ORGANIC CHEMISTRY II MARKING SCHEME

1. 1990 Q28

(a) (i) Hydrogen

(ii) I – Q – $CH_3CH\text{-}CH_2$ propane

II S- CH_3CH_3COOH Propane acid

(iii) Addition/Bromination/halogenation

(iv) I –Ethanol

II –Few drops of conc H_2SO_4

III Warm(heat) Temp<80^0c consumes energy/reaction is exothermic

2. 1994 Q4

(a) (i) Pentanoic acid

(ii) C_3H_6O

(iii) 163 ± 2

(iv) The boiling point increases with increase in CH_2 i.e with increase of carbon. This is because the molecular mass increases in CH_2, it follows that this increase in intermolecular force, will require more heat to break the bond.

(b) Effervescence , colourless gas is given off/CO_2 is given off(turns lime water turbid)

(c) Let the volume be Vcm^3

Moles of NaOH = $V \text{ x } \frac{0.2}{100}$

Moles of C_3COOH = $\frac{3,0}{60} = 0.05$

Since 1 mole of NaOH = 1 mole of C_3COOH

$V \text{ x } \frac{0.2}{100} = 0.05$

$V = \frac{0.05}{0.2} \times 1000 = 250cm^3$

3. 1996 Q5 P2

a) i) $C_2H_4O_2$. Its M.P is higher than 10^oC

ii) C_5H_{12} and C_6H_{14}

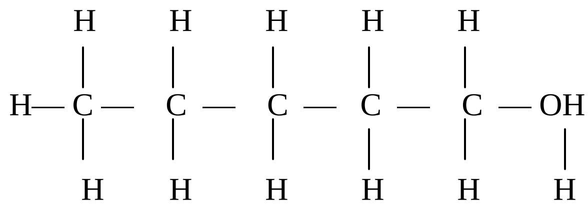
C_6H_{14} has a higher M.P therefore stronger van der waal force / intermolecular forces.

iii) C_3H_8O is more soluble in water than $C5H_{12}$ because it forms hydrogen ` bonds with water molecules OR because it is polar due to the presence of OH / OH mixes with water (Hydrogen bond if formed)

b) i) C_4H_8

ii) $C_4H_8 + 6O_2 \longrightarrow 4\,CO_2 + 4\,H_2O$

c) i)



ii) Concentrated sulphuric acid / Al_2O_3 / Concentrated phosphoric acid.
Heat (160 – 180^{o}C)

d) i) Saponification / Hydrolysis. (1 mark)

ii) Esters / fats (1 mark)

4. 1997 Q2 P2

a) i) Buta – 1 – ol

ii) Propanoic acid

iii) Ethylethanoate.

b) i) CnH_2n n = No. of carbon atoms

ii) 70(not 70g if g = ½ mark)

iii) C_5H_{10}; $CH_3CH = CHCH_2\ CH_3$. $CH_3CH = CCH_3$

5. 1998 Q21 P1

(a) Polystyrene or polyphenylethene

6. 1999 Q5 P1

(a) (i) Propanoic acid

(ii) Esters

(b)The colour of the solution changes from orange yellow to green (I) because (is reduced to Cr while ethanol is oxidized to ethanol acid (I)

(c) (i) Soap / Soap detergent

(ii) Sodium chloride

(iii)-to make Soap float (w.t.t.e)

(i) –A molecule of the cleansing agent has polar () and non polar parts.($^{1}/_{2}$)Non-polar parts dissolve in oil (1/2) and the polar part (1/2) dissolves in water when the mixtures is agitated (1/2) the oil droplets coagulate and can be washed away with water.

