Coordinate Bond Chemistry Questions with Solutions

Q-1: Which of the following molecules does not have coordinate bonds?
a) CH_3-NC
b) CO
c) O_3
d) CO_3^{2-}

Answer: d) CO_3^{2-}

Q-2: Which types of bonds are present in N_2O_5?
a) only coordinate
b) only ionic
c) coordinate and ionic
d) covalent and coordinate

Answer: d) covalent and coordinate

Q-3: Which of the following occurs during the formation of a coordinate bond?
a) Electron transfer
b) Electron donation
c) Electron sharing
d) equal electron transfer between bonded atoms

Answer: b) Electron donation

Explanation: When a donor atom donates its pair of electrons to the acceptor atom, a coordinate bond is formed. Electron donation occurs as a result.

Q-4: When NH_3 and BF_3 form a covalent coordinate bond, electron donation occurs in
a) 2p-orbital of N-atom
b) 2p-orbital of B-atom
c) 1s-orbital of H-atom
d) 2p-orbital of F-atom

Answer: b) 2p-orbital of B-atom

Explanation: Boron has an empty 2p-orbital, while nitrogen has a single electron pair. Nitrogen donates its pair of electrons to the empty 2p orbital of boron.

Q-5: Coordinate bond is also known as
a) Native bond
b) Dative bond
c) Polar covalent bond
d) Electrovalent bond

Answer: b) Dative bond

Q-6: How is the pi- coordinate bond formed? Explain with an example

Answer: Pi-coordinate bonds are typically formed in compounds with back bonding. It is formed by electrons being donated from the donor atom to the atom that requires electrons. As an example: Boron has an empty p-orbital in BF_3, while fluorine has a lone pair of electrons. As a result, fluorine donates its lone pair of electrons to the Boron atom, thereby satisfying its deficiency.

Q-7: Mention the type of ***π***-coordinate bond in each of the following:

1) $N(SiH_3)_3$
2) BF_3
3) BCl_3
4) $H_3Si\text{-}N=C=S$
5) OCl_2

Answer:

Compound	Direction of donation	Type of ***π***-coordinate bond
$N(SiH_3)_3$	2p of N to 3d of Si	2p***π***-3d***π***
BF_3	2p of F to 2p of B	2p***π***-2p***π***
BCl_3	3p of Cl to 2p of B	2p***π***-3p***π***
$H_3Si\text{-}N=C=S$	2p of N to 3d of Si	2p***π***-3d***π***
OCl_2	2p of O to 3d of Cl	2p***π***-3d***π***

Q-8: How many dative bonds do sodium isocyanide and sodium cyanide have?

Answer: The formula for sodium isocyanide is NaNC, which has only one dative bond. Sodium cyanide, on the other hand, is NaCN, which has no dative bonds.

Q-9: Is it possible for a coordinate bond to be a sigma bond?

Answer: A coordinate bond is similar to a regular covalent bond, except that both electrons in the bond come from the same atom. A single coordinate bond is, therefore, a sigma bond..

Q-10: Match the column I with column II

Column I	**Column II**
a) $H^+ + H_2O$	1) Covalent bond
b) I + I	2) Coordinate bond
c) Na + ½ Cl_2	3) Polar covalent bond
d) H_2+I_2	4) Ionic bond

Answers: a)-2, b)-1, c)-4), d)-3

Q-11: A coordinate bond is formed in a molecule when an atom
a) has an electric charge
b) has all of its valence electrons shared
c) has only one unshared electron
d) has one or more unshared electron pairs.

Answer: d) has one or more unshared electron pairs
Q-12: Why is $N(SiH_3)_3$ planar but $(SiH_3)_3P$ pyramidal?

Answer: When electron pairs are donated from the central atom to a side atom, hybridisation always decreases by one step. In $N(SiH_3)_3$, electron donation takes place from 2p of N-atom to 3d of Si atom. As a result of the formation of the 2p(N)$\boldsymbol{\pi}$-3d(Si)$\boldsymbol{\pi}$ coordinate bond, $N(SiH_3)_3$ is planar and not pyramidal.

On the other hand, in $(SiH_3)_3P$ there is no such coordinate bond formation, therefore hybridization remains unaffected.

Q-13: When two species, X and Y, form an electron-pair bond but X does not contribute electrons to the bond. What information can be predicted about the X-Y bond?

Answer: Because Y contributes electrons to the bond formation, the bond formed between X and Y is covalent. Because one atom is donating electrons, it is also coordinate. The bond is thus a coordinate covalent bond.

Q-14: In coordination compounds, a coordinate covalent bond is formed between what kind of particles?
a) A ligand and counter ion
b) Metal and ligand
c) Counter ion and metal
d) between ligands

Answer: b) Metal and ligand

Explanation: Ligands are electron donor species that donate electrons to metal ions through the formation of coordinate covalent bonds.

Q-15: Explain the formation of a coordinate bond in the CO molecule.

Answer: A covalent coordinate bond is formed between carbon and oxygen in a CO molecule. The oxygen atom donates one of its unshared electron pairs to carbon, allowing both carbon and oxygen to have a stable configuration.

Practise Questions on Coordinate Bond

Q-1: In a coordinate bond
a) Electrons are transferred between bonded atoms
b) Electrons are equally shared between bonded atoms
c) Electrons are shared only by one atom
d) Electrons are donated by both the atoms

Answer: c) Electrons are shared only by one atom

Q-2: What type of bond exists between B and O in $(C_2H_5)_2OBH_3$?
a) Banana bond
b) Hydrogen bond
c) Ionic bond
d) Dative bond

Answer: d) Dative bond
Explanation: O has a lone pair of electrons that it donates to Boron's empty 2p orbital, forming a dative bond.

Q-3: Which of the following species contain a coordinate bond?
a) $FeCl_3$

b) CO
c) $[Fe(CN)_5NO]^{2-}$
d) N_3^-

Answer: b) and c)

Q-4: What are the conditions required for the formation of ***π***-coordinate bond?

Answer: For a molecule to form a ***π***-coordinate bond, the following conditions must be met:
a) The atom-atom bond should be polar.
b) For donation, a lone pair must be present on the donor atom, and the acceptor must have empty orbitals.
c) For effective overlapping, at least one element must be from the second period.

Q-5: Why is the Lewis acidity of BF_3 lower than that of BCl_3, despite the fact that fluorine is more electronegative than chlorine?

Answer:.Acidity in a molecule occurs when it lacks electrons. The formation of a 2p(B)***π***-2p(F)***π*** coordinate bond reduces the electron deficiency in BF_3. However, in BCl_3, it is of the type 2p(B)***π***-3p(Cl)***π***, which has a lower strength than the 2p(B)***π***-2p(F)***π*** coordinate bond. As a result, BF_3 has a lower Lewis acidity than BCl_3.