Science

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(Chapter – 4) (Carbon and its Compounds)

(Class – X)

Exercises

Question 1:
Ethane, with the molecular formula C_2H_6 has

(a) 6 covalent bonds.

(b) 7 covalent bonds.

(c) 8 covalent bonds.

(d) 9 covalent bonds.

Answer 1:
(b) Ethane has 7 covalent bonds.

Question 2:
Butanone is a four-carbon compound with the functional group

(a) carboxylic acid.

(b) aldehyde.

(c) ketone.

(d) alcohol.

Answer 2:
(c) The functional group of butanone is ketone.

Question 3:
While cooking, if the bottom of the vessel is getting blackened on the outside, it means that

(a) the food is not cooked completely.

(b) the fuel is not burning completely.

(c) the fuel is wet.

(d) the fuel is burning completely.

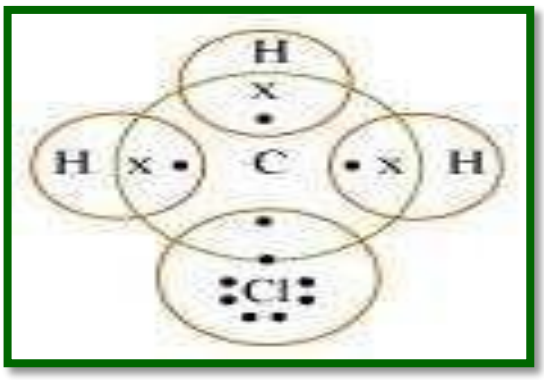
Answer 3:
(b) While cooking, if the bottom of the vessel is getting blackened on the outside, then it means that the fuel is not burning completely.

Question 4:

Explain the nature of the covalent bond using the bond formation in CH_3Cl.

Answer 4:

Carbon can neither lose four of its electrons nor gain four electrons as both the processes require extra amount of energy and would make the system unstable. Therefore, it completes its octet by sharing its four electrons with other carbon atoms or with atoms of other elements. The bonds that are formed by sharing electrons are known as covalent bonds. In covalent bonding, both the atoms share the valence electrons, i.e., the shared electrons belong to the valence shells of both the atoms.



Here, carbon requires 4 electrons to complete its octet, while each hydrogen atom requires one electron to complete its duplet. Also, chlorine requires an electron to complete the octet. Therefore, all of these share the electrons and as a result, carbon forms 3 bonds with hydrogen and one with chlorine.

Question 5:

Draw the electron dot structures for

(a) ethanoic acid.

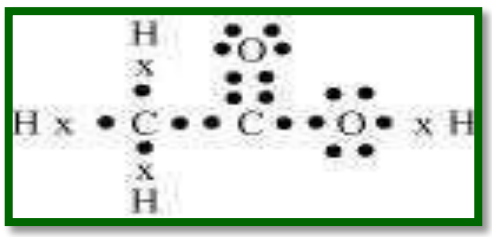
(b) H_2S.

(c) propanone.

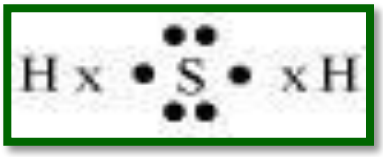
(d) F_2.

Answer 5:

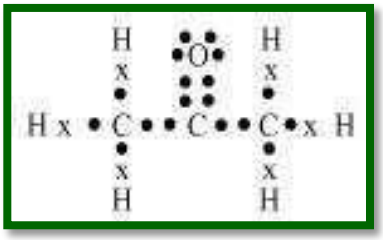
(a) Ethanoic acid



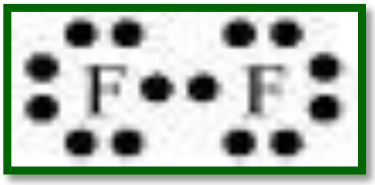
(b) H_2S



(c) Propanone



(d) F_2



Question 6:

What is a homologous series? Explain with an example.

Answer 6:

A homologous series is a series of carbon compounds that have different numbers of carbon atoms but contain the same functional group.

For example, methane, ethane, propane, butane, etc. are all part of the alkane homologous series. The general formula of this series is C_nH_{2n+2}.

Methane	CH_4
Ethane	CH_3CH_3
Propane	$CH_3CH_2CH_3$
Butane	$CH_3CH_2CH_2CH_3$

It can be noticed that there is a difference of $-CH_2$ unit between each successive compound.