7. 2000 Q5 P1

(a) (i) Pent -2 –ene

(ii) Butanoic acid

(b) (i) substitution

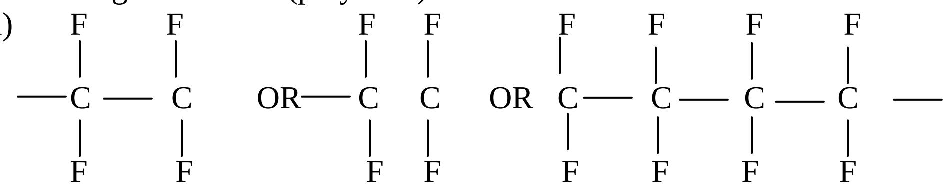
(ii) Addition

(c) (i) $2C_4H_{10(g)} + 130_2(g) \longrightarrow 8CO_{2(g)} + 10H_{2(l)}$

(ii) Carbon dioxide (CO_2) is produced. This then dissolves in water, forming an acid solution.

(d) (i) Process where monomers (small molecules) form together to form large molecules (polymers)

(ii)



(e) -Cheaper

-More durable

- Can be recycled

-Can be made on demand

-Easy available

-Easily moulded/made into many shapes

-Not attacked by acids or alkalis

-corrosion resistant

8. 2001 Q2 P2

(a) (i) Alkyline

(ii) Carboxylic acid or Alkanoic acid

(b) (i) Vulcanisation

(ii) - To harden rubber

- To make it tougher/ stronger
- To make it durable
- To last longer

(any answer cancels the correct)

(c) (i) $2CH_3CH_2CH_2OH(I) + 2 K (I) \rightarrow 2CH_3CH_2CH_2OK(s) + H_2(g)$

(State symbols not necessary in equations involving organic)

(ii) I Dehydration

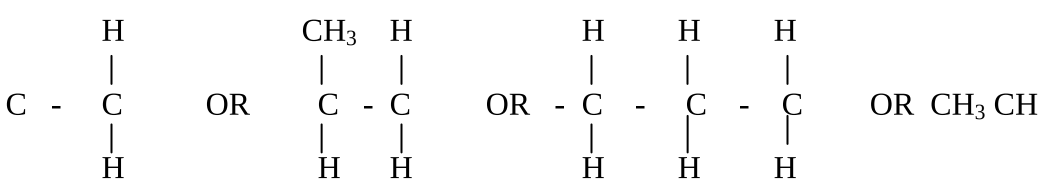
II Hydrogenation

(iii) A 1,2 – dibromopropane or formula, $CH_2Br – CHBrC_3$

B Ethene or formula C_4H_4

(iv) Nickel/ Palladium/ Platinum

(v)



(d) - Production of hydrogen

- Production of carbon tetrachloric
- Production of acetylene or ethane
- Production of carbon black used for making printers ink
- Preparation of methanol
- Preparation of chloroform

9. 2002 Q7 P2

(a) Write the structural formula of:

(i) Methanol (1 mark)

```
                        H
                        |
CH3OH      OR    H  -   C  -  OH
                        |
                        H
```

(ii) Methanoic acid

```
                             O
                           //
HCOOH      OR    H  -   C   -   OH
```

(b) Write the equation for the reaction between methanoic acid and aqueous sodium hydroxide

$NaOH(aq) + HCOOH(aq) \rightarrow HCOONa(aq) + H_2O(aq)$

(c) (i) Name the product formed when methanol reacts with methanoic acid

Methylmethanoate // $HCOOCH_3$ // H – C – O – CH_3

(ii) State one condition necessary for the reaction in © (i) above to take

Place

- add conc. H_2SO_4
- Heat to 180^0C // warm // heat

(d) (i) Describe one chemical test that can be used to distinguish between

hexane and hexane

- Use a bromine water // acidified potassium permanganate
- If hexane they will be decoloured
- If hexane no decolourisation

(ii) State one use of hexane

Fuel // solvent // manufacture hexanol // hexanoic acid, hexanol

(iii) Hydrogen gas reacts with hexane form hexane. Calculate the volume or hydrogen gas required to convert 42g of hexane to hexane at S.T.P (C = 12.0, H = 1.0, Molar gas volume at S.T.P is = 22.4 litres). (4 marks)

