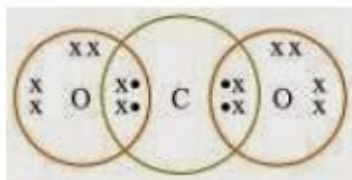


Carbon and its Compounds

1. What would be the electron dot structure of carbon dioxide which has the formula of CO_2 ?

Solution :



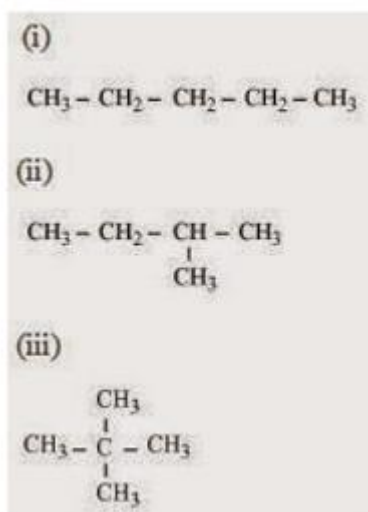
2. What would be the electron dot structure of a molecule of sulphur which is made up of eight atoms of sulphur?

Solution :



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

Solution : The isomers are as under:



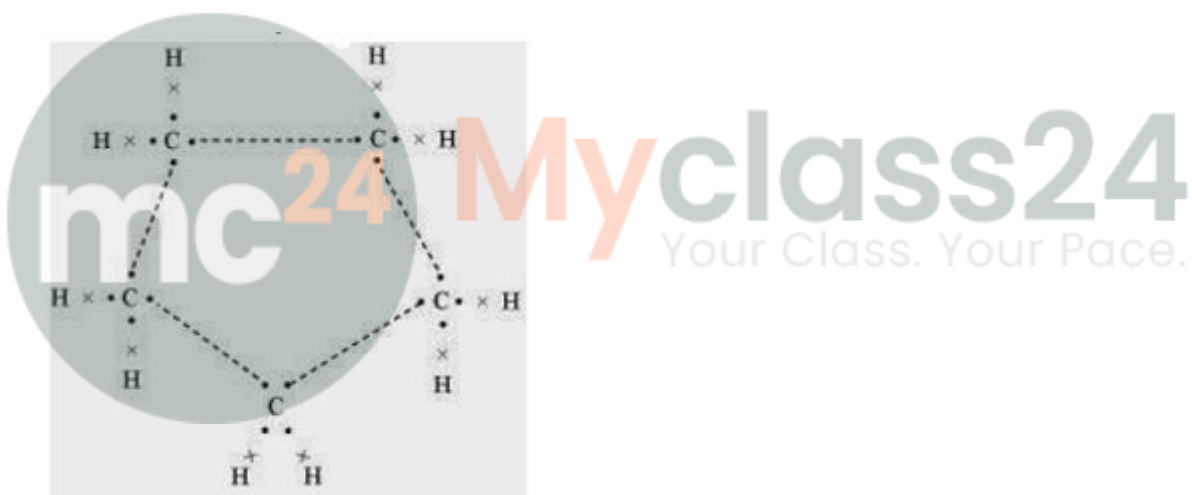
4. What are two properties of carbon which lead to the huge number of carbon compounds we see around us?

Solution : The two properties are :

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

5. What will be the formula and electron dot structure for cyclopentane?

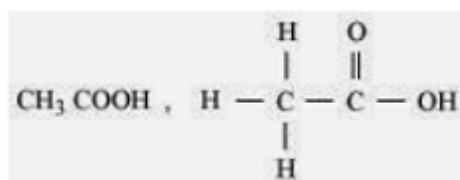
Solution : Formula of cyclopentane is C_5H_{10} . The electron dot structure cyclopentane is:



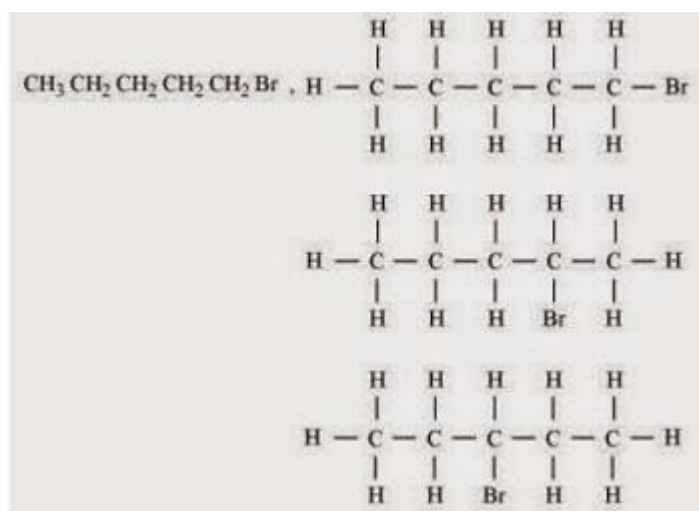
6. Draw the structure for the following compounds :

