Organic Chemistry–Some Basic Principles and Techniques

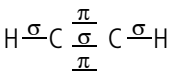
CHAPTER 12

TRY YOURSELF

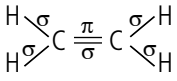
ANSWERS

1. A double bond will always have one sigma bond and one pi-bond a triple bond will always have one sigma bond and two pi-bonds.

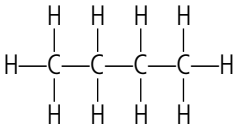
(a) From the structure of C_2H_2, it is clear that it has three sigma bonds and two pi-bonds.



(b) From the structure of C_2H_4,it is clear that it has five sigma bonds and one pi-bond.

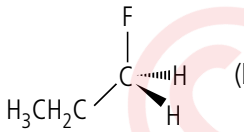
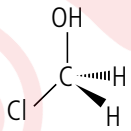


(c) From the structure of C_4H_{10}, it is clear that it has thirteen sigma bonds and zero pi-bonds.

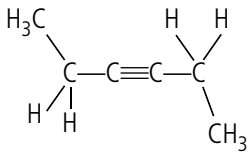


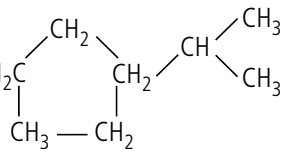
2. (1) σ-bond results by the end to end overlapping of two *s*-orbitals or *p*-orbitals or one *s* and one *p*-orbital while π-bond results from the sideways overlapping of two π-orbitals.

(2) σ-bond can have independent existence while π-bond always exists along with a σ-bond.

3. (a)  (b) 

4. In the given structure, there are 6 carbons and 10 hydrogens.



5. (i) 

(ii) $H-C\equiv C-CH_2-CH_2-C\equiv N$

6. (a) Homocyclic, alicyclic, saturated

(b) Homocyclic, aromatic, unsaturated

(c) Heterocyclic, alicyclic, saturated

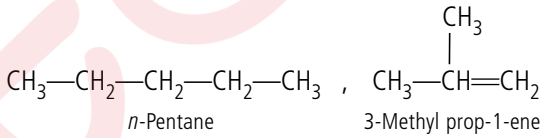
(d) Unsaturated

7. **Benzenoid aromatic compounds :** Organic compounds containing one or more fused benzene ring and their functional derivatives.

Example : Benzene, naphthalene.

Non-benzenoid aromatic compounds : Aromatic compounds which do not contain a benzene ring but instead contain other highly unsaturated rings. Example : Tropolone, azulene.

8. Open chain compounds are called aliphatic compounds.

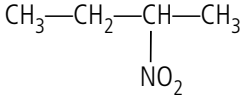


n-Pentane 3-Methyl prop-1-ene

9. (a) 3-Methylaniline

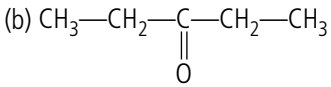
(b) 4-Chloro-3-hydroxy-2-methyl-pentanal

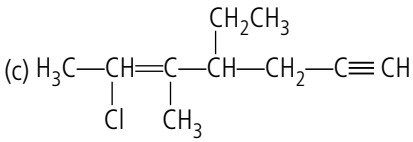
10. $-NO_2$(nitro) group has only a prefix not any suffix.



2-Nitrobutane

11. (a) 

(b) 

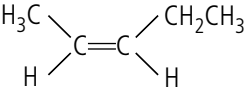
(c) 

12. (a) Chain isomerism

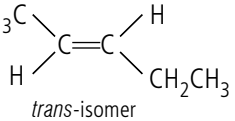
(b) Functional group isomerism

13. (a) *trans* (b) *cis*

(c) *cis* (d) neither

14. (a) 