Question 7:

How can ethanol and ethanoic acid be differentiated on the basis of their physical and chemical properties?

Answer 7:

- ✓ Ethanol is a liquid at room temperature with a pleasant odour while ethanoic acid has vinegar-like smell. The melting point of ethanoic acid is 17°C. This is below room temperature and hence, it freezes during winters.
- ✓ Ethanoic acid reacts with metal carbonates and metal hydrogencarbonates to form salt, water, and carbon dioxide gas while ethanol does not react with them.

Metal Carbonates/Metal Hydrogencarbonates + Carboxylic acid

↓

Salt + Water + Carbon dioxide

For example,

$$2CH_3COOH + Na_2CO_3 \longrightarrow 2CH_3COONa + H_2O + CO_2$$

Metal Carbonates/Metal Hydrogencarbonates + Alcohols

↓

No reaction

For example,

$$CH_3CH_2OH + Na_2CO_3 \longrightarrow \text{No reaction}$$

Question 8:

In the electrolytic refining of a metal M, what would you take as the anode, the cathode and the electrolyte?

Answer 8:

In the electrolytic refining of a metal M:

Anode → Impure metal M

Cathode → Thin strip of pure metal M

Electrolyte → Solution of salt of the metal M

Question 9:
Why are carbon and its compounds used as fuels for most applications?

Answer 9:
Most of the carbon compounds give a lot of heat and light when burnt in air. Saturated hydrocarbons burn with a clean flame and no smoke is produced. The carbon compounds, used as a fuel, have high calorific values. Therefore, carbon and its compounds are used as fuels for most applications.

Question 10:
Explain the formation of scum when hard water is treated with soap.

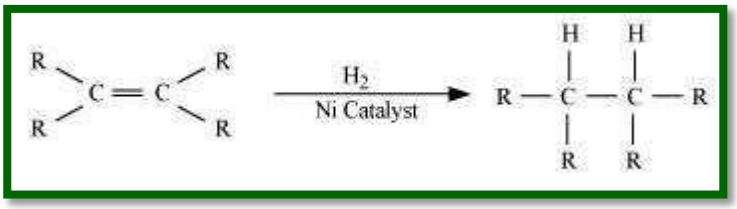
Answer 10:
Soap does not work properly when the water is hard. A soap is a sodium or potassium salt of long chain fatty acids. Hard water contains salts of calcium and magnesium. When soap is added to hard water, calcium and magnesium ions present in water displace sodium or potassium ions from the soap molecules forming an insoluble substance called scum. A lot of soap is wasted in the process.

Question 11:
What change will you observe if you test soap with litmus paper (red and blue)?

Answer 11:
Since soap is basic in nature, it will turn red litmus blue. However, the colour of blue litmus will remain blue.

Question 12:
What is hydrogenation? What is its industrial application?

Answer 12:
Hydrogenation is the process of addition of hydrogen. Unsaturated hydrocarbons are added with hydrogen in the presence of palladium and nickel catalysts to give saturated hydrocarbons.



This reaction is applied in the hydrogenation of vegetables oils, which contain long chains of unsaturated carbons.

Question 13:

Which of the following hydrocarbons undergo addition reactions:
C_2H_6, C_3H_8, C_3H_6, C_2H_2 and CH_4.

Answer 13:

Unsaturated hydrocarbons undergo addition reactions. Being unsaturated hydrocarbons, C_3H_6 and C_2H_2 undergo addition reactions.

Question 14:

Give a test that can be used to differentiate chemically between butter and cooking oil.

Answer 14:

Butter contains saturated fats. Therefore, it cannot be hydrogenated. On the other hand, oil has unsaturated fats. That is why it can be hydrogenated to saturated fats (solids).

Question 15:

Explain the mechanism of the cleaning action of soaps.

Answer 15:

Cleansing action of soaps:

The dirt present on clothes is organic in nature and insoluble in water. Therefore, it cannot be removed by only washing with water. When soap is dissolved in water, its hydrophobic ends attach themselves to the dirt and remove it from the cloth. Then, the molecules of soap arrange themselves in micelle formation and trap the dirt at the centre of the cluster. These micelles remain suspended in the water. Hence, the dust particles are easily rinsed away by water.