



## CHEMISTRY

### BOOKS - PEARSON IIT JEE FOUNDATION

#### CHEMICAL BONDING

#### Example Solution

1. Between  $CaCl_2$  and  $KCl$ , which has a stronger ionic bond? Why?

 [Watch Video Solution](#)

2. Between  $CuO$  and  $CuS$ , which is more covalent and why?

 [Watch Video Solution](#)

3. Distinguish between polar and non-polar covalent bonds with respect to

(i) mode of formation

(ii) Charge separation

(iii) type of atoms involved in bond formation.

 [Watch Video Solution](#)

4. Ionic bond formation takes place between sodium and chlorine. But between hydrogen and chlorine, covalent bond formation takes place. Give reason.

 [Watch Video Solution](#)

5. Explain how chlorine exhibits a maximum covalency of 7.

 [Watch Video Solution](#)

6. Both helium and beryllium have  $ns^2$  valence electronic configuration. However, beryllium forms compounds and helium cannot form compounds. Explain.

 [Watch Video Solution](#)

7. Why is the repulsion between two lone pairs of electrons more than that between a lone pair and a bond pair or a bond pair and a bond pair of electrons?

 [Watch Video Solution](#)

8. Hydrogen bond is nothing but strong dipole-dipole attraction. Justify.

 [Watch Video Solution](#)

9. Why do  $NH_3$  and  $H_2O$  act as electron pair donors?

 [Watch Video Solution](#)

10. Between van der Waals forces and dipole-dipole attractions, which are stronger? Why?

 [Watch Video Solution](#)

11. Some metals like sodium can be cut with a knife. How do you explain with respect to metallic bond?

 [Watch Video Solution](#)

12. Sharing of three electron pairs between two atoms results in the formation of a \_\_\_\_\_ bond.

 [Watch Video Solution](#)

13. What type of forces acts between the ions during the formation of a crystal of ionic compound?

 [Watch Video Solution](#)

14. What type of overlapping take place in a sigma and a pi bond?

 [Watch Video Solution](#)

15. Why is more energy required to break a sigma bond than a pi bond?

 [Watch Video Solution](#)

16. The number of non-bonded electrons present on the central atom in the molecule of ammonia is \_\_\_\_\_.

 [Watch Video Solution](#)

17. How is the strength of the covalent bond related to overlapping of the orbitals?

 [Watch Video Solution](#)

18. Why do polar covalent compounds dissolve in water?

 [Watch Video Solution](#)

19. If the electron pair is unequally shared between the bonded atoms, it results in \_\_\_\_\_ bond.

 [Watch Video Solution](#)

20. What would be the shape of  $XY_3$  molecule if there is no lone pair on the central atom?

 [Watch Video Solution](#)

21. Why is the H-O-H bond angle in  $H_2O$  smaller than H-N-H bond angle in  $NH_3$ ?

 [Watch Video Solution](#)

22. In the formation of a  $Br_2$  molecule, the overlapping of \_\_\_\_\_ orbitals takes place.

 [Watch Video Solution](#)

23. How many lone pair of electrons are present on the central atom of  $CH_4$ ,  $H_2O$ ,  $NH_3$ ,  $PCl_3$  and  $PCl_5$  molecules?

 [Watch Video Solution](#)

24. What type of bond formation takes place between the atoms of Group IA and Group VIIA?



[Watch Video Solution](#)

25. Although the number of bond pair of electrons in the valence shell of phosphorus in a  $PCl_3$  molecule is 3, its shape is not trigonal planar.

Why?



[Watch Video Solution](#)

26. What are the donors in a hydronium ion and ammonium ion?



[Watch Video Solution](#)

27. Why do metals conduct electricity?



[Watch Video Solution](#)



28. The number of  $\sigma$  bonds and  $\pi$  bonds in  $CO_2$  molecule are \_\_\_\_\_ respectively.

 [Watch Video Solution](#)

29. Why does the presence of a lone pair change the shape of the molecule?

 [Watch Video Solution](#)

30. Why are the participating atoms of a co-ordinate bond called the donor and the acceptor?

 [Watch Video Solution](#)

31. The electrostatic forces of attraction between the metallic ions and free electrons is called \_\_\_\_\_.





Watch Video Solution

32. How many electrons are present in the valence shells of the central atoms in the molecules of  $BeCl_2$ ,  $BF_3$  and  $PCl_5$ ?



