

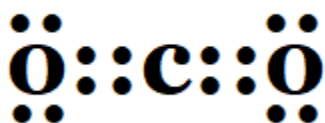
Chapter-4

Carbon and its Compounds

2 MARKS QUESTIONS

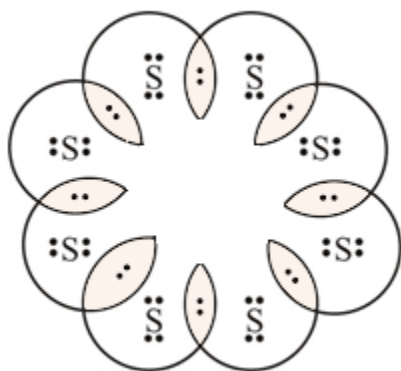
1.What would be the electron dot structure of carbon dioxide which has the formula of CO₂?

Solution :



2.What would be the electron dot structure of a molecule of Sulphur which is made up of eight atoms of Sulphur? (Hint – The eight atoms of Sulphur are joined together in the form of a ring).

Solution:



3.What are oxidising agents?

Solution:

Oxidising agents are those compounds which either remove hydrogen or add oxygen to a compound. For example, halogens, potassium nitrate, and nitric acid.

4.Which of the following hydrocarbons undergo addition reactions:

C_2H_6 , C_3H_8 , C_3H_6 , C_2H_2 and CH_4 ?

Solution:

Unsaturated hydrocarbons undergo addition reactions. C_3H_6 and C_2H_2 are unsaturated hydrocarbons which undergo addition reactions.

5.Explain the formation of scum when hard water is treated with soap.

Solution:

Scum is produced from the reaction of hard water with soap. Calcium and magnesium present in the hard water form an insoluble precipitate called scum.

6.What are two properties of carbon which lead to the huge number of carbon compounds we see around us?

Solution :

The two properties are :

(a) catenation- the ability to form bonds with other atoms of carbon.

(b) Tetravalency of carbon.

7.Would you be able to check if water is hard by using a detergent?

Solution :

No, we would be able to check if water is hard by using a detergent.

8.People use a variety of methods to wash clothes. Usually after adding the soap, they beat the clothes on stone, or beat it with a paddle, scrub with a brush or the mixture is agitated in a washing machine. Why is agitation necessary to get clean clothes?

Solution :

Agitation is necessary to obtain complete micelle formation and the emulsion of oil in water so that the whole of dirt is removed on rinsing with water.

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

Solution :

Butter and cooking oil can be differentiated with the help of bromine water test. Cooking oil will decolorize the red colour of bromine water on shaking while butter will not.

4 MARKS QUESTIONS

1.What are the two properties of carbon which lead to the huge number of carbon compounds we see around us?

Solution:

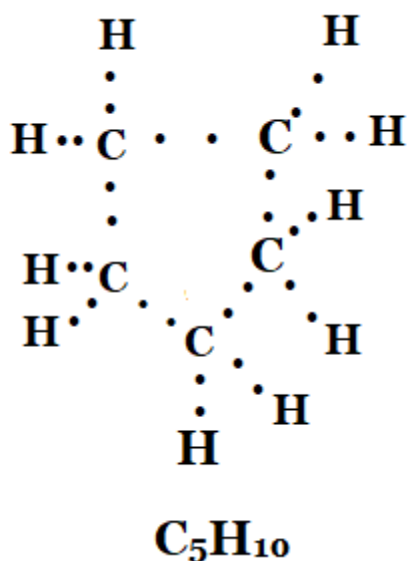
Two properties of carbon which lead to the huge number of carbon compounds we see around us are as given below:

- Carbon has six valence electrons which is actually a high number of valency.
- Covalent bonding happens easily with carbon atoms and numerous others, such as oxygen, chlorine, nitrogen, sulphur, hydrogen, etc.

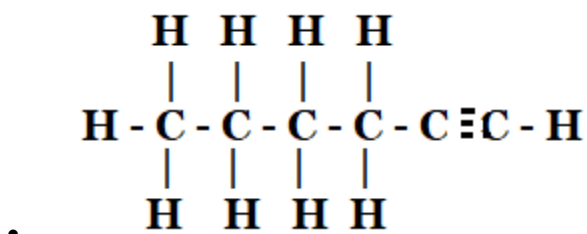
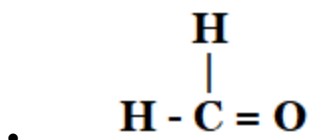
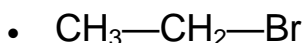
2.What will be the formula and electron dot structure of cyclopentane?