$C_6H_{12} + H_2 = C_6 H_{14}$ mole ratio = 1:1

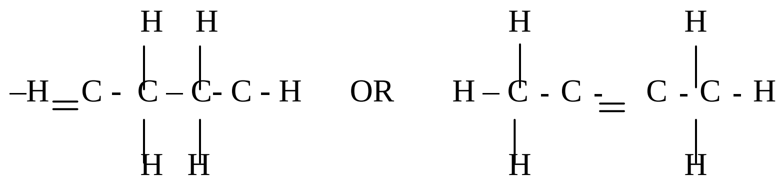
R.MM of hexane = $^{42}/_{84}$ = 0.5

Moles of hydrogen = 0.5

Volume of hydrogen = 0.5 x 22.4 = 11.2 litres of 11 dm^3

10. 2003 Q7 P2

a) Ethane burns with a pale blue flame while ethane burns with a yellow flame.
Ethane is saturated while ethyne is unsaturated. OR Ethane burns with a non smoky flame while ethyne burns with a Smokey/sooty flame.

b) 

c) (i) I Oxidation

II B -Ethane

C - Sodium ethanoate.

(ii) $CH_3\ CH_2\ OH_{(i)} + 30_{2(g)} \longrightarrow 2C0_{2(g)} + 6H_2O$

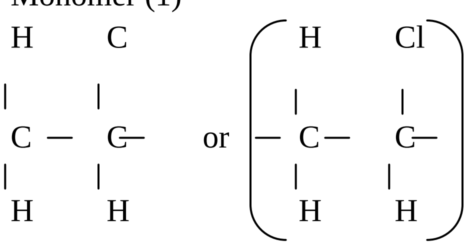
(ii) to bring the reacting particles in close contract for the reaction to occur.

(iv) -Fuel

- Manufacturer of carbon black used in making paint and paint ink
- Manufacture of hydrogen gas
- Manufacture of carbon disulphide
- Manufacture of chloromethane, tetra chloromethane
- Manufacture of hydrogen used in manufacture of ammonia
- Manufacture of hydrogen cyanide
- Manufacture of ethyne.

11. **2004 Q13, 23 P1**

13 (a) Monomer (1)

(a) 

23. Water in test-tube 2
Soap reacts with Ca^{2+} or Mg^{2+} in hard water
Soap reacts with Ca^{24} or Mg^{24}

12. **2005 Q6 P2**

a) i)V1 : $CH_3CH_2CH_2C – OH$ and

$$\begin{array}{l} \qquad\qquad\qquad\qquad\quad O \\ \qquad\qquad\qquad\qquad\quad \| \\ CH_3CH_2CH_2C-OH \end{array}$$

V3 : $CH_3CH_2CH_2C-OH$

ii) V2 : $CH_3CH_2CH = CH_2$ and V5 : $CH_3CH_2CH_2CH_3$

iii) V4 : $CH_3CH_2CH = CH_2$

It is unsaturated compound and during polymerization the

double bond is broken to allow another monomer to combine.

(b)

	Advantage	Disadvantage
R – COO- Na+	They are cheaper compared to soap less detergents	Forms a scum with water containing calcium and magnesium ions
$R-SO_3-Na^+$	They do not form scum with Ca^{2+} and Mg^{2+}	They are made from petroleum products or vegetable oils which are expensive.

I (i) Easters

(ii) $C_2H_4O_2(aq) + C_2H_5OH(l) \rightleftharpoons CH_3COOC_2H_3(l) + H_2O(l)$

(i) Used as solvents

In the manufacture of drugs and chemicals
In flavouring and preservation of food
In manufacture of synthetic fibres

(iv) $2CH_3COOH(aq) + K_2CO_3(aq) \rightarrow 2CH_3COOK(aq) + CO_2(g) + H_2O(l)$

(d (i) Natural fibres include rubber, cellulose, wool, starch, silk etc.

(ii) Advantage; can be made into complicated shapes more easily, less expensive, not affected by acids. Alkalis, water and air, less dense and stronger.

13. 2006 Q7 P1

a) Refrigeration (1mark)

b) - They deplete the ozone layer.

- They cause green house effect. (2marks)

14. 2006 Q11 P1

a)

- Acidify water with nitric acid.
- Add aqueous lead nitrate.
- Formation of white PPt shows presence of CT

b) provides essential minerals e.g Ca^{2+} (1mark)

15. 2007 Q2 P1

Mass in $500cm^3$ = 15 x 1.05 = 15.75g

Mass in $100cm^3$ = 15.75 x 2 = 31.5

Molarity $= \frac{315}{60} = 0.103$

16. 2007 Q15 P1

(a) The calcium and magnesium compounds in this water cannot be decomposed by heating i.e. $CaCl_2$, $CaSO_4$, $MgSO_4$ and $MgCl_2$

(b) Ionic exchange

Uses sodium carbonate (washing soda)

17. 2007 Q2 P2

(a) (i) 2-Methyl – Prop – i – ene

1Pent – I – yne

(b) (i) Change from orange to green

(ii) Effervescence and a colourless gas which burn with a 'pop' sound produced

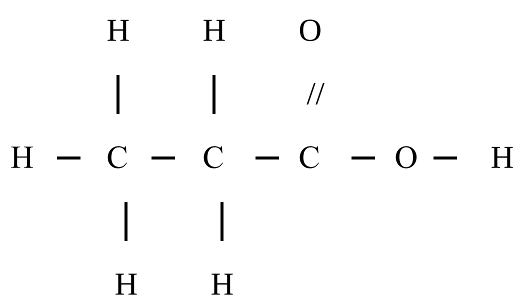
(c) **Step 1**

Fermentation: Glucose solution is mixed with yeast. The enzyme zymase from yeast converts glucose to ethanol

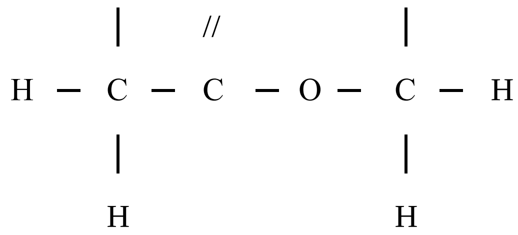
Step II

Dehydration: Ethanol is mixed with concentrated sulphuric acid and heated in presence of Al_2O_3 as a catalyst

(d)



(ii) H O H



(e) Produced CO_2 which causes global warming
Produces acidic – compounds which causes acidic rain

19. 2008 Q4 P1

(a) $C_{13}H_{27}COONa^{+}$ Regardless of charges i.e. $C_{13}H_{27}COONa$
(b) Soapy detergent/ soaps
(c) $(C_{13}H_{27}COO\text{-})_2$ Ca or $CI3H27COO)_2Mg^{2+}$

20. 2008 Q1c P2

(i) Global warning
(ii) I Ammonium nitrate
II Aerosols, Propellant, Freons

21. 2009 Q2 P1

(a) $Ca(HCO_3)_2(aq) \rightarrow CaCO_3(S) + H_2O(l) + CO_2(g)$
(b) Sodium carbonate (l) Soda ash/ washing soda
Calcium hydroxide (l) / Lime water $_2$ Ammonia Sol;
Sol; Sodium per mutito/ Sodium Duminium Silicate.

22. 2009 Q25 P1

(a) Colourless solution becomes brown/ black
L_2 (aq)/S
(b) Blue PPt dissolving to form a deep blue solution (l) $Cu(NH_3)_4^{2+}$ (3marks)

23. 2010 Q13 P1

a) Margarine
Reagents – hydrogen /H_2
Condition – high temperature 150 – 250^0C (range must be given)
b) Soap
Reagent – sodium hydroxide / NaOH **or** potassium hydroxide
Condition – heating (Rej; warming to temperature e.g. 50^0C

24. 2010 Q21 P1

a) Chlorofluorocarbon
b) When ozone is depicted, high energy UV radiation reach the earth, which ,may cause skin cancer to human beings.

c) Global warming/ green house effect(Rej: acid rain

25. 2010 Q25 P1

Test	**Observation**	**Inference**

To the first portion, $1cm^3$ of soap solution was added	No lather formed	Water hard containing Mg^{2+} / Ca^{2+} ions
The second portion was boiled, cooled and $1cm^3$ of soap solution was added	No lather formed	Permanent hardness of water
To the third portion, $3cm^3$ of aqueous sodium carbonate was added, the mixture filtered and $1cm^3$ of soap solution added to the filtrate.	Lather formed immediately	Na_2CO_3 removed the hardness. Water was soft. Mg^{2+}/Ca^{2+} absent. Mg^{2+} / Ca^{2+} are ppted out.

25. 2011 Q15 P1

(a) $Ca(St)_2$ or $Mg\ (St)_2$ ac

$Ca(St)_2$ or $MgSt_2$

(b) $Ca^{2+}{}_{(aq)} + Co_3^{2-}{}_{(aq)} \longrightarrow CaCo_{3(s)}$

Or $Mg^{2+}{}_{(aq)} + Co_3^{2-}{}_{(aq)} \longrightarrow MgCo_{3(s)}$

26. 2012 Q10 P1

(a) Mg^{2+} , Ca^{2+} **or** magnesium ions, calcium ions

[rej Mg or Na

(b) Mg^{2+} or Ca^{2+} ions are exchanged with Na^+ ions in the resion

Or

Ions in hard water are exchanged with Na^+ ions in the exchange resins or

$2R\text{-}Na + Ca^{2+} \longrightarrow R_2 - Ca + 2Na^+$

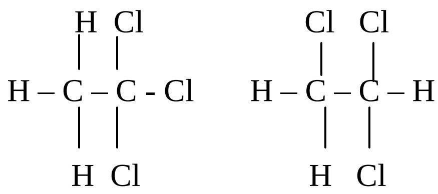
$2R\text{-}Na + Mg^{2+} \longrightarrow R_2 - Mg + 2Na^+$

27. 2012 Q21 P1

– plastic bottles

- Packaging of materials, Ceiling boards
- Making crates
- Toothbrush handles
- Cups, plates
- Building materials
- Models dummies

28. 2012 Q2 P2

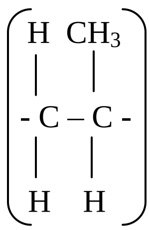
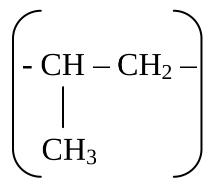
(a)  (2 marks)

(b) Identify correct reagent √ correct observation √ (4 marks)

- Ethene – When bubbled through acidified Kmno$_4$, the Kmno$_4$ is decolourised, while ethane does not decolourise.
- Ethene burns with smoky flame, while ethane does not burn with smoky flame.

(c) (i) concentrated sulphuric (vi) acid or Al_2O_3 or H_3PO_4 (1 mark)

if sulphuric acid is written ½ mark

(ii)  or  (1 mark)

(iii) $2CH_3CH_2COOH + Na_2CO_{3\,(s)} \longrightarrow 2CH_3CH_2COONa + CO_{2\,(g)}$

Ignore the states (1 mark)

(iv) $2C_3H_8O + 9O_2 \longrightarrow 6CO_2 + 8H_2O$ √ 1 (3 marks)

Moles of CO2 = $^{18}/_{24}$ = 0.75moles √ ½

Moles of propan = $\frac{0.75 \times 2}{6}$ = 0.25moles √ ½

1 mole of $C_3H_8O \longrightarrow$ 60g √ ½

0.25moles $\longrightarrow$?

= 15g √ ½