- (i) Ethanoic acid
- (ii) Bromopentane
- (iii) Butane
- (iv) Hexanal

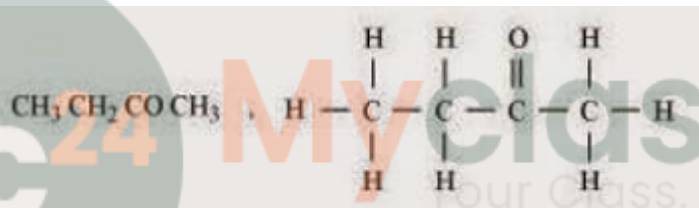
Solution : Structure of compounds are given as under :



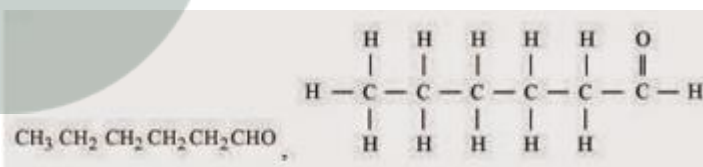
(i) Ethanoic acid



(ii) Bromopentane

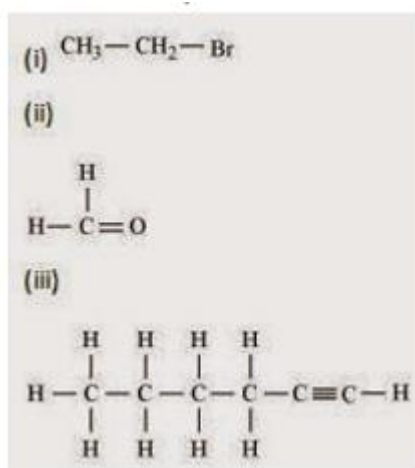


(iii) Butanone



(iv) Hexanal

7. How would you name the following compounds?



Solution :

(i) Bromomethane

(ii) Methanal (Formaldehyde)

(iii) Hexyne

8. 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.

2. People use a variety of methods to wash clothes. Usually after adding the soap, they 'beat' the clothes on a 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 get clean clothes as agitation aid soap micelles to trap the oil, grease or any other impurities that have to be removed. When they are being beaten or agitated, the particles are removed from the clothes' surfaces and go into the water, thus cleaning the clothes.

Exercise questions Page number 77-78

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

Solution: Ethane, with the molecular formula C_2H_6 has 7 covalent bonds

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

(a) carboxylic acid

(b) aldehyde

(c) ketone

(d) alcohol

Solution: Answer is option C i.e Ketone.

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.

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

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

Solution: Carbon can neither lose 4 electrons nor do gain four electrons as these process make the system unstable due to 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 the electrons and as a result, carbon forms 3 bonds with hydrogen and one with chlorine.

5. Draw the electron dot structures for

(a) ethanoic acid

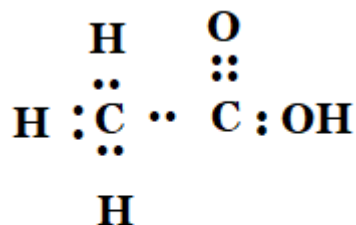
(b) H_2S

(c) propanone

(d) F_2

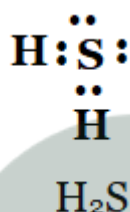
Solution:

a)

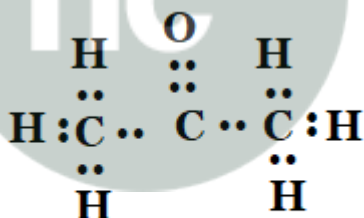


ethanoic acid

b)

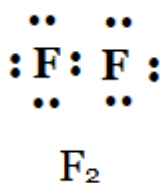


c)



propanone

d)



6. 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 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 the 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.

