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Jars Education

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Time : 1 Hour 15 Minute

STD 11 Science Chemistry
Chapter Based Test

Total Marks : 40

SECTION A

*** Choose The Right Answer From The Given Options.[1 Marks Each]** **[6]**

1. Which of the following is polar molecule?

(A) SiF_4 (B) XeF_4 (C) BF_3 (D) SF_4

2. Which one of the following species has plane triangular shape?

(A) N_3 (B) NO_3^- (C) NO_2^- (D) CO_2

3. The molecule in which xenon is surrounded by three lone pairs and two bond pairs is:

(A) XeF_2 (B) XeF_4 (C) XeF_6 (D) XeO_4

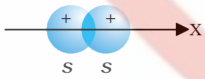
4. The group valence of the element is generally equal to the:

(A) Number of dots in Lewis symbol. (B) Eight minus the number of dots.

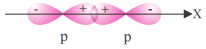
(C) Valence electrons. (D) Any of the above may possible.

5. The molecule of hydrogen atom is formed due to the overlapping of orbitals of two hydrogen atoms. Which of the following types of overlapping takes place in the formation of H_2 molecule?

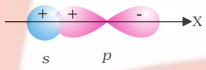
(A)



(B)

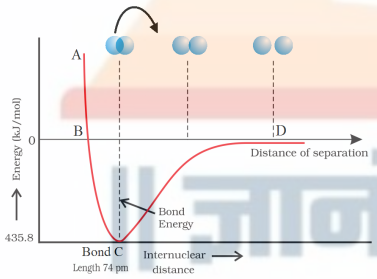


(C)



(D) All of these.

6.



The above potential energy curve is given for the formation of H_2 molecule as a function of internuclear distance of H-atoms. At what point in the curve H, is found in the most stable state?

(A) A (B) B (C) C (D) D

*** Answer The Following Questions In One Sentence.[1 Marks Each]** **[5]**

7. Discuss the shape of the following molecules using the VSEPR model:

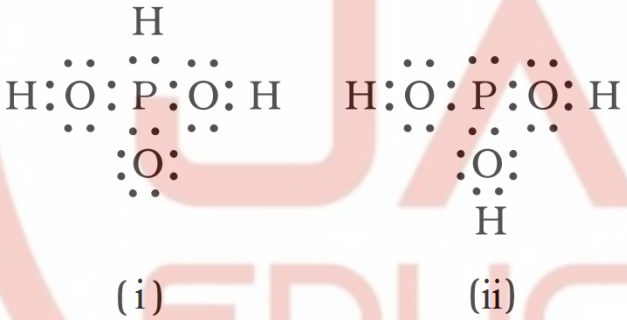
$BeCl_2$

8. Discuss the shape of the following molecules using the VSEPR model:
   $SiCl_4$
9. Which hybrid orbitals are used by carbon atoms in the following molecules?
   CH_3 -CHO
10. Identify the compounds which do not follow octet rule.
    PCl_3, SO_2, SO_3, NO_2, SF_4, NO, BF_3, H_2S, SF_6.
11. Out of O_2 and N_2 molecules, which has greater bond dissociation enthalpy and why?

SECTION B

*** Given Section consists of questions of 2 marks each.** **[6]**

1. H_3PO_3 can be represented by structures 1 and 2 shown below. Can these two structures be taken as the canonical forms of the resonance hybrid representing H_3PO_3? If not, give reasons for the same.



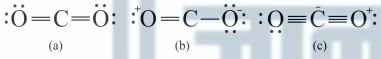
(i) (ii)

2. Explain why carbon has a valency of four and not two and why are the four C-H bonds in methane identical.
3. In the following ionisation processes, how will the bond orders in N_2 and O_2 be influenced?
   i. $N_2 \longrightarrow N_2^+ + e^-$
   ii. $O_2 \longrightarrow O_2^+ + e^2$

SECTION C

*** Given Section consists of questions of 3 marks each.** **[9]**

1. Which of the following Lewis structure of CO_2 molecule is least significant resonating form?



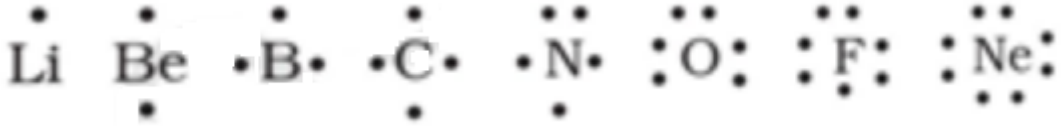
(a) (b) (c)

2. Arrange the following sets of molecules in the decreasing order of bond angle.
   i. SF_6, CCl_4, H_2O, NH_3
   ii. CH_4, NH_3, H_2O, BF_3
3. Explain the shape of BrF_5.

