1) The number of moles of AgCl precipitated when excess of $AgNO_3$ solution is added to one mole of $[Cr(NH_3)_4Cl_2]Cl$ solution is

a) one

b) three

c) two

d) four

Answer :

The complex has only one mole of ionisable chlorine, the chlorine outside the square bracket. $[Cr(NH_3)_4Cl_2]Cl$

Ans : (a)

2) The octahedral and paramagnetic complex is

a) $[Fe(CN)_6]^{3-}$

b) $[Fe(CN)_6]^{4-}$

c) $[Cu(NH_3)_4]^{+2}$

d) $[Ni(CN)_4]^{-2}$

Answer :

Charge on Fe is F^{+3}

Electronic Configuration of Fe^{+3} [Ar]

When strong ligands CN^- approach pairing of electron taken place but still contains one unpaired electron hence paramagnetic

Ans : (a)

3) Ionisable and non - ionisable valency of copper in $[Cu(NH_3)_4]SO_4$

a) 4 and 2

b) 2 and 4

c) 2 and 2

d) 1 and 4

Answer :

Ionisable valency = O.No.=2; Non ionisable is co-ordination no.=4

Ans : (b)

4)Which of the following complex will give white precipitate with $BaCl_2(aq)$?

- a) $[Cr(NH_3)_5SO_4]Cl$
- b) $[Co(NH_3)_4SO_4]NO_2$
- c) $[Cr(NH_3)_5Cl]SO_4$
- d) both (1) and (3)

Answer :

contains SO_4^{-2} ion

Ans : (c)

5) The number of d-electrons in $[Cr(H_2O)_6]^{+3}$[Z of Cr=24] is

a) 2

b) 3

c) 4

d) 5

Answer :

Electronic configuration of Cr^{+3} is [Ar] **3d**

since H_2O is a weak field ligand number of unpaired electrons remain unchanged.

Ans : (b)

6) The donor atoms in EDTA are

a) two N and two O

b) two N and four O

c) four N and two O

d) three N and three O

Answer :

Ans : (b)

7) Which of the following ligands is not chelating?

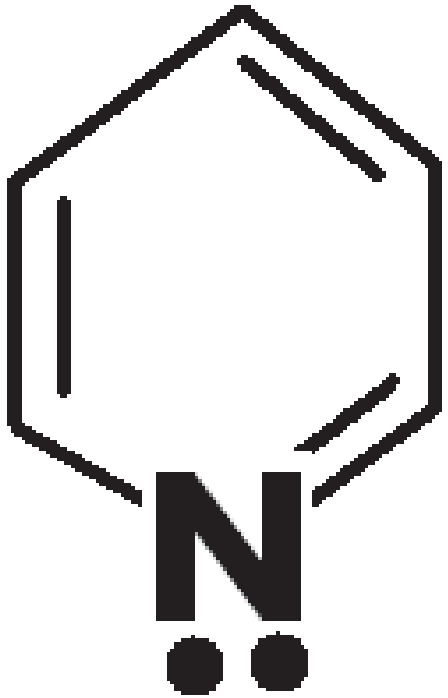
a) EDTA

b) en

c) oxlate

d) pyridine

Answer :



monodentate ligand can not form chelate

Ans : (d)

8) The IUPAC name of $[CoCl(NO_2)(en)_2]Cl$ is

a) chloronitrobis (ethylenediamine) cobalt (III) chloride

b) chloronitrobis (ethylenediamine) cobalt (II) chloride

c) chlorobis (ethylene diamine) nitrocobalt (III) chloride

d) bis (ethylenediamine) chloronitrocobalt (III) chloride

Answer :

Ans : (c)

9) The IUPAC name for the complex $[CrCl_2(H_2O)_4]NO_3$ is

a) dichlorotetraaquachromium (III) nitrate

b) tetraaquodichlorochromate (III) nitrate

c) dichlorotetraaqueous-chromium (IV) nitrate

d) tetraaquadichlorochromium (III) nitrate

Answer :

Ans : (d)

10) The chemical formula for iron hexacyano-ferrate (II) is

a) $Fe[Fe(CN_6)]$

b) $Fe_3[Fe(CN)_6]$

c) $Fe_3[Fe(CN)_6]_4$

d) $Fe_4[Fe(CN)_6]_3$

Answer :