Solution:

The formula and electron dot structure of cyclopentane is as given below:



3. How would you name the following compounds?



Solution:

- 1. Bromoethane
 2. Methanal or Formaldehyde
 3. 1 – Hexyne

4. A mixture of oxygen and ethyne is burnt for welding. Can you tell why a mixture of ethyne and air is not used?

Solution:

A mixture of oxygen and ethyne is burnt for welding instead of a mixture of ethyne and air because the production of heat is very important for welding metals. When oxygen and ethyne are burnt, it burns completely and produces a higher temperature than air and ethyne. Oxygen and ethyne produce a very hot blue flame, but the mixture of air and ethyne gives out a sooty flame which means that there are unburnt particles, resulting in lesser heat.

5. Would you be able to check if water is hard by using a detergent?

Solution:

It is not possible to check if water is hard by using a detergent because detergents are salts of ammonium or sulphonates of long-chain carboxylic acids. Unlike soaps, they do not react with calcium and magnesium to distinguish the nature of water.

6. 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: (b) the fuel is not burning completely

Solution:

While cooking, if the bottom of the vessel is getting blackened on the outside indicates that the fuel is not burning completely.

7. Why are carbon and its compounds used as fuels for most applications?

Solution:

Carbon and its compounds are used as fuels for most applications because they have high calorific values and give out a lot of energy. Most of carbon compounds give a lot of heat and light when burnt in the air.

8. Explain the formation of scum when hard water is treated with soap.

Solution:

Scum is produced from the reaction of hard water with soap. Calcium and magnesium present in the hard water form an insoluble precipitate called scum.

9. What change will you observe if you test soap with litmus paper (red and blue)?

Solution:

When soap is dissolved in water due to the formation of alkaline NaOH or KOH, the solution is alkaline. The solution changes the colour of the red litmus to blue, but in the soap solution, the blue litmus remains blue.

10. What is hydrogenation? What is its industrial application?

Solution:

Hydrogenation is a process or a chemical reaction between hydrogen and other compounds. It is usually done in the presence of catalysts. For example, nickel, palladium or platinum. Hydrogenation is used mainly to saturate organic compounds.

7 MARKS QUESTIONS

1. How many structural isomers can you draw for pentane?

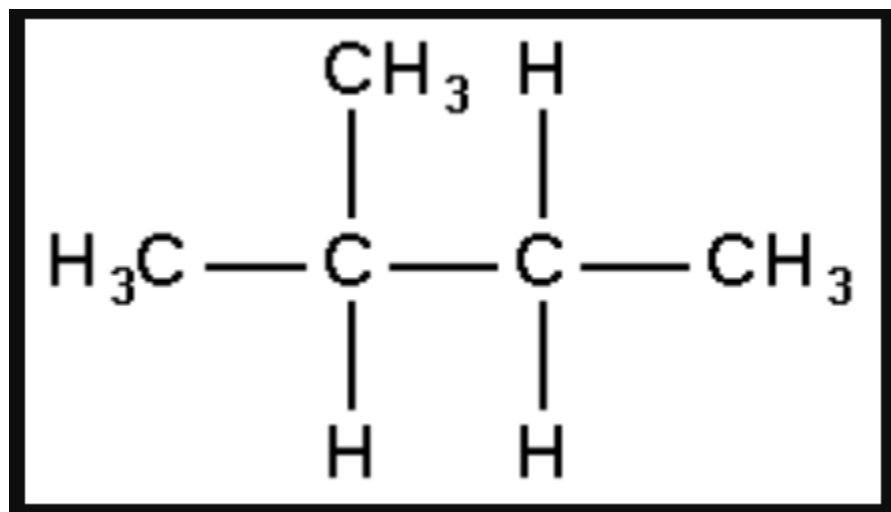
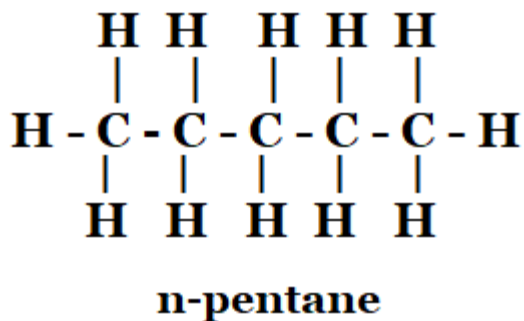
Solution:

The structural isomers of pentane are as follows:

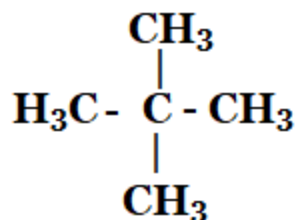
n-pentane

2-methylbutane

2, 2-dimethylpropane



2-methylbutane



2,2 dimethylpropane

2. Draw the structures for the following compounds.

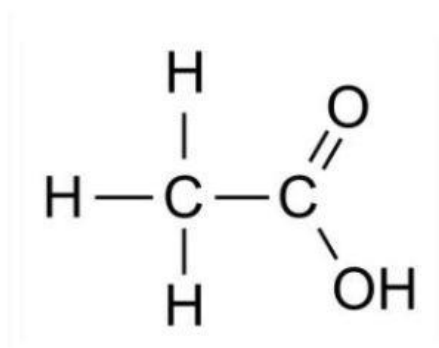
(i) Ethanoic acid

(ii) Bromopentane*

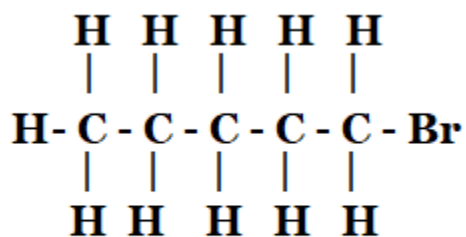
(iii) Butanone

(iv) Hexanal

Solution: i)

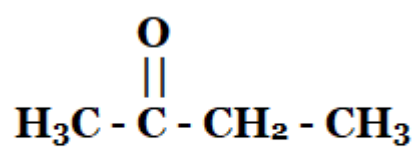


ii)



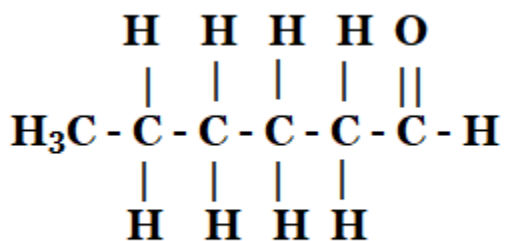
Bromopentane

iii)



Butanone

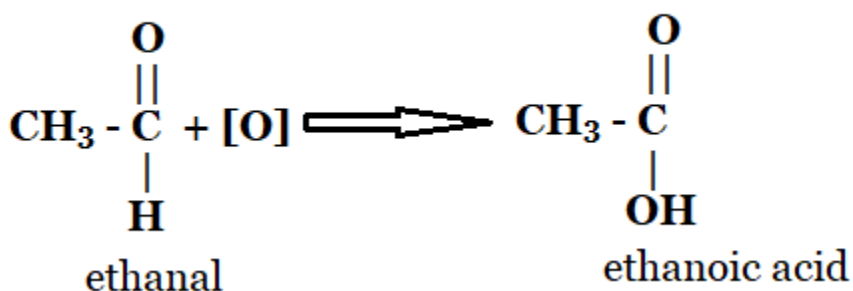
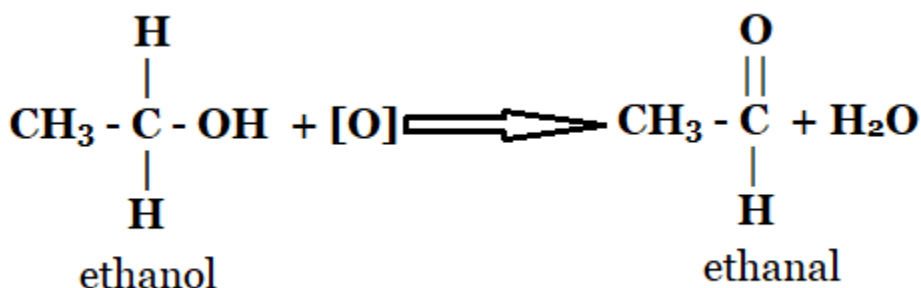
iv)



Hexanal

3. How is the conversion of ethanol to ethanoic acid an oxidation reaction?

Solution:



The conversion of ethanol to ethanoic acid involves the removal of the hydrogen atom and the addition of oxygen, and it is an oxidation reaction. In the first step, a H_2 molecule is removed from ethanol to form ethanal. As the loss of hydrogen is oxidation, so the reaction is an oxidation reaction. Similarly, an oxygen atom is added to form ethanoic acid from ethanal. As the gain of oxygen is called oxidation, the reaction is an oxidation reaction.