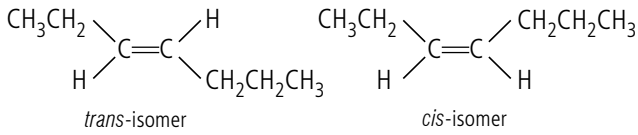
cis-isomer



trans-isomer

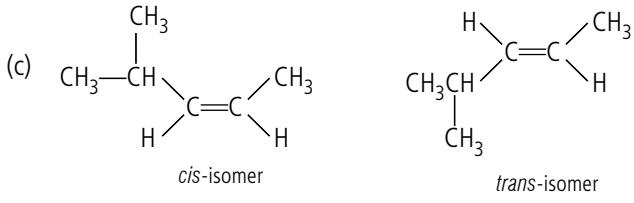
2-Bromo-2-pentene

(b)



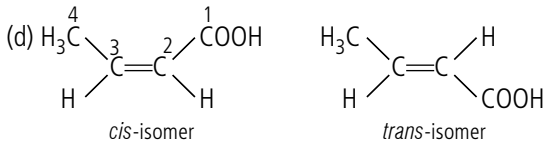
3-Heptene

(c)



4-Methyl-2-pentene

(d)



2-Butenoic acid

15. Electrophile: $CH_3\overset{+}{C}H_2$, $\dot{C}H_3$

Nucleophile: OH^-, $\ddot{\bar{C}}H_3$

16. Water is highly polar compound with high density of electrons or electron rich molecule. Hence, water is an example of nucleophile.

17. $(CH_3)_3C^+$ has nine alpha hydrogens and has nine hyperconjugation structures while $CH_3\overset{+}{C}H_2$ has three alpha hydrogens and has three hyperconjugation structures, therefore$(CH_3)_3C^+$ is more stable than $CH_3\overset{+}{C}H_2$.

18. (i) There are three structural isomers of pentane:

$CH_3 - CH_2 - CH_2 - CH_2 - CH_3$

n-Pentane

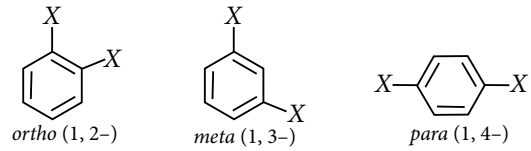
$CH_3 - CH_2 - CH(CH_3) - CH_3$

2–Methylbutane

$CH_3 - C(CH_3)_2 - CH_3$

2, 2 -Dimethylpropane

19. Three isomers are possible. These are :



Since, these isomers differ in the position of the substituents on the benzene ring, therefore, these are called position isomers.

20. $H-C\equiv C^- > H_3C-C\equiv C^- > CH_3-CH_2^-$

The stability of the carbanion increases with the increase in *s*-character of the carbon carrying the *–ve* charge.

21. (i) $(CH_3)_3\bar{C} : < CH_3-\ddot{\bar{C}}H-CH_3 < CH_3-\ddot{\bar{C}}H_2$

(ii) $CH_3COOH < H-COOH < Cl-CH_2-COOH$

22. (i) Fractional distillation because the boiling points of the two liquids differ by just 9°.

(ii) Simple distillation since the boiling points of the two liquids are widely apart.

23. Steam distillation is applied to separate substances which are steam volatile and are immiscible with water. In steam distillation, steam from a steam generator is passed through a heated flask containing the liquid to be distilled. The mixture of steam and the volatile organic compound is condensed and collected. The compound is later separated from water by using a separating funnel. In steam distillation the liquid boils when the sum of the vapour pressure due to organic liquid (p_1) and that due to water (p_2) becomes equal to the atmospheric pressure (p).

$$p = p_1 + p_2$$

Since p_1, is lower than p, the organic liquid vaporises at lower temperature than its boiling point without decomposition.

24. Halogen in an organic compound is detected by Carius method. A known mass of an organic compound is heated with fuming nitric acid in presence of silver nitrate contained in Carius tube. Carbon and hydrogen are oxidised to carbon dioxide and water. The halogen present forms silver halide, that is finally weighed.

25. When nitrogen and sulphur are both present in an organic compound, sodium thiocyanate is formed and it gives blood red colour.

$$Na + C + N + S \longrightarrow NaSCN$$

$$Fe^{3+} + SCN^- \longrightarrow \underset{\text{Blood red}}{[Fe(SCN)]^{2+}}$$

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