Ans : (d)

11) The compound $[Cr(H_2O)_6]Cl_3$ and $[Cr(H_2O)_3Cl_3]3H_2O$ are example of

a) linkage isomerism
b) hydrate isomerism
c) ligand isomerism
d) ionization isomerism

Answer :

Ans : (b)

12) The complex ions $[Co(NH_3)_5(NO_2)]^{2+}$ and $[Co(NH_3)_5(ONO)]^{2+}$ are

a) ionization isomers
b) linkage isomers
c) coordination isomers
d) geometrical

Answer :

Ans : (b)

13) The possible number of ionization isomers for the complex $[MCl_2Br_2]SO_4$ is

a) 3
b) 2
c) 4
d) 5

Answer :

$[MCl_2Br_2]\ SO_4$;
$[MClBr_2SO_4]Cl$;
$[MCl_2BrSO_4]Br$

Ans : (a)

14) The effective atomic number of iron (at. No.26) in the complex $K_4[Fe(CN)_6]$ is

a) 24
b) 35
c) 36
d) 18

Answer :

Ans : (c)

15) Coordination number and oxidation number of Cr in $K_3[Cr(C_2O_4)_3]$ are, respectively

a) 4 and +2

b) 6 and +3

c) 3 and +3

d) 3 and 0

Answer :

Ans : (b)

16) In which of the following complex the central metal ion is not in a state of d^2sp^3 hybridized state

a) $[CoFe_6]^{3-}$

b) $[Co(NH_3)_6]^{3+}$

c) $[Fe(CN)_6]^{3-}$

d) $[Cr(NH_3)_6]^{3+}$

Answer :

F is a weak ligand, forms outer d complex sp^3d^2

Ans : (a)

17) Which of the following is paramagnetic?

a) $K_4[Fe(CN)_6]$

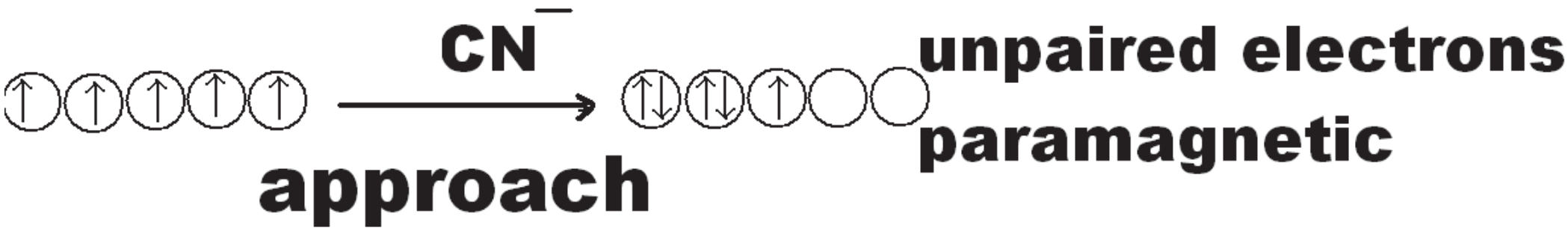
b) $K_3[Fe(CN)_6]$

c) $[Ni(CO)_4]$

d) $[Co(NH_3)_6]Cl_3$

Answer :

Fe^{+3} [Ar]



Ans : (b)

18) In the complex $[Ni(H_2O)_2 (NH_3)_4]^{2+}$, the number of unpaired electron is