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

Solution:

Ethanol	Ethanoic acid
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

17. 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 : Soap is sodium or potassium salt of long chain fatty acid. Two ends of soap molecules have different properties. The ionic end is hydrophilic. It dissolve in water while the hydrogen chain is hydrophobic, it dissolve in hydrocarbon. The hydrocarbon chains are oriented towards the oil droplet while the ionic ends are oriented towards water. Micelles formation will not take place in ethanol.

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

Solution : Carbon on combustion gives carbon dioxide and water. This reaction is accompanied by evolution of heat and light. The same is true for compounds of carbon. That is why carbon and its compounds are used as fuel for most applications.

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

Solution : Hard water contains hydrogen carbonates, chlorides and sulphates of calcium and magnesium which reacts with soap to form scum. For example, calcium chloride reacts with soap to form scum.

Sodium stearate + Calcium chloride $\rightarrow$ sodium chloride + Calcium stearate(scum)

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

Solution : Soap is sodium or potassium salt of fatty acid. It is obtained by treating of oil with caustic soda. Sodium stearate is thus a salt of weak acid and strong base. Its water solution will be slightly alkaline and will turn red litmus red.

12. 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.

13. 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.

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

Solution: 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 color 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 color of bromine water is

discharged. So, if an organic compound decolorizes bromine water, then it will be an unsaturated hydrocarbon (containing a double bond or a triple bond), but saturated hydrocarbon (alkanes) do not decolorize bromine water.

Bromine water test is performed to differentiate between the unsaturated compounds (like alkenes and alkynes) and the saturated compounds. Bromine water is added to an unsaturated hydrocarbon and the red brown color of bromine solution is discharged. So if there is discoloration then the compound will be an unsaturated hydrocarbon.

15. 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 that are called micelles and are used for capturing the oil droplets and then the other end being 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 being the hydrophilic end which dissolves in the water and is attracted towards the water and the second one being the hydrophobic end 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. **7. Why do you think the noble gases are placed in separate group?**

Solution : Noble gases are inert elements. Their properties are different from all other elements. Therefore, the noble gases are placed in a separate group.

8. How could the Modern Periodic table remove various anomalies of Mendeleev's Periodic Table?

Solution : Modern Periodic Table settled the placement of isotopes as isotopes have same atomic number. Position of controversial position of hydrogen is also settled in modern periodic table.

9. Name two elements you would expect to show chemical reactions similar to magnesium. What is the basis for your choice?

Solution : Calcium and Strontium would show chemical reactions similar to magnesium. They have the same number of electrons in the outermost shell.

10. Name :

- (a) Three elements that have a single electron in their outermost shells.
- (b) Two elements that have two electrons in their outermost shells.
- (c) Three elements with filled outermost shells.

Solution :

- (a) Lithium, sodium and potassium have a single electron in their outermost shells.
- (b) Magnesium and calcium have two electrons in their outermost shells.
- (c) Helium, neon and argon have filled outermost shells.

4.

a) Lithium, Sodium, Potassium Are All Metals That React With Water To Liberate Hydrogen Gas. Is There Any Similarity in the Atoms of These Elements?

Ans: Yes, all the three elements lithium, sodium, and potassium have one electron in the valence shells.

b) Helium is an Unreactive Gas and Neon is a Gas of Extremely Low Reactivity. What, if Anything, Do Their Atoms Have in Common?

Ans: Helium (He) and neon (Ne) are inert gas. Their outermost shells are completely filled. Helium has a duplet in its K shell, while neon has an octet in its K, L shell.

5. In the Modern Periodic Table, Which are the Metals Among the First Ten Elements?

Ans: Lithium (Li) and beryllium (Be) are metals among the first ten elements.

6. By Considering Their Position in the Periodic Table, Which One of the Following Elements Would You Expect To Have Maximum Metallic Characteristic? Ga, Ge, As, Se and Be.

Ans: Be and Ga are expected to be more metallic but Metallic character increases when we go from top to bottom. Due to its larger size for gallium, it is the most metallic among the given elements.

1. Which of the following statements is not a correct statement about the trends when going from left to right across the periods of Periodic Table.

(a) The elements become less metallic in nature.

(b) The number of valence electrons increases.

(c) The atoms lose their electrons more easily.

(d) The oxides become more acidic

Solution:

Correct answer is c . The atoms lose their electrons more easily.

The atoms lose their electrons more easily is a wrong statement because as we move from left to right across the periods of the periodic table, the non-metallic character increases.

Therefore, tendency to lose an electron decreases.

2. Element X forms a chloride with the formula XCl_2 , which is a solid with a high melting point. X would most likely be in the same group of the Periodic Table as (a) Na (b) Mg (c) Al (d) Si

Solution:

Answer is Magnesium because Mg has the valency 2 which is same as the group (a) Na (b) Mg (c) Al (d) Si

Also, Mg when combines chloride forms $MgCl_2$.

3. Which element has?

(a) Two shells, both of which are completely filled with electrons?

(b) The electronic configuration 2, 8, 2?

(c) A total of three shells, with four electrons in its valence shell?

(d) A total of two shells, with three electrons in its valence shell?

(e) twice as many electrons in its second shell as in its first shell?

Solution:

a) Neon has two shells which are completely filled.

b) Magnesium has electronic configuration 2, 8, 2

c) Silicon has a total of three shells, with four electrons in its valence shell

d) Boron a total of two shells, with three electrons in its valence shell

e) Carbon has twice as many electrons in its second shell as in its first shell

4. (a) What property do all elements in the same column of the Periodic Table as boron have in common?

(b) What property do all elements in the same column of the Periodic Table as fluorine have in common?

Solution:

(a) All the elements which lie in the same column as that of boron belong to group 13. Therefore, they have three electrons in their respective valence shells. Except, boron which is a non-metal, all other elements (i.e., aluminum, gallium, indium and thallium) in this group are metals.

(b) All elements in the same column of the Periodic Table as fluorine have in common three electrons in their valence shell and they all belong to group thirteen.

18. An atom has electronic configuration 2, 8, 7.

(a) What is the atomic number of this element?

(b) To which of the following elements would it be chemically similar?

(Atomic numbers are given in parentheses.)

N(7), F(9), P(15), Ar(18)

Solution : Chlorine has the electronic configuration 2, 8, 7.

(a) Atomic number of element is 17.

(b) F (9)

19. The position of three elements A, B and C in the Periodic Table are shown below :

Group 16	Group 17
–	–
–	A
–	–
B	C

(a) State whether A is a metal or non-metal.

(b) State whether C is more reactive than A

(c) Will C be larger or smaller in size than B?

(d) Which type of ion, cation or anion, will be formed by element A?

Solution :

(a) A is a non-metal.

(b) C is less reactive than A.

(c) C will be smaller than B.

(d) A will form anion.

7. Nitrogen (atomic number 7) and phosphorus (atomic number 15) belong to group 15 of the Periodic Table. Write the electronic configuration of these two elements. Which of these will be more electronegative? Why?

Solution:

Atomic number of Nitrogen is 7 hence Electronic configuration of Nitrogen is $1s^2 2s^2 2p^3$

Atomic number of Nitrogen is 15 hence Electronic configuration of Phosphorous is $1s^2 2s^2 2p^6 3s^2 3p^3$

On moving down a group in the periodic table, the number of shell increases. Due to this, valence electrons move away from the electrons and the effective nuclear charge decreases. This causes the decrease in the tendency to attract electron and hence electro negativity decreases. Because of all these reasons Nitrogen is more electronegative than phosphorus.

8. How does the electronic configuration of an atom relate to its position in the Modern Periodic Table?

Solution:

The number of valence electrons decides an atom's position in the periodic table while the electronic configuration decides the number of valence electrons.

9. In the Modern Periodic Table, calcium (atomic number 20) is surrounded by elements with atomic numbers 12, 19, 21 and 38. Which of these have physical and chemical properties resembling calcium?

Solution:

Calcium has an atomic number of 20, and thus has an electronic configuration of 2, 8, 8, 2. Thus, calcium has 2 valence electrons. The electronic configuration of the element having atomic number 12 is 2, 8, 2. Thus, this element with 2 valence electrons resemble calcium the most.

10. Compare and contrast the arrangement of elements in Mendeleev's Periodic Table and the Modern Periodic Table.

Solution:

Mendeleev's Periodic Table	Modern Periodic Table
Elements are arranged in the increasing order of their atomic masses.	Elements are arranged in the increasing order of their atomic numbers.
There are 8 groups	There are 18 groups
Each groups are subdivided into sub group 'a' and 'b'	Groups are not subdivided into sub-groups.

Groups for Noble gas was not present as noble gases were not discovered by that time

A separate group is meant for noble gases.

There was no place for isotopes.

This problem has been rectified as slots are determined according to atomic number.

