\text{g} &= \frac{6.95}{278} = 0.025 \\ \backslash \quad 0.05 \text{ moles in } 250\text{cm}^3 &= 0.025 \times \frac{1000}{250} = 0.1 \\ \text{Concentration} &= \frac{6.95}{278} \times \frac{1000}{250} = 0.1 \end{aligned}$$

20. i) Step I: Hydrogen

**Step II: Hydrogen chloride gas// HCL**

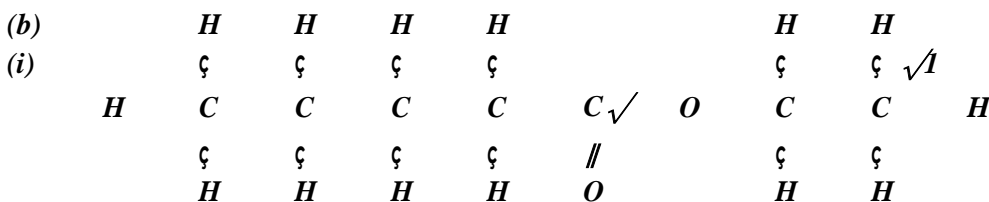
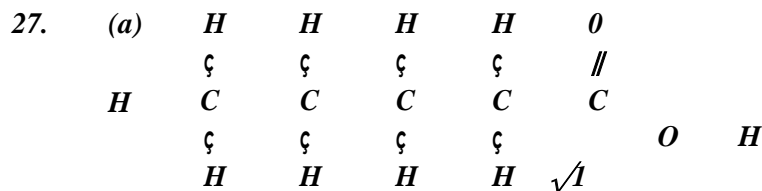
**Step III: Sodium hydroxide/ NaOH/ Sodalime**



iii) Environmental pollutant

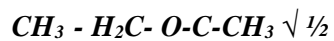
It is not biodegradable/ Not decomposed by bacterial

21. i) Butan – 2 – Ol ✓<sup>1/2</sup>  
 ii) 4 – methylhex – 2- ene ✓  
 iii) Propyl ethnoate ✓
22. a) Soap less detergent ✓  
 b) Non- biodegradable resulting in pollution ✓
23. a)  
 b) Addition
24. (a) A – Sodium ethanoate  
 B – Acidified  $KMnO_4$  or  $K_2Cr_2O_7$   
 (b) Oxidation
25. (a)  $NH_{3(g)} + HNO_{3(aq)} \rightarrow NH_4NO_{3(s)}$
- (b) 17kg ammonia ◦ 80kg  $NH_4NO_3$  ( <sup>1/2</sup> )  
 $\frac{5.3kg \times 80}{17} = 24.94Kg$  (1<sup>1/2</sup> kg)
26. (a) A reaction between an ethanol and alkanoic acid to form ester;



(ii) Ethylpentanoate . ✓1

28. i) ethylethanoate ✓<sup>1/2</sup>



ii) step 2: oxidation  $\checkmark \frac{1}{2}$

step 4: esterification  $\checkmark \frac{1}{2}$

iii) sodium hydroxide, or NaOH  $\checkmark 1$

29. a) Hydrogen.  $\checkmark^1$

b) (i) A No effervescence takes place.  $\checkmark^{\frac{1}{2}}$

(ii) B There is effervescence  $\checkmark^{\frac{1}{2}}$  and the gas produced turns lime water into white precipitate.  $\checkmark^{\frac{1}{2}}$

30. a)  $Y \checkmark$   
b)  $Z$  and  $W \checkmark$  have same atomic number but different mass number.  $\checkmark$
31. (a) Insulators  
(b) Are non-conductor since they lack delocalised electrons

32. (a) Soapless detergent

(b) Non-biodegradable

33. (a) No. of half-lives  $(n) = \frac{120}{20} = 6$

$$Y \times \left(\frac{1}{2}\right)^6 = 3.5 \text{ P }^{1/2}$$

$$Y = 3.5 \times 2^6 \text{ P }^{1/2}$$

$$Y = 224 \text{g P }^{1/2}$$

(all steps for equation )

OR:

(b) – To study the rate of absorption of fertilizer by plants using radioactive phosphorous  
 - Tracing chemical and physiological processes such as photosynthesis  
 - Sterilizing equipment (Iny one )

34. (i) Polypropene

(ii)  $(\text{H}_2\text{C}=\text{CH}-\text{CH}_3)_n = 4956$

$$(12 \times 3) + (6 \times 1) = 36 + 6 = 42 \text{ (molecular mass of 1 unit)}$$

$$\text{no. of units} = 42n = 4956$$

$$42n = 4956$$

$$\frac{42n}{42} = \frac{4956}{42}$$

$$n = 118 \text{ P } 1$$

35. i)  $\text{RCOONa}^+$  Soapy detergent

$\text{RCH}_2\text{OSO}_3\text{Na}^+$  soap less detergent

ii)  $\text{RCH}_2\text{OSO}_3\text{Na}^+$  does not form scum. Its calcium and magnesium salts are soluble

iii) Chlorine bleaches by oxidation

$\text{SO}_2$  bleaches by reduction

36. (a) Polyphenylethene

(b)

P