SECTION D

*** Case study based questions** **[4]**

1. Read the passage given below and answer the following questions from (i) to (v).



The attractive force which holds variousconstituents (atoms, ions, etc.) together in differentchemical species is called a chemical bond. In order to explain the formation of chemicalbond in terms of electrons, a number ofattempts were made, but it was only in 1916when Kössel and Lewis succeededindependently in giving a satisfactoryexplanation. They were the first to providesome logical explanation of valence which wasbased on the inertness of noble gases. Lewis postulated that atoms achieve thestable octet when they are linked bychemical bonds. In the formation of amolecule, only the outer shell electrons takepart in chemical combination and they areknown as valence electrons. The inner shellelectrons are well protected and are generallynot involved in the combination process.G.N. Lewis, an American chemist introducedsimple notations to represent valenceelectrons in an atom. These notations arecalled Lewis symbols. For example, the Lewissymbols for the elements of second period areas under:

The bond formed, as a result of theelectrostatic attraction between thepositive and negative ions was termed as the electrovalent bond. The electrovalenceis thus equal to the number of unitcharge(s) on the ion.

Kössel and Lewis in 1916 developed animportant theory of chemical combinationbetween atoms known as electronic theoryof chemical bonding. According to this,atoms can combine either by transfer ofvalence electrons from one atom to another(gaining or losing) or by sharing of valenceelectrons in order to have an octet in theirvalence shells. This is known as octet rule. when two atoms share oneelectron pair they are said to be joined bya single covalent bond. In many compoundswe have multiple bonds between atoms. Theformation of multiple bonds envisagessharing of more than one electron pairbetween two atoms. If two atoms share twopairs of electrons, the covalent bondbetween them is called a double bond. Forexample, in the carbon dioxide molecule, wehave two double bonds between the carbonand oxygen atoms. Similarly in ethenemolecule the two carbon atoms are joined bya double bond. The Lewis dot structures provide a pictureof bonding in molecules and ions in termsof the shared pairs of electrons and theoctet rule. The Lewis dotstructures can be written by adopting thefollowing steps:

- The total number of electrons required forwriting the structures are obtained byadding the valence electrons of thecombining atoms. For example, in the CH_4molecule there are eight valence electronsavailable for bonding.
- For anions, each negative charge wouldmean addition of one electron. Forcations, each positive charge would result in subtraction of one electron from the totalnumber of valence electrons. For example,for the CO_3^{2-} ion, the two negative chargesindicate that there are two additionalelectrons than those provided by theneutral atoms.
- Knowing the chemical symbols of thecombining atoms and having knowledgeof the skeletal structure of the compound, it is easyto distribute the total number of electronsas bonding shared pairs between theatoms in proportion to the total bonds.

- In general the least electronegative atomoccupies the central position in themolecule/ion. For example in the NF_3 andCO_3^{2-}, nitrogen and carbon are the centralatoms whereas fluorine and oxygenoccupy the terminal positions.
- After accounting for the shared pairs ofelectrons for single bonds, the remainingelectron pairs are either utilized for multiplebonding or remain as the lone pairs. Thebasic requirement being that each bondedatom gets an octet of electrons.

i. ... postulated that atoms achieve the stable octet when they are linked by chemical bonds.
   a. Lewis
   b. Debye
   c. Charles
   d. Sidgwick

ii. ... in 1916 developed an important theory of chemical combination between atoms known as electronic theory of chemical bonding.
   a. Kössel
   b. Lewis
   c. Both a) & b)
   d. Sidgwick

iii. In the formation of a molecule, only the outer shell electrons take part in chemical combination and they are known as ...
   a. Backscattered electrons
   b. Valence electrons
   c. Primary electrons
   d. Secondary electrons

iv. In the CH_4 molecule there are ... valence electrons available for bonding.
   a. 4
   b. 6
   c. 8
   d. 10

v. The type of bond between atoms in a molecule of CO2 is:
   a. Ionic bond
   b. Metallic bond
   c. Hydrogen bond
   d. Covalent bond.

SECTION E

*** Given Section consists of questions of 5 marks each.** **[10]**

1. Which out of NH_3 and NF_3 has higher dipole moment and why?
2. Compare the relative stability of the following species and indicate their magnetic properties;

   O_2, O_2^+, O_2^- (superoxide), O_2^{2-} (peroxide)

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