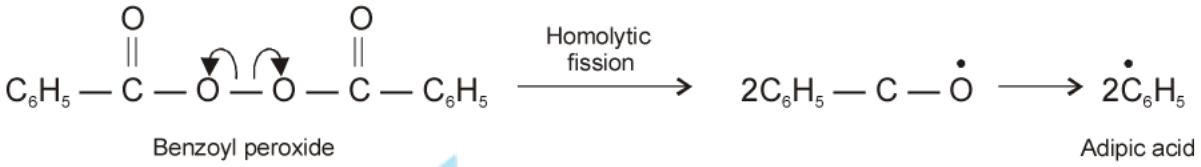
Name :.....
Time : 6 hr

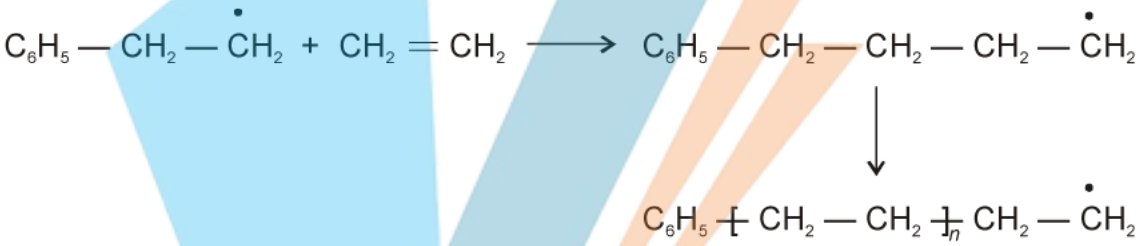
Total Marks = 63
Date: 25/10/2017

S1. The mechanism of chain growth polymerisation of ethene of free radical mechanism is given below:

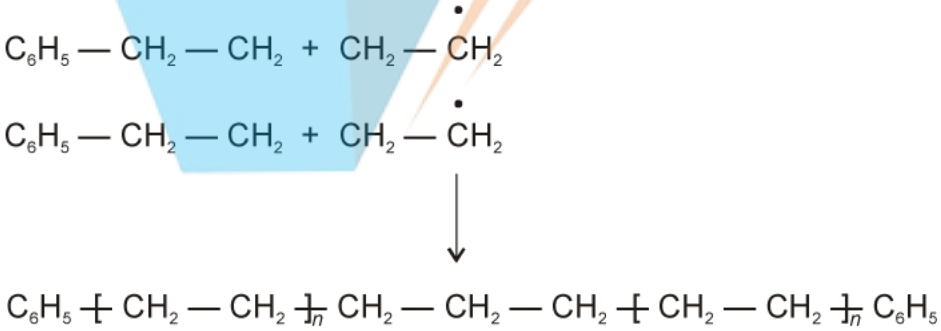
Step I: Chain initiation step



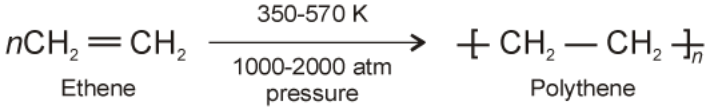
Step II: Chain propagation step



Step III: Chain terminating step



S2. **Low density polythene:**



Uses:

(a) As a packing material in the form of thin plastic bags.

(b) As insulation of electricity carrying wires and cables.

(c) For the manufacture of pipes, toys, squeeze bottles.

High density polythene:

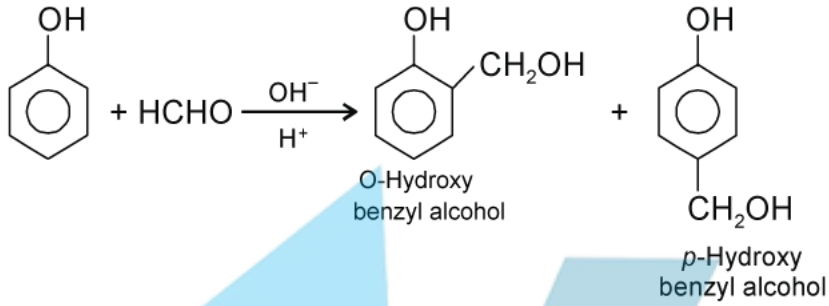
$$n CH_2 = CH_2 \xrightarrow[\text{Zeiglar-Natta catalyst}]{\text{333-343 K 6-7 atm}} +CH_2 - CH_2+_n$$

Uses:

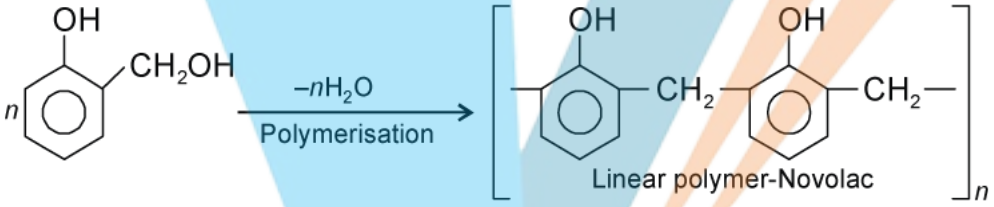
(a) For the manufacture of buckets, tubes, dustbins etc.

(b) For the manufacture of different house wares, pipes etc.

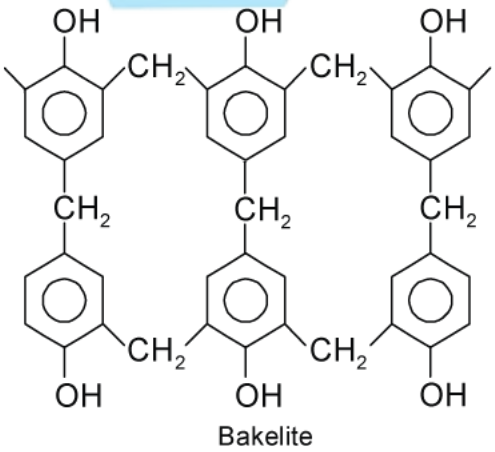
S3. Bakelite is a condensation polymer and is obtained from phenol and formaldehyde in the presence of either an acid or base.



The condensation of *o*-hydroxy benzyl alcohol or *p*-hydroxy benzyl alcohol gives a linear polymer called 'Novolac'



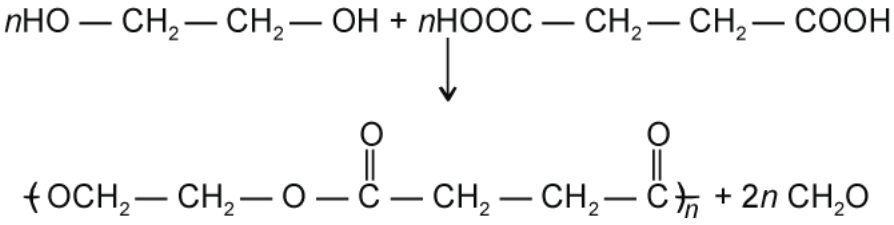
On further heating with formaldehyde, 'novolac' undergoes cross-linking to form an infusion solid called bakelite. This is very hard, scratch and water resistant. It possess excellent, electrical insulating character and hence, it finds major use in making electrical goods.



Bakelite

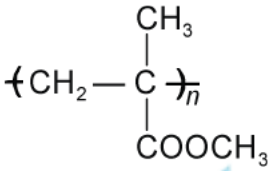
S4. **Polyesters:** The polymers having ester linkages and called polyesters. These are formed by condensation reaction between the hydroxy group of an alcohol with carboxylic group of an acid. The reaction is accompanied with the elimination of water molecule.

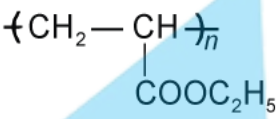
Example: Terylene is a polyester.

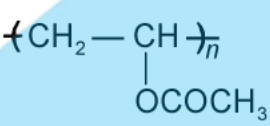


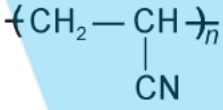
Dacron is the best known of the polyesters. It is condensation polymer of ethylene glycol and terephthalic acid.

Polyacrylates: Polymers obtained by the addition polymerization of various types of acrylic monomers are called polyacrylates. Important polymers of this class are:

(a) Polymethyl acrylate 

(b) Poly ethyl acrylate 

(c) Polyvinyl acetate 

(d) Polyacrylo nitrile 

S5. These can be classified into following types:

(a) **Polyesters:** Examples are, Terylene, glyptal.

(b) **Polyamides:** Examples are, Nylon-6, Nylon-6,6.

(c) **Polyformaldehyde resins:** Examples are, Bakelite, melamine.

S6. (a) Phenol and formaldehyde

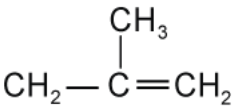
(b) Vinyl chloride

(c) Chloroprene

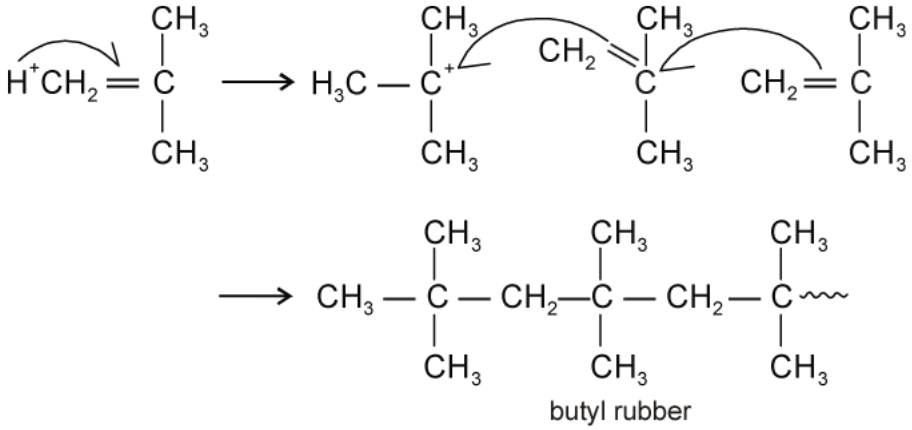
(d) Adipic acid and hexamethylene diamene.

S7. In cationic addition polymerisation, a cationic intermediate species, for propagating the addition chain process, is formed. Such as intermediate is easily stablised by a monomer carrying electron donating group like isobutylene, i.e.,

The vinylic monomer containing electron

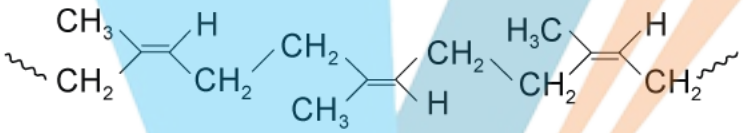


The vinylic monomer containing electron donating group *e.g.,* isobutylene easily stabilises cation intermediate which are formed by addition of H^+ at C = C bond. Thus cationic polymerisation is facilitated in monomers containing electron donating groups.

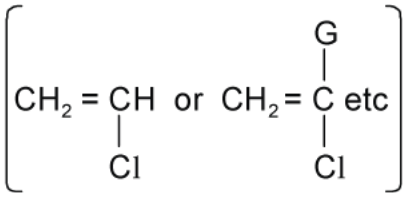


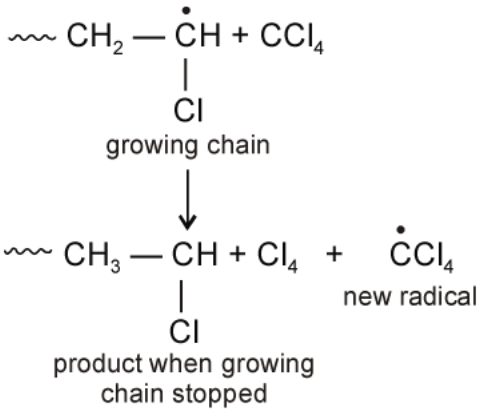
S8. We will prefer to polymerise acrylonitrile (CH_2 = CHCN) under anionic addition polymerisation conditions. It is because under anionic conditions, the active centre of propagating species is negatively charged. The polymerisation easily occurs with monomers like acrylonitrile becaus it contains electron withdrawing group such as nitrile. The density and facilitate the attack by nucleophile. Thus, acrylonitrile should be polymerised under anionic polymerisation conditions.

S9. Natural rubber is considered as a linear 1, 4-polymer of isoprene (2-methyl-1, 3-butadiene). In this polymer, the residual double bonds are located between C_2 and C_3 of isoprene units in the polymer. All these doubles bonds have cis-configuration.



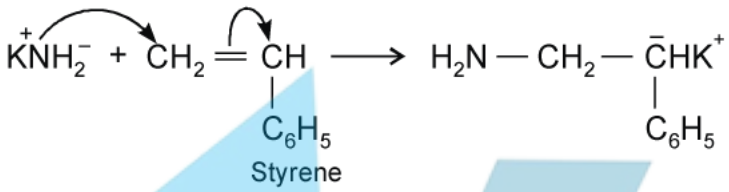
S10. It is because even the traces of certain impurities, which can act as chain transfer agent (or inhibitor) can interfere with the original polymerisation chain reaction. Hence monomers should be free from all impurities particularly such inhibitors. Examples of inhibitors (or chain transfer agents) are: CCl_4, CBr_4, amines, phenols, quinones etc.

S11. Carbon tetra chloride is a chain transer agent (or inhibitor) and greatly influences the polymerisation process. For example, vinyl chloride or its derivatives  in the presebce if CCl_4 polymerise to form PVC etc., of a lower average molecular mass. It is due to the fact growing vinylic radical which normally would add on a monomer react with CCl_4 to end the original chain and produces a new radical which (CCl_3) initiates a new polymerisation chain with monomer. It is illustrated as follows :

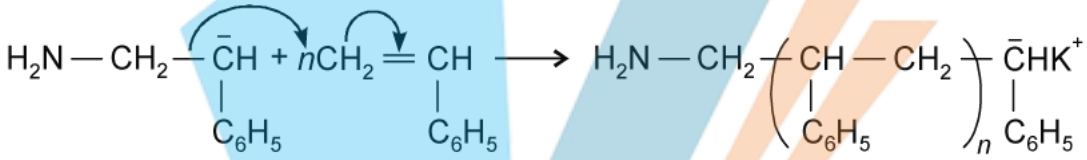


S12. **Anionic Addition Polymerisation:** Styrene undergoes anionic polymerisation easily. This is because C_6H_5 — Group in styrene is electron withdrawing resulting in the formation of ions.

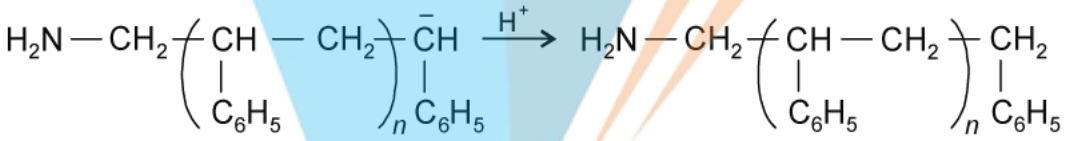
(a) **Chain Initiation Step:**



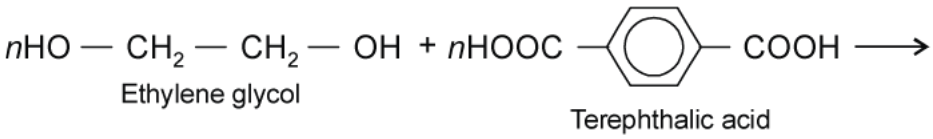
(b) **Chain propagation Step:**

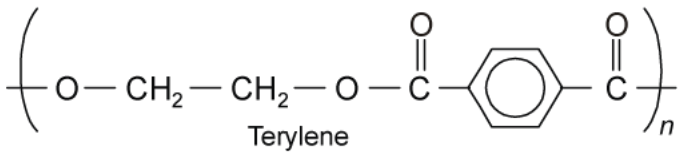


(c) **Chain Termination Step:**

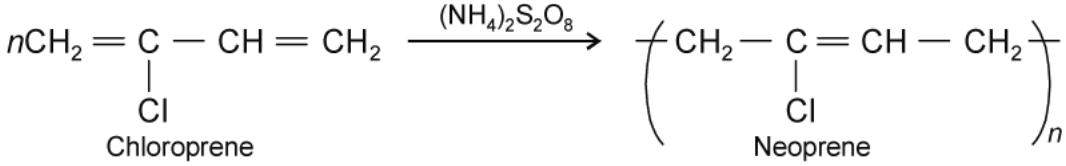


S13. (a) Terylene is prepared by the condensation between ethylene glycol and terephthalic acid.





(b) Neoprene is obtained by addition polymerisation of chloroprene.



S14. (a) Ranitidine is used as antacid.

(b) Paracetamol is used as analgesic and antipyretic drug.

(c) Tincture of iodine is used as antiseptic.

S15. (a) Hard water contains calcium ions which with soap to form calcium salt of soap which is insoluble in water. This forms scum and the soap goes waste.

$$\underset{\text{Sodium stearate (soap)}}{2C_{17}H_{35}COONa} + Ca^{2+} \longrightarrow \underset{\substack{\text{Calcium stearate}\\(\text{insoluble})}}{(C_{17}H_{35}COO)_2Ca} + 2\,Na^{+}$$

(b) (i) **Broad spectrum antibiotics:** These are the medicines which are effective against several harmful microorganisms. Tetracycline, and chloramphenicol are examples of this type of antibiotics. Chloramphenicol is used to cure typhoid, dysentery, acute fever, urinary infectious, meningitis and pneumonia.

(ii) **Non-ionic detergents:** Esters of high molecular mass formed by reaction between polyethylene glycol and stearic acid act as non-ionic detergents

$$\underset{\text{Polyethylene glycol stearate}}{CH_{39}(CH_2)_{16}COO(CH_2CH_2O)_nCH_2CH_2OH}$$

As it is an ester, it is non-ionic.

S16. (a) Hard water contains calcium ions which with soap to form calcium salt of soap which is insoluble in water. This forms scum and the soap goes waste.

$$\underset{\text{Sodium stearate (soap)}}{2C_{17}H_{35}COONa} + Ca^{2+} \longrightarrow \underset{\substack{\text{Calcium stearate}\\(\text{insoluble})}}{(C_{17}H_{35}COO)_2Ca} + 2\,Na^{+}$$

(b) (i) **Broad spectrum antibiotics:** These are the medicines which are effective against several harmful microorganisms. Tetracycline, and chloramphenicol are examples of this type of antibiotics. Chloramphenicol is used to cure typhoid, dysentery, acute fever, urinary infectious, meningitis and pneumonia.

(ii) **Non-ionic detergents:** Esters of high molecular mass formed by reaction between polyethylene glycol and stearic acid act as non-ionic detergents

$$\underset{\text{Polyethylene glycol stearate}}{CH_{39}(CH_2)_{16}COO(CH_2CH_2O)_nCH_2CH_2OH}$$

As it is an ester, it is non-ionic.

S17. (a) **Antihistamines:** Drugs which counteract the effect of histamine which is produced due to allergy are called antihistamines. For example Chlorophnaramine.

(b) **Antacids:** Drugs which are used in treating hyperacidity are called antacids. For example, $Mg(PH)_2$.

S18. Biodegradable detergents are those detergents which are decomposed by microorganisms into harmless products. They do not create water pollution. Detergents having linear alkyl chains are biodegradable. Non-biodegradable detergents are those which are not decomposed by microorganisms in the environment. They create water pollution. For example, *n*-lauryl sulphonate is biodegradable whereas detergent with branched chains are non-biodegradable.

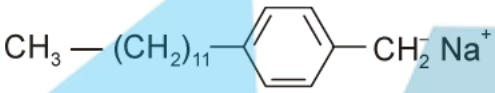
Consequence of using non-biodegradable detergents : Bacteria can not degrade this easily. Effluents containing such drugs reach the river, pond etc. These persist in water even after sewage treatment and causing foaming in river, ponds and streams and their water gets polluted.

S19. (a) **Cationic detergents:** These are quaternary ammonium salts. For example, cetyltrimethylammonium chloride.

(b) **Anionic detergents:** These are so called because a large part of their molecules are anions. These are of two types:

(i) **Sodium alkyl sulphates:** For example, sodium lauryl sulphate, $C_{11}H_{23}CH_2OSO_3Na$.

(ii) **Sodium alkylbenzenesulphonates:** The most widely used domestic detergent is sodium dodecylbenzenesulphonate (SDS).



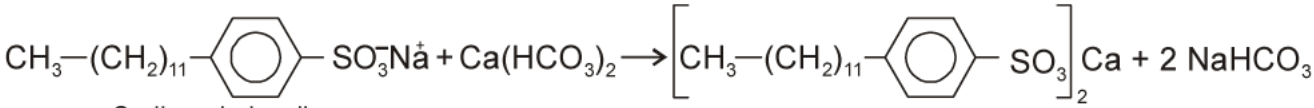
(c) **Neutral or Non-ionic detergents:** These are esters of high molecular mass alcohols with fatty acids. For example, polyethylene glycol stearate,

$$CH_3(CH_2)_{16}COO(CH_2CH_2O)_nCH_2CH_2OH$$

Polyethylene glycol stearate

S20. Water containing calcium hydrogent carbonate is hard water. Calcium ions react with soap to form calcium salts of soap which are insoluble. They form a gummy mass and stick to the clothes. This difficulty does not arise when we use detergents because calcium salts of detergents are soluble in water.

$$\underset{\text{Sodium stearate (Soap) Soluble in water}}{2C_{17}H_{35}COONa} + Ca(HCO_3)_2 \longrightarrow \underset{\text{Calcium stearate (insoluble)}}{(C_{17}H_{35}COO)_2Ca} + 2NaHCO_3$$



Sodium dodecylbenzene Sulphonate (synthetic detergent)

Calcium dodecylbenzene sulphonate (Soluble in hard water)

S21. (a) $\underbrace{CH_3(CH_2)_{10}CH_2}_{\text{Hydrophobic part}} - \underbrace{OSO_3^-Na^+}_{\text{Hydrophilic part}}$

(b) $\underbrace{CH_3(CH_2)_{15}}_{\text{Hydrophobic part}} - \underbrace{\overset{+}{N}(CH_3)_3\,Br^-}_{\text{Hydrophilic part}}$

(c) $\underbrace{CH_3(CH_2)_{16}}_{\text{Hydrophobic part}} - \underbrace{COO(CH_2CH_2O)_nCH_2CH_2OH}_{\text{Hydrophilic part}}$