4. A mixture of oxygen and ethyne is burnt for welding. Can you tell why a mixture of ethyne and air is not used?

Solution:

A mixture of oxygen and ethyne is burnt for welding instead of a mixture of ethyne and air because the production of heat is very important for welding metals. When oxygen and ethyne are burnt, it burns completely and

produces a higher temperature than air and ethyne. Oxygen and ethyne produce a very hot blue flame, but the mixture of air and ethyne gives out a sooty flame which means that there are unburnt particles, resulting in lesser heat.

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

Solution:

Carbon can neither lose 4 electrons nor gain four electrons as these processes make the system unstable due to the requirement of extra energy. Therefore, CH_3Cl completes its octet configuration by sharing its 4 electrons with carbon atoms or with atoms of other elements. Hence, the bonding that exists in CH_3Cl is a covalent bonding.

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 electrons, and as a result, carbon forms 3 bonds with hydrogen and one with chlorine.

6. Draw the electron dot structures for

(a) ethanoic acid

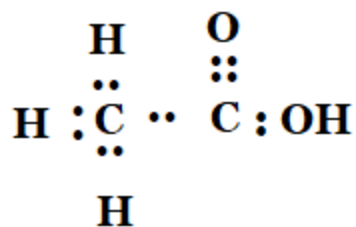
(b) H_2S

(c) propanone

(d) F_2

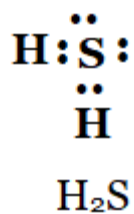
Solution:

a)

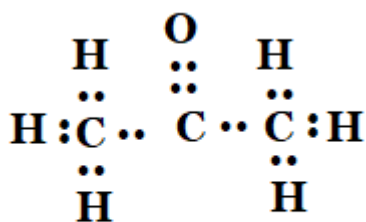


ethanoic acid

b)

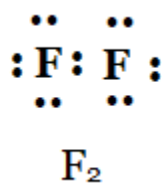


c)



propanone

d)



7. What is a homologous series? Explain with an example.

A homologous series is a series of compounds which has the same functional group. This also contains a similar general formula and chemical properties. Since there is a change in the physical properties, we can say that there would be an increase in molecular size and mass.

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.

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

Solution:

Ethanol	Ethanoic acid
It does not react with sodium hydrogen carbonate	Bubbles and fizzes with sodium hydrogen carbonate
A good smell	Smells like vinegar
No action in litmus paper	Blue litmus paper to red
Burning taste	Sour taste

9. Why does micelle formation take place when soap is added to water? Will a micelle be formed in other solvents, such as ethanol also?

Solution:

Micelle formation takes place because of the dirt particles in water and clean water. There are two mediums that are involved: one is pure water, and the other is dirt, also called impurities. The soap also has two mediums:

- (i) organic tail
- (ii) ionic head

So the organic tail mixes and dissolves with the dirt, whereas the oil or grease and ionic head dissolve and mix with the water. Therefore, when the material to be cleaned is removed from the water, the dirt is taken off by the soap molecules in the water. Hence, the soap cleans by forming closed structures through the mutual repulsion of the micelles (positively charged heads).

Other solvents, such as ethanol, in which sodium salt of fatty acids does not dissolve, so not able to form such micelles.

10. Give a test that can be used to differentiate between saturated and unsaturated hydrocarbons.

Solution:

The bromine water test is used to differentiate between the unsaturated compounds (like alkenes and alkynes) and the saturated compounds. For this purpose, bromine is used in the form of bromine water. A solution of bromine in water is called bromine water. Bromine water has a red-brown colour due to the presence of bromine in it. When bromine water is added to an unsaturated compound, then bromine gets added to the unsaturated compound, and the red-brown colour of bromine water is discharged. So, if

an organic compound decolourises bromine water, then it will be an unsaturated hydrocarbon (containing a double bond or a triple bond), but saturated hydrocarbons (alkanes) do not decolourise bromine water.

The bromine water test is performed to differentiate between the unsaturated compounds (like alkenes and alkynes) and the saturated compounds. When bromine water is added to an unsaturated hydrocarbon, the red-brown colour of the bromine solution is discharged. So, if there is dis-colouration, then the compound will be an unsaturated hydrocarbon.