a) 0

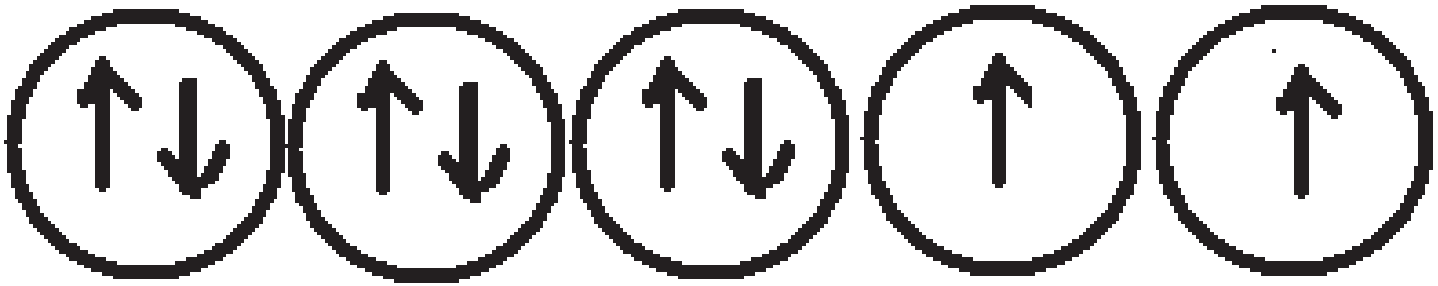
b) 1

c) 3

d) 2

Answer :

Ni^{+2} has under gone sp^3d^2 hybridisation



Ans : (d)

19) Which one of the following is not expected to show paramagnetism?

a) $[Ni(H_2O)_6]^{2+}$

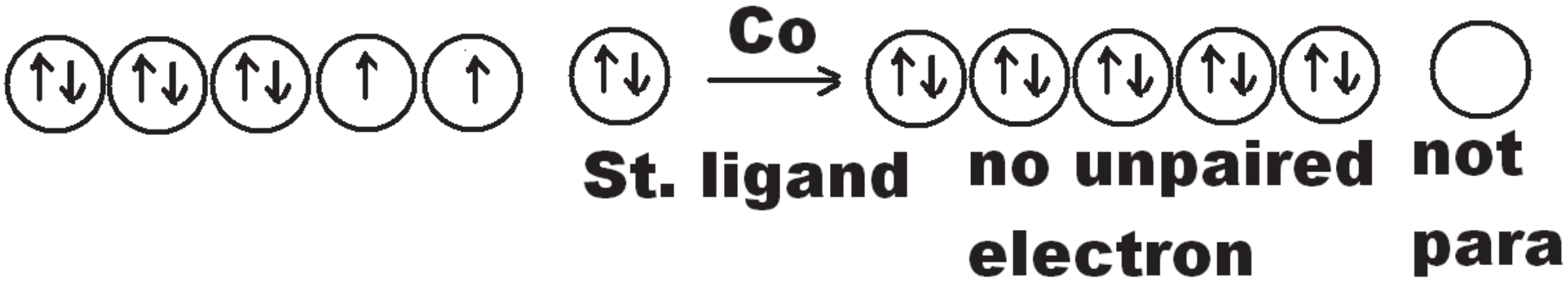
b) $Ni(CO)_4$

c) $[Ni(NH_3)_4]^{2+}$

d) $[Co(NH_3)_6]^{2+}$

Answer :

Ni atom [Ar]



Ans : (b)

20) Which complex has square planar structure?

a) $Ni(CO)_4$

b) $[NiCl_4]^{2+}$

c) $[Ni(H_2O)_6]^{2+}$

d) $[Cu(NH_3)_4]^{2+}$

Answer :

(d) dsp^2 hybridisation

Ans : (d)

21) Amongst the following complex ions, which one has the highest paramagnetism?

a) $[Cr(H_2O)_6]^{3+}$

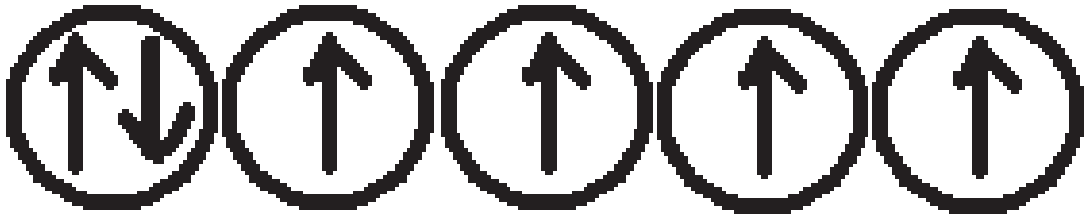
b) $[Fe(H_2O)_6]^{2+}$

c) $[Cu(H_2O)_6]^{2+}$

d) $[Zn(H_2O)_6]^{2+}$

Answer :

Fe^{+2} [Ar]



H_2O is a weak ligand

Ans : (b)

22) The compounