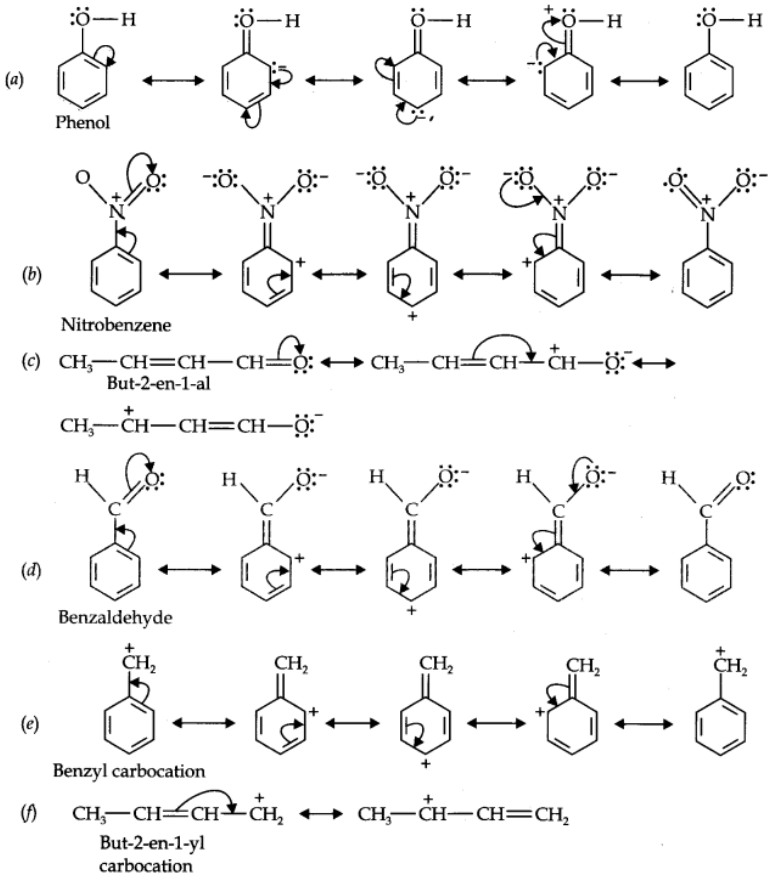
Question 11. Draw the resonance structures for the following compounds. Show the electron shift using curved-arrow notation.
(a) C_6H_5OH (b) $C_6H_5NO_2$
(c) $CH_3CH{=}CHCHO$
(d) $C_6H_5{-}CHO$
(e) $C_6H_5{-}CH_2$
(f) $Ch_3Ch{=}ChCh_2$
Answer:



Question 12. What are electrophiles and nucleophiles? Explain with examples:
Answer: Electrophiles: The name electrophiles means electron loving. Electrophiles are electron deficient. They may be positive ions or neutral molecules.
Ex: H^+, Cl^+, Br^+, NO_2^+, R_3C^+, RN_2^+, $AlCl_3$, BF_3
Nucleophiles: The name nucleophiles means 'nucleus loving' and indicates that it attacks the region of low electron density (positive centres) in a substrate molecule. They are electron rich they may be negative ions or neutral molecules.
Ex: Cl^- Br^-, CN^-, OH^-, RCR_2^-, NH_3, RNH_2, H_2O, ROH etc.

Question 13. Identify the reagents shown in bold in the following equations as nucleophiles or electrophiles
(a) $CH_3COOH + HO^- \rightarrow CH_3COO^- + H_2O$
(b) $CH_3COCH_3 + CN \rightarrow (CH_3)_2\,C(CN)(OH)$

(c) $C_6H_5 + CH_3CO \rightarrow C_6H_5COCH_3$

Answer:

Nucleophiles: (a) and (b) and Electrophile: (c)

Question 14. Classify the following reactions in one of the reaction type studied in this unit.

(a) $CH_3CH_2Br + HS^- \rightarrow CH_3CH_2SH + Br^-$

(b) $(CH_3)_2C{=}CH_2 + HCl \rightarrow (CH_3)_2CCl{-}CH_3$

(c) $CH_3CH_2Br + HO^- \rightarrow CH_2{=}CH_2 + H_2O + Br^-$

(d) $(CH_3)_3C{-}CH2OH + HBr \rightarrow (CH_3)_2$ C Br $CH_2CH_2CH_3 + H_2O$

Answer:

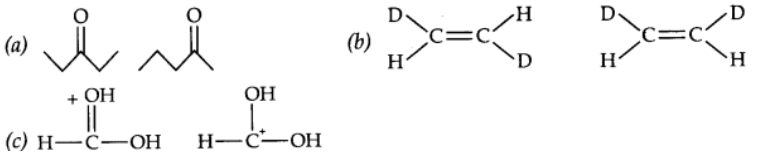
(a) Nucleophilic substitution

(b) Electrophilic addition

(c) Bimolecular elimination

(d) Nucleophilic substitution with rearrangement.

Question 15. What is the relationship between the members of following pairs of structures? Are they structural or geometrical isomers or resonance contributors?



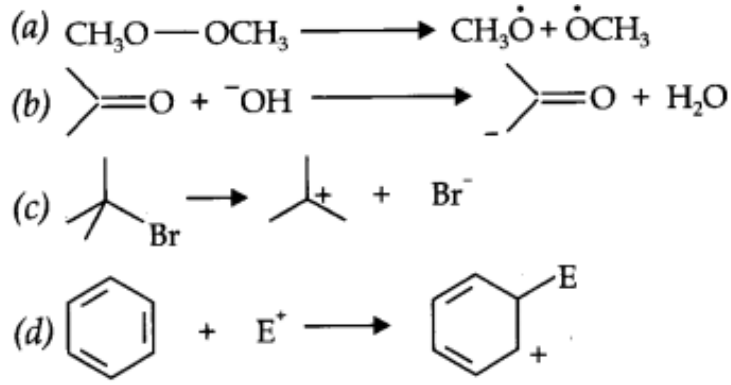
Answer:

(a) Structural isomers (actually position isomers as well as metamers)

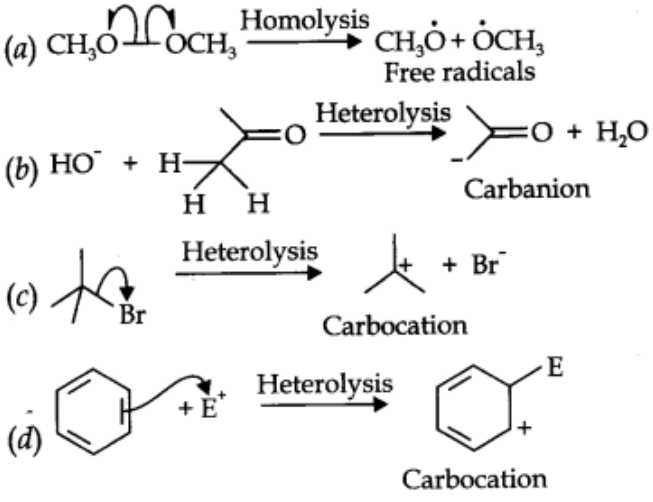
(b) geometrical isomers

(c) resonance contributors because they differ in the position of electrons but not atoms

Question 16. For the following bond cleavages, use curved-arrows to show the electron flow and classify each as homolysis or heterolysis. Identify reactive intermediate produced as free radical, carbocation and carbanion.



Answer:



Question 17. Explain the terms inductive and electromeric effects. Which electron displacement effect explain the following correct orders of acidity of the carboxylic acids?

(a) $Cl_3CCOOH > Cl_2CHCOOH > ClCH_2 COOH$

(b) $CH_3CH_2COOH > (CH_3)_2 CHCOOH > (CH_3)_3CCOOH$

Answer: Inductive Effect: The inductive effect refers to the polarity produced in a molecule as a result of higher electronegativity of one atom compared to another.Atoms or groups which lose electron towards a carbon atom are said to have +1 Effect.

Those atoms or groups which draw electron away from a carbon atom are said to have -I Effect.

Commomexamples of -I effect are:

NO_2, F, Cl, Br, I, OH etc.

Examples of +1 effect are (Electron releasing)

$(CH_3)_2C—$, $(CH_3)_2CH—$, $CH_3CH_2—$ $CH_3—$ etc.

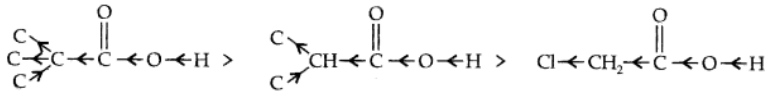
Electromeric effect: The electromeric effect refers to the polarity produced in a multiple bonded compound as it is approached by a reagent.

The atom A has lost its share in the electron pair and B has gained this share.

As a result A acquires a positive charge and B a negative charge. It is a temporary effect and takes place only in the presence of a reagent.

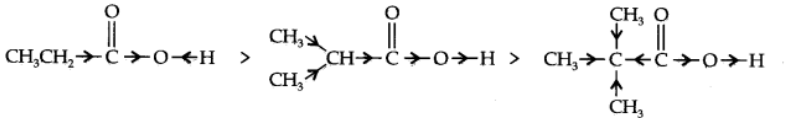
(a) -I-effect as shown below:

As the number of halogen atoms decreases, the overall -I- effect decreases and the acid strength decreases accordingly.



(b) +I-effect as shown below:

As the number of alkyl groups increases, the +I-effect increases and the acid strength
decreases accordingly.



Question 18. Give a brief description of the principles of the following techniques taking an example in each case: (a) Crystallisation (b) Distillation (c) Chromatography

Answer:

(a) Crystallisation: In this process the impure solid is dissolved in the minimum volume of a suitable solvent. The soluble impurities pass into the solution while the insoluble ones left behind. The hot solution is then filtered and allowed to cool undisturbed till crystallisation is complete. The crystals are then separated from the mother liquor by filtraration and dried.

Example: crystallisation of sugar.

(b) Distillation: The operation of distillation is employed for the purification of liquids from non-volatile impurities. The impure liquid is boiled in a flask and the vapours so formed are collected and condensed to give back pure liquid in another vessel. Simple organic liquids such as benzene toluene, xylene etc. can be purified.

(c) Chromatography: Chromatography is based on the principle of selective distribution of the components of a mixture between two phases, a stationary phase and a moving phase. The stationary phase can be a solid or liquid, while the moving phase is a liquid or a gas. When the stationary phase is solid the basis is adsorption and when it is a liquid the basis is partition. Chromatography is generally

used for the Reparation of coloured substances such as plant pigments or dyestuffs.

Question 19. Describe the method, which can be used to separate two compounds with different solubilities in a solvent S.
Answer: Fractional crystallisation is used for this purpose. A hot saturated solution of these two compounds is allowed to cool, the less soluble compound crystallises out while the more soluble remains in the solution. The crystals are separated from the mother liquor and the mother liquor is again concentrated and the hot solution again allowed to cool when the crystals of the second compound are obtained. These are again filtered and dried.

Question 20. What is the difference between distillation, distillation under reduced pressure and steam distillation?
Answer: Distillation is used in case of volatile liquid mixed with non-volatile impurities.
Distillation under reduced pressure: This method is used to purify such liquids which have very high boiling points and which decompose at or below their boiling points.
Steam distillation is used to purify steam volatile liquids associated with water immiscible impuritites.

********** END **********