11. Explain the mechanism of the cleaning action of soaps.

Solution:

There are so many impurities and dirt mixed in water, and most of all, the dirt does not dissolve in the water. Soap molecules are a combination of salts such as sodium or potassium. The molecules are of a long chain of carboxylic acids. So, when the carbon chain is dissolved in oil, and the ionic end is dissolved in the water, the soap starts cleansing and trapping the dirt. When this happens, the soap molecules form structures called micelles that are used for capturing the oil droplets, and then the other end is the ionic faces. This will then form an emulsion in water and help in dissolving the dirt or impurities when the clothes are washed.

The soap molecules have different properties at different ends. The first end is the hydrophilic end, which dissolves in the water and is attracted towards the water, and the second one is the hydrophobic end, which is dissolved in the hydrocarbons and is repulsive to water. The hydrophobic tail aligns itself along the surface of the water because it is not soluble in the water.

MULTIPLE CHOICE QUESTIONS

1) The electronic configuration of an element is found to be 2, 4. How many bonds can one carbon atom form in a compound?

- (a) 1
- (b) 2
- (c) 4
- (d) 6

Correct Answer: Option (c)

2) The following chemical reaction shows the addition of chlorine to methane in the presence of sunlight:

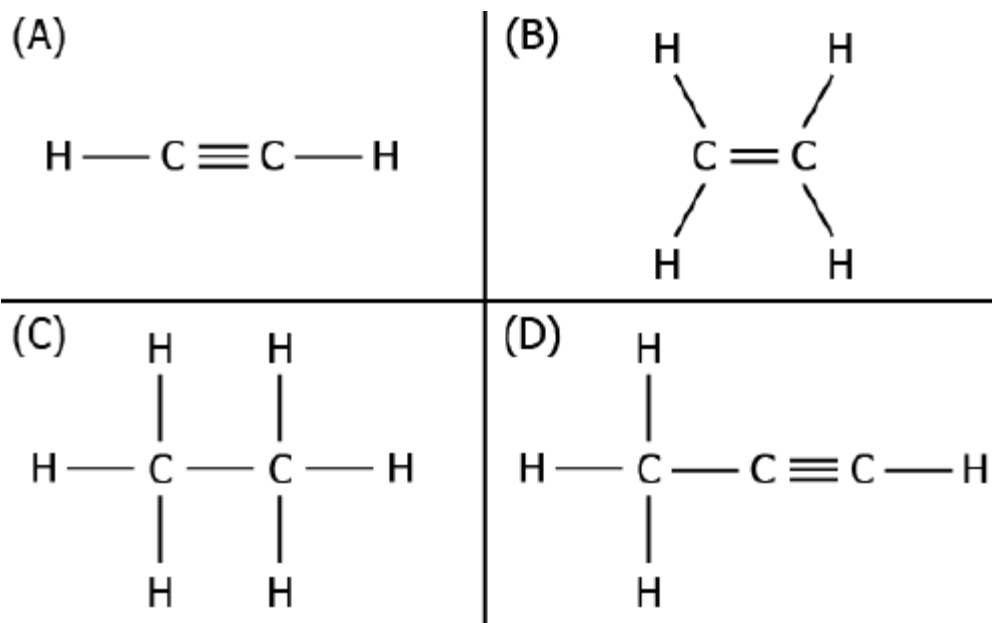


What is likely to be the product of the reaction represented by “X”?

- (a) $\text{CH}_4 + \text{H}_2\text{SO}_4$
- (b) $\text{CH}_3\text{Cl} + \text{HCl}$
- (c) $\text{CHCl}_3 + \text{HCl}$
- (d) $\text{CH}_3\text{Cl} + \text{H}_2\text{SO}_4$

Correct Answer: Option (b)

3) The image represents the structure of a few hydrocarbon compounds.

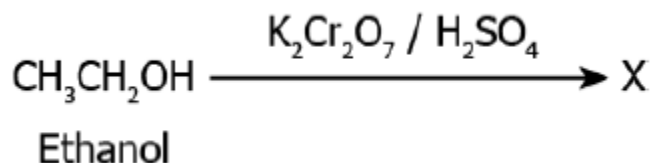


Which of these compounds can be classified as alkynes?

- (a) Only (A)
- (b) Only (B)
- (c) Both (A) and (D)
- (d) Both (B) and (C)

Correct Answer: Option (c)

4) The below image represents a chemical reaction where ethanol is oxidised using potassium dichromate and sulphuric acid.

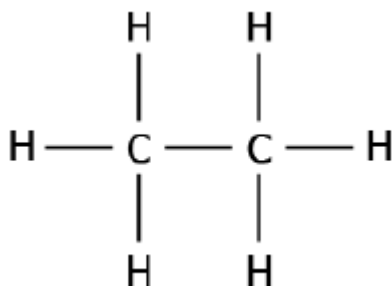


Which of the following option represents the product “X”?

- (a) CH_2O
- (b) CH_3CH
- (c) $\text{CH}_3\text{H}_2\text{O}$
- (d) CH_3COOH

Correct Answer: Option (d)

5) The given image represents the structure of a carbon compound known as ethane.

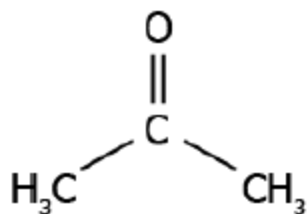


Which of the following option explains the naming of ethane?

- (a) The presence of a functional group connected with a single bond
- (b) As it contains two carbon atoms, and a single bond connects the carbon atoms
- (c) Carbon compound with a total number of eight atoms is named ethane
- (d) As it contains six hydrogen atoms, and a single bond connects the carbon and hydrogen atom

Correct Answer: Option (b)

6) The following image represents a carbon compound.



Which functional group is present in the compound?

- (a) Alcohol
- (b) Aldehyde
- (c) Carboxylic acid
- (d) Ketone

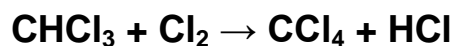
Correct Answer: Option (d)

7) A carbon compound contains two atoms of carbon. Which name should the carbon compound bear?

- (a) Butane
- (b) Ethane
- (c) Methane
- (d) Propane

Correct Answer: Option (b)

8) The following chemical reaction shows the addition of chlorine gas to hydrocarbon in the presence of sunlight.



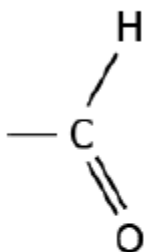
How does chlorine react to a hydrocarbon compound in the presence of sunlight?

- (a) It adds hydrogen to the compound
- (b) It adds an oxygen atom to the compound
- (c) It substitutes hydrogen atom from the compound
- (d) It breaks double and triple bonds into a single bond

Correct Answer: Option (c)

9) Which of these functional groups can combine with carbon to produce alcohol?

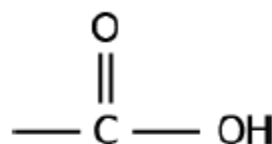
(a)



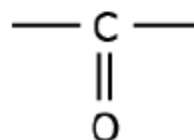
(b)



(c)



(d)



Correct Answer: Option (b)

10) A student studies that vinegar, which is a diluted form of ethanoic acid, freezes during winter. What does this suggest about the physical properties of pure ethanoic acid?

- (a) It has a low boiling point
- (b) It has a low melting point
- (c) It has a very high boiling point
- (d) It has a very high melting point

Correct Answer: Option (b)

11) Which of the following is the molecular formula of cyclobutane?

- a) C_4H_{10}
- b) C_4H_6
- c) C_4H_8
- d) C_4H_4

Correct Answer: Option (c)

FILL IN THE BLANKS

(1).The form of carbon which is known as black lead is ____

Answer: graphite.

(2) The form of carbon which is used as a lubricant at high temperature is ____

Answer: graphite.

(3) Compounds of carbon with hydrogen alone are called ____

Answer: hydrocarbons.

(4) C_nH_{2n} is the general formula of ____ hydrocarbons.

Answer: alkene

(5) Hydrocarbons having the general formula C_nH_{2n-2} are called ____

Answer: alkynes.

(6) Ethene and ethyne are examples of ____ hydrocarbons.

Answer: unsaturated

(7) Ethyne has ____ carbon-hydrogen single bonds.

Answer: two

(8) Carbon compounds have usually ____ melting points and boiling points because they are ____ in nature.

Answer: covalent

(9) The property of carbon atoms to form long chains in compounds is called ____

Answer: catenation.

(10) The general formula C_nH_{2n} for cycloalkanes is the same as that of ____

Answer: alkenes.