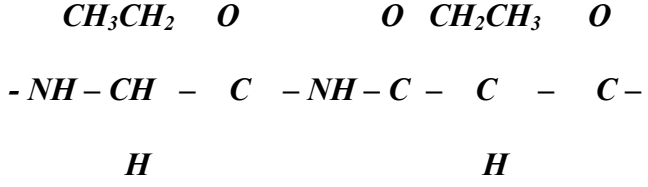
Organic chemistry II (alkanoic acids and alkanols)

1. (i) Ethylbutanoate
   (ii) $CH_3CH_2CH_2$
   (iii) Esters
2. a) $-CH- CH- CH_2 - CH - CH_2- CH - CH_2 - CH$
   b) Polypheny/ ethane
3. 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
4. $(NH_4)_2\ CO_{3(s)} \rightarrow 2NH_{3(g)} + CO_{2(g)} + H_2O_{(l)}$
5. The first amount of soap precipitates $Ca^{2+}_{(aq)}$ and $Mg^{2+}_{(aq)}$ ions and soften water.
   Then additional soap dissolves oil from the fabric.
6. a)



   b) 0.00005mol. P = 0.515 g of monomer.
   = 1.0 mole of poly mer = $\frac{1X\ 0.515}{0.0005} = 10300$ g

   RFM $(C_4H_9ND_2)n = 48 + 9 + 32 = 103$
   $= (C_4H_9NO_2) = 10300$
   $103n = 10300$
   $\therefore n = 100$ molecules
7. Agent A – magnesium salt formed is soluble hence doesn't form scum
8. (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
9. – 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
- Turn on the tap to collect water-ethanol mixture while pentane remains in the separating funnel.
- 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 ✓1
    (b) 30^oC and yeast ✓1
11. (ii) $R = \frac{\Delta v}{\Delta t}$
    $= \frac{43 - 40.5}{}$

$180 - 150$

$= \frac{25}{30}$

$= 0.0833 cm^3/s$

(ii) 57seconds

(iv) $2H_2O_{2(l)} \xrightarrow{MnO_2} 2H_2O_{(l)} + O_{2(g)}$

(b) (i) To oxidize H_2 produced to water

(ii) Z

(iii) $Q = 1t$

$= 0.1 \times 30 \times 60$

$= 180C$

$96500c = 1F$

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

$= 0.001865F$

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

$2F = 65g$

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

= 0.0606g of Zn was consumed

12. *(a) (i) Ethylethanoate.*

(ii) 2 – bromobut – l – ene

(b) (i) P – $CH_3COOCH_2\ CH_3$

S – CH_3CHONa

(ii) I. Step I -Type – dehydration.

Reagent – Concentrated sulphur acid.

II. Step II- Type – Oxidation

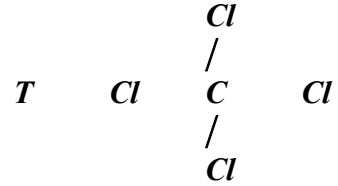
Reagent – acidified potassium magnate VII/ Potassium dichromate (VI)

III. Step III- Type – Hydrogenation

Reagent – Hydrogen

(iii) R – Soda lime

(iv)



Tetrechloromethane

(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) $CH_3CH_2CH_3 + SO_2$ _____ $3CO_2 + 4H_2O$
(N.B ignore state symbols)

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

vii) RMM of monomer = 42 ✓½

$$42n = 12600$$

$$N = \frac{12600}{42} = 300 \checkmark ½$$

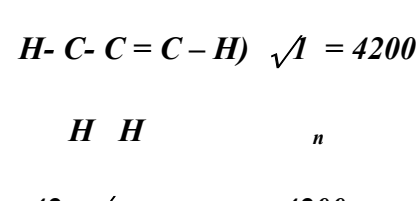
14. *a) i) Propene √1*

ii) $2CH_3CH_2COOH + Na_2CO_3$ √½ $2CH_3CH_2COONa + CO_2 + H_2O$

b) Making packing materials √1

c) $KMnO_4$ √½ / K_2CrO_7

d)



H- C- C = C – H) √1 = 4200

H H *n*

42n √ = 4200
n = 4200 /42
= 100 √

e) Esterification √1

f) Conversion of oils to fats. √1

g) Propane burns with a clear falme √1 while propyne burns with a sooty flame √1because propyne has a higher √1 C : H ration than propane.

h) $C_2H_4(g) + 3O_2(g) \rightarrow 2CO_2(g) + 2H_2O(l)$ *√1*

1 Vol. 3 vol
1 Vol. = 1000 cm^3 *√½*
Vol of O_2 *required = 3 x 1000* cm^3 *= 3000* cm^3 *√½*
Vol of air required = $\frac{100}{20} \times 3000$ cm^3
= 15,000 cm^3 *√½*

15. (a) (i) Q - CH_3CH_2COOH (accept name (propanoic acid)
R – CH_3CH_2COOH (Propanoic acid) ✓1
P- Hydrogen ✓ 1

✓ 1

(ii) Step I Esterification
Step 4 – Oxidation ✓ 1

(iii)

Reject

(iv) Condition – 180 – 250° ✓ ½
reagent – Conc. H_2SO_4 ✓ 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) $2C_2H_{2(g)} + 5O_{2(g)}$ _____ $4CO_{2(g)} + 2H_2O_{(g)}$

iii) Environmental pollutant
It is not biodegradable/ Not decomposed by bacterial

19. i)

Fe	*S*	*O*	*H_2O*
$^{20.2}/_{56}$	$^{11.5}/_{32}$	$^{23.0}/_{16}$	$^{45.3}/_{18}$
$^{0.36}/_{0.36}$	$^{0.36}/_{0.36}$	$^{1.44}/_{0.36}$	$^{2.52}/_{0.36}$
1	*1*	*4*	*7*

Empirical formula: $FeSO_4 + H_2O$

ii) 6.95g $= {}^{6.95}/_{278} = 0.025$
$\therefore$ *0.05 moles in 250cm³* $= 0.025 \times {}^{1000}/_{250} = 0.1$
Concentration $= {}^{6.95}/_{278} \times {}^{1000}/_{250} = 0.1$

20. i) Step I: Hydrogen
Step II: Hydrogen chloride gas// HCL
Step III: Sodium hydroxide/ NaOH/ Sodalime
ii) $2C_2H_{2(g)} + 5O_{2(g)}$ _____ $4CO_{2(g)} + 2H_2O_{(g)}$

iii) Environmental pollutant

It is not biodegradable/ Not decomposed by bacterial

21. *i) Butan – 2 – Ol ✓½*

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_2O7

(b) Oxidation

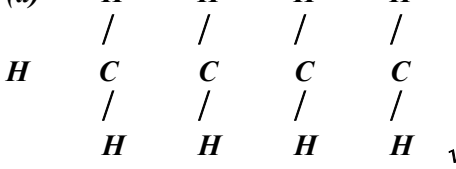
25. *(a) $NH_{3(g)} + HNO_{3(aq)} \quad NH4NO_{3(s)}$*

(b) 17kg ammonia ≡ 80kg NH_4NO_3 (½)

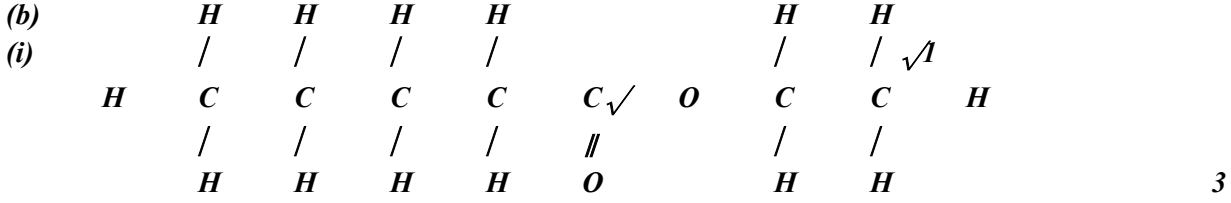
∴ 5.3kg ≡ $\frac{80 \times 5.3}{17} = 24.94Kg$ (1½ kg)

26. *(a) A reaction between an ethanol and alkanoic acid to form ester;*

27. *(a)*



(b) (i)



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(ii) Ethylpentanoate . √1

28. *i) ethylethanoate✓½*

CH_3 - H_2C- O-C-CH_3 ✓½

ii) step 2: oxidation ✓½

step 4: esterification ✓½

iii) sodium hydroxide ,or NaoH✓1

29. *a) Hydrogen. √1*

b) (i) A No effervescence takes place. √½

(ii)B There is effervescence √½ and the gas produced turns lime water into white precipitate.√½

30. ***a) Y ✓1***

b) Z and W ✓1 have same atomic number but different mass number. ✓1

31. (a) Insulators

(b) Are non-conductor since they lack delocalised electrons

32. (a) Soapless detergent

(b) Non-biodegradable ✓

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

$Y \times (½)^6 = 3.5$ ✓ ½

$Y = 3.5 \times 2^6$ ✓ ½

$Y = 224g$ ✓ ½

(all steps for equation)

OR:

(b) – To study the rate of absorption of fertilizer by plants using radioactive phosphorous ✓1

- Tracing chemical and physiological processes such as photosynthesis ✓1

- Sterilizing equipment (1ny one)

34. (i) Polypropene

(ii) $(H_2C= CH – CH_3)_n = 4956$ ✓1

(12 x 3) + (6x1) = 36 + 6 = 42 (molecular mass of 1 unit)

no. of units = $42n$ ✓1 *$= 495$*

$42n = 4956$

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

$n = 118$ ✓ 1

35. i) $RCOONa^+$ Soapy detergent

$R\ CH_2\ OSO_3\ Na^+$ soap less detergent

ii) $RCH_2OSO_3\ Na^+$ does not form scum. Its calcium and magnesium salts are soluble

iii) Chlorine bleaches by oxidation

SO_2 bleaches by reduction

36. (a) Polyphenylethene

(b)

✓