Watch Video Solution

33. In  $PCl_5$  molecule, the bond angles are \_\_\_\_\_ and \_\_\_\_\_.



Watch Video Solution

34. The shape of  $BeCl_2$  is \_\_\_\_\_.



Watch Video Solution

35. The forces of attraction between the elemental gaseous molecules are called \_\_\_\_\_.



Watch Video Solution

 Watch Video Solution

36. How many new hybrid orbitals are formed in  $sp$ ,  $sp^2$  and  $sp^3$  hybridisations?

 Watch Video Solution

37. The shape of  $BF_3$  molecule is \_\_\_\_\_.

 Watch Video Solution

38. Define an ionic bond and a covalent bond.

 Watch Video Solution

39. How many sigma bonds and pi bonds are there in a chlorine molecule? Justify your answer.

 Watch Video Solution

[Watch Video Solution](#)

40. Why is a nitrogen molecule less reactive than an oxygen molecule?

 [Watch Video Solution](#)

41. Explain the role of electron affinity and ionisation potential during the ionic and covalent bond formation?

 [Watch Video Solution](#)

42. Explain the structure of  $BeCl_2$  with the help of hybridisation.

 [Watch Video Solution](#)

43. Why is  $BeCl_2$  molecule linear, but  $BF_3$  is trigonal planar?

 [Watch Video Solution](#)

44. Write about the partial covalent nature of ionic bond and explain it on the basis of Fajan's rules.

 [Watch Video Solution](#)

45. Explain the structure of  $CH_4$  with the help of hybridisation.

 [Watch Video Solution](#)

46. Explain the formation of hydrogen, oxygen and nitrogen molecules.

 [Watch Video Solution](#)

47. Distinguish between a sigma and a pi bond.

 [Watch Video Solution](#)

48. Explain different types of bond formation in  $H_3N \rightarrow BF_3$ .

 [Watch Video Solution](#)

### Very Short Answer Type Questions

1. Why do atoms have a tendency to form molecules?

 [Watch Video Solution](#)

### Essay Type Questions

1. What are the factors on which the geometrical shapes of covalent molecules depend? Explain with suitable examples.

 [Watch Video Solution](#)

2. (a) What is hybridisation?

(b) What are the conditions for an atom to undergo hybridisation?

(c) How can we explain the shapes and bond angles of  $BeCl_2$ ,  $BCl_3$  and  $CH_4$  with hybridisation?

 [Watch Video Solution](#)

## Level 1

1. Ionic compounds are soluble in organic solvents.

 [Watch Video Solution](#)

2.  $BF_3$  does not obey the octet rule.

 [Watch Video Solution](#)

3. The bond angle in ammonia is  $109^{\circ} 28'$ .

 [Watch Video Solution](#)

4. Sigma bond is stronger than the pi bond. Explain.

 [Watch Video Solution](#)

5. The hydrogen bond is always formed between the molecules of the same substance.

 [Watch Video Solution](#)

6. Covalent bonds are non-directional bonds.

 [Watch Video Solution](#)



7. In  $CaF_2$ , the number of electron(s) transferred from calcium to fluorine atoms is \_\_\_\_\_.

 [Watch Video Solution](#)

8. The bond formed by end on overlap is \_\_\_\_\_ than the bond formed by side on overlap.

 [Watch Video Solution](#)

9. Linear overlapping of any two pure atomic p-orbitals lead to \_\_\_\_\_ bond formation.

 [Watch Video Solution](#)

10. Cl-C-Cl bond angle in  $CCl_4$  is \_\_\_\_\_.

 [Watch Video Solution](#)

11. Among the hydrogen halides \_\_\_\_\_ has maximum ionic character.

 [Watch Video Solution](#)

12. The shape of  $BeCl_2$  is \_\_\_\_\_.

 [Watch Video Solution](#)

13. In ammonia-boron trifluoride complex, the donor molecule is \_\_\_\_\_.

 [Watch Video Solution](#)

14. Match the entries given in Column A with appropriate ones from Column B.

Column A

Column B

- |                              |                                       |
|------------------------------|---------------------------------------|
| A. Nitrogen                  | ( ) a. Polar covalent bond            |
| B. Xenon                     | ( ) b. $107^\circ$                    |
| C. Ammonia                   | ( ) c. Octahedral                     |
| D. Sulphur hexafluoride      | ( ) d. $109^\circ 28'$                |
| E. Hydrogen chloride         | ( ) e. Triple bond                    |
| F. Methane                   | ( ) f. Two lone pairs of electrons    |
| <del>E. Water molecule</del> | <del>( ) g. Octet configuration</del> |



Watch Video Solution

15. Expanded octet occurs in

- A.  $NH_3$
- B.  $PF_5$
- C.  $H_2O$
- D.  $O_2$

Answer: B



Watch Video Solution

16. The lesser covalency of  $FeCl_2$  over  $FeCl_3$  is due to

- A. lower polarizing power of  $Fe^{+2}$  than that of  $Fe^{+3}$  ion
- B. lower polarizing power of  $Fe^{+3}$  than that of  $Fe^{+2}$
- C. higher polarizability of  $Fe^{+3}$  than  $Fe^{+2}$
- D. higher polarizability of  $Fe^{+2}$  than  $Fe^{+3}$

Answer: A



Watch Video Solution

17. An element X has low ionisation energy and another element Y has high electron affinity. The bond formed between them could be

- A. ionic
- B. polar covalent

C. co-ordinate covalent

D. non-polar covalent

**Answer: A**

 [Watch Video Solution](#)

**18.** Which of the following statement regarding pi bond is not true?

A. It may be formed by the overlapping of p-atomic orbitals

B. It has no independent existence

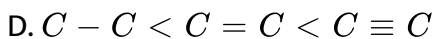
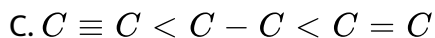
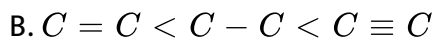
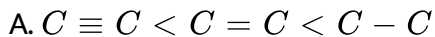
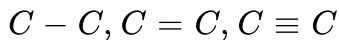
C. It is weaker bond compared to  $\sigma$  bond

D. It is weaker bond compared to  $\sigma$  bond

**Answer: D**

 [Watch Video Solution](#)

19. Arrange the following in increasing order of their bond lengths.



Answer: A



Watch Video Solution

20. Which of the following statements is wrong?

A. KCl is soluble in water

B. HCl conducts electricity in its aqueous solution

C. Acetic acid is soluble in water

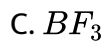
D. The bond formed between aluminum and fluorine is covalent.

**Answer: D**



[View Text Solution](#)

21.  $NH_4^+$  is isostructural with



**Answer: B**



[Watch Video Solution](#)

22. In water molecule, the bond angle of  $104.5^\circ$  around oxygen is accounted due to

- A. high electron affinity of oxygen
- B. very high repulsions between lone pair and bond pair of electrons.
- C. very high repulsion between lone pair and lone pair electrons
- D. small size of hydrogen

**Answer: C**

 [Watch Video Solution](#)

**23.** Which of the following bonds is more polar when compared to other?

- A. O-H
- B. N-H
- C. C-H
- D. H-H

**Answer: A**

 [Watch Video Solution](#)



24. The number of sigma and pi bonds in benzene are

- A.  $6\sigma$  and  $3\pi$  bonds
- B.  $12\sigma$  and  $3\pi$  bonds
- C.  $9\sigma$  and  $3\pi$  bonds
- D.  $6\sigma$  and  $6\pi$  bonds

Answer: B



Watch Video Solution

25. Which among the following pairs of molecules possess same geometry?

- A.  $BeCl_2$ ,  $SiO_2$
- B.  $CO_2$ ,  $SiO_2$
- C.  $BF_3$ ,  $PCl_3$

D.  $F_2O$ ,  $H_2S$

**Answer: D**



**Watch Video Solution**

26. The number of  $\sigma$  and  $\pi$  bonds in  $C_2H_2$  is \_\_\_\_\_

A. 0 and 4

B. 2 and 2

C. 3 and 2

D. 4 and 2

**Answer: C**



**Watch Video Solution**

27. A species  $H_3O^+$  pyramidal in shape. The number of lone pairs of electrons is

- A. 0
- B. 1
- C. 2
- D. 3

**Answer: B**



[Watch Video Solution](#)

28. The shape of  $H_2O$  molecule is \_\_\_\_\_.

- A. linear
- B. tetrahedral
- C. v-shaped
- D. trigonal planar

**Answer: C**

 [Watch Video Solution](#)

**29.** The covalency of 'N' in  $NH_4^+$  ion is equal to number of

- A. covalent bonds
- B. co-ordinate bonds
- C. covalent bonds and co-ordinate bonds
- D. valence electrons

**Answer: C**

 [Watch Video Solution](#)

**30.** Two substances X and Y are dissolved in water under suitable conditions. X is a gas while Y is a solid under normal conditions. Solution of Y is found to conduct electricity but not 'X'. Based on the conclusion

identify the nature of bond present in X and Y with appropriate reasons as given below.

Arrange the steps given below in a sequence.

(1) Y is a solid at room temperature and its aqueous solution conducts electricity. This shows that it is an ionic compound.

(2) X on dissolution in water does not conduct electricity and is a gas at room temperature. Hence it should be a non-polar covalent molecule.

(3) Aqueous solutions of both ionic compounds and polar covalent compounds conduct electricity because of the presence of free ions.

(4) All ionic compounds are solids and most of the non-polar covalent molecules are gases or solids at room temperature. Polar covalent compounds are liquids or gases.

A. 3 4 2 1

B. 1 4 3 2

C. 1 3 2 4

D. 3 1 2 4

**Answer:**

31. The formation of double bond in an oxygen molecule is explained below. Arrange the given points in a sequential order.

(1)  $2p_y$  orbitals of each oxygen atom overlap laterally/sidewise to form a pi bond.

(2) Thus, double bond between two oxygen atoms in which one  $p_z - p_z$  sigma bond and  $p_y - p_y$  pi bond is formed.

Itimg

src="https://d10lp6p6xz60nq.cloudfront.net/physics\_images/PS\_CHM\_X\_C04\_E

width="80%"gt

(3) All the three  $2p$  orbitals are perpendicular to each other. Hence,  $2p_z$  orbitals of each oxygen atom overlap end to end to form a sigma bond.

(4) The electronic configuration of oxygen is O:  $1s^2 2s^2 2p_x^1 2p_y^2 2p_z^1$ .

A. 3 1 4 2

B. 4 3 1 2

C. 3 4 2 1

**Answer:**



[View Text Solution](#)

**32.** The necessary steps required to show the formation of  $CCl_4$  by Lewis electron dot diagram have been jumbled. Arrange them in a sequence.

Itimg

src="https://d10lpgp6xz60nq.cloudfront.net/physics\_images/PS\_CHM\_X\_C04\_E

width="80%"gt

(1) Thus, an electron pair is shared between C and Cl. This is the Lewis electron dot diagram for  $CCl_4$ .

(2) Write the symbol of chlorine and represent its valence electrons with the help of crosses, that is,

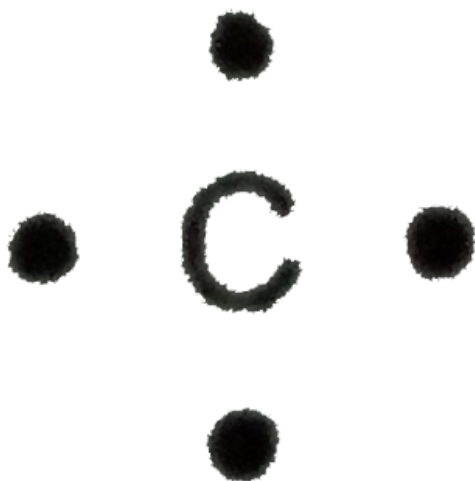
Itimg

src="https://d10lpgp6xz60nq.cloudfront.net/physics\_images/PS\_CHM\_X\_C04\_E

width="80%"gt

(3) Write the symbol of carbon and represent its valence electrons with

the help of dots, that is,



(4) When carbon combines with four chlorine atoms, the carbon atom contributes four electrons for sharing, whereas each chlorine atom contributes only one electron for sharing. Thus, both the atoms in  $CCl_4$  attain an octet.

A. 1 3 2 4

B. 2 1 3 4

C. 4 3 2 1

D. 3 2 4 1



**Answer:**



[View Text Solution](#)

**33.** Which among the following substances does not conduct electricity in its aqueous solution state?

A. glucose

B. alcohol

C. hydrochloric acid

D. common salt

**Answer:**



[Watch Video Solution](#)

**34.** The ease of formation of which of following chlorides is maximum?

A. NaCl

B. KCl

C. RbCl

D. CsCl

**Answer:**

 [Watch Video Solution](#)

**35.** During the formation of sodium chloride from its constituents,

A. Na undergoes oxidation and acts as an oxidizing agent

B. Na undergoes reduction and Cl undergoes oxidation.

C. Cl undergoes reduction and acts as a reducing agent

D. Na acts as a reducing agent and Cl acts as an oxidizing agent.

**Answer:**

 [Watch Video Solution](#)

36. The valence electronic configurations of two elements are  $4s^1$  and  $3s^23p^5$ . The type of bond expected to be present between them is

- A. polar covalent bond
- B. non-polar covalent bond
- C. metallic bond
- D. ionic bond

**Answer:**



[Watch Video Solution](#)

37. The angular shape of water molecule is due to

- A. high electron affinity of oxygen
- B. very high repulsions between lone pair and bond pair of electrons.
- C. very high repulsion between lone pair and lone pair electrons

D. small size of hydrogen

**Answer:**



[Watch Video Solution](#)

**38.** The element that has the strongest metallic bond among  ${}_{11}A^{23}$ ,  ${}_{12}B^{24}$ ,  ${}_{13}C^{27}$  and  ${}_{19}D^{39}$  is \_\_\_\_\_.

A. A

B. B

C. C

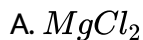
D. D

**Answer:**



[Watch Video Solution](#)

39. Identify the compound that exhibits maximum ionic character among the following:



**Answer:**



[Watch Video Solution](#)

40. Identify the favourable conditions for the formation of ionic bond:

A. low IP value of metal, low EA value of non-metal

B. high IP value of metal, high EA value of non-metal

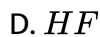
C. low IP value of metal, high EA value of non-metal

D. high IP value of metal, low IP value of non-metal

**Answer:**

 [Watch Video Solution](#)

**41.** Among the following molecules, p-p overlap takes place in



**Answer:**

 [Watch Video Solution](#)

**42.** Among the following molecules H-bond is present in



B.  $PH_3$

C.  $H_2S$

D.  $CH_4$

**Answer:**

 [Watch Video Solution](#)

**43.** The covalency of oxygen in hydronium ion is equal to number of

A. covalent bonds

B. co-ordinate bonds

C. covalent bonds and co-ordinate bonds

D. valence electrons

**Answer:**

 [View Text Solution](#)

44. A solid compound 'A' consists of simple ions. Choose corresponding answers from the choices given below.

Nature of the bond present in A will be

A. ionic

B. covalent

C. molecular

D. hydrogen bond

**Answer:**

 [Watch Video Solution](#)

Level 2

1. Both  $CH_4$  and  $CCl_4$  are non-polar molecules, but  $CHCl_3$  is a polar molecule. Discuss.

 [Watch Video Solution](#)



2. Copper (I) and silver (I) halides are more covalent in nature compared to sodium and potassium halides although the charges on the ions are same. How do you account for this?

 [Watch Video Solution](#)

3. The orbitals p and d can form  $\pi$  bonds, but the s-orbital cannot form a  $\pi$  bond. Give reasons.

 [Watch Video Solution](#)

4. Compare the shapes of the meniscus of water in a glass tube and in wax coated glass tube. Give an appropriate reason.

 [Watch Video Solution](#)

5. Between  $NF_3$  and  $BF_3$ , which is the more polar molecule? Why?

 [Watch Video Solution](#)

6. Noble gases do not usually form chemical bonds. But xenon forms a number of stable compounds. Account for this.

 [Watch Video Solution](#)

7. Just like  $H_2O$ , there are two lone pairs in  $Cl_2O$  molecule. But bond angle in  $Cl_2O$  is  $111^\circ$ . Explain.

 [Watch Video Solution](#)

8. Though sulphur has only two unpaired electrons it exhibits covalency of 2, 4, 6. Explain.

 [View Text Solution](#)

9. Phosphorous can form  $PCl_5$  molecule in the excited state of phosphorous atom. But the formation of  $PH_5$  is not possible in the same state. Account for this.

 [View Text Solution](#)

10. Between LiF and LiI, which has the higher lattice energy and why?

 [View Text Solution](#)

11. Which among the following geometries is most preferred with respect to  $ClF_3$  molecule and why?

Itimg

src="https://d10lpgp6xz60nq.cloudfront.net/physics\_images/PS\_CHM\_X\_C04\_E

width="80%"gt

 [View Text Solution](#)

**12.** Explain and give reasons for the changes in potential energy after the bond formation in a diatomic molecule from the given graph.

Itimg

src="https://d10lpgp6xz60nq.cloudfront.net/physics\_images/PS\_CHM\_X\_CO4\_E

width="80%"gt



[View Text Solution](#)

**13.** In comparison with sodium salts, ammonium salts are more soluble in water. Explain.



[View Text Solution](#)

**14.** Compare NaCl and CsCl with respect to ease of formation and also strength of ionic bond.



[Watch Video Solution](#)

15. Comment on the intensity of charge of an electric field when HF and dry air are placed between two charged parallel plates.

 [View Text Solution](#)

16. Phosphorous can form  $PCl_5$  molecule in the excited state of phosphorous atom. But the formation of  $PH_5$  is not possible in the same state. How do you account for this?

 [Watch Video Solution](#)

17. Predict hybridisation and shape of  $SF_4$  molecule.

 [Watch Video Solution](#)

18. All halides of sodium are ionic. Fluorides and chlorides of magnesium are ionic. But among halides of aluminum, only  $AlF_3$  is ionic. How do you account for this variation?



[Watch Video Solution](#)

19. The nitrogen atom of  $NH_3$  acts as a donor during the formation of a co-ordinate covalent bond while the central nitrogen atom in  $NO_2$  cannot act as a donor. Explain.



[Watch Video Solution](#)

20. Increase in temperature decreases the conductivity of metallic conductors. Give a reason.



[View Text Solution](#)

21. Why are metals malleable and ductile?



[View Text Solution](#)

1.  $CO_2$  exists in the gaseous state, whereas  $SiO_2$  is a hard solid though both carbon and silicon belong to the same group. Give reasons.

 [Watch Video Solution](#)

2. A molecule has 3 bonded pairs and 2 lone pairs on the central atom. Explain the shape of the molecule with an example.

 [Watch Video Solution](#)

3.  $XeF_2$  is also a linear molecule like  $BeCl_2$ . But they differ in their formation and structural aspects. How can you justify this?

 [View Text Solution](#)

4. A molecule has an octahedral geometry. So how many number of valence electrons should the central atom possess and are the number of

valence electrons is the same if one, two bond pairs are successively replaced by lone pairs? What are the geometries of the molecules with one and two lone pairs? Explain with the help of hybridisation.

 [View Text Solution](#)

5. Thallous compounds are more common and stable than thallic compounds. Justify this statement.

 [Watch Video Solution](#)

6. Lattice energies of fluorid, chloride, bromide and iodide compounds are 766.5, 597.5, 537.5 and 437.03 k J/mol, respectively. Compare the oxidizing capacities of the halogens on the basis of the lattice energies of these compounds with an appropriate reason.

 [Watch Video Solution](#)



7. A molecule ' $AB_5$ ' has five bond pairs around the central atom 'A'. If the bond pair of electrons are successively replaced by one, two and three lone pair of electrons, then what would be the preferred shapes of the molecules and how do they differ from actual geometry of  $AB_5$ ?

 [View Text Solution](#)

8. Though covalent character increases from lithium fluoride to lithium iodide, lithium fluoride is insoluble in water while lithium iodide is soluble. Justify the above statement.

 [View Text Solution](#)

9. Between  $NF_3$  and  $BF_3$ , which is the more polar molecule? Why?

 [Watch Video Solution](#)

10. The atomic number of tin is 50 and chlorine is 17. What should be the shape of  $SnCl_2$  molecule in its vapour state?



[View Text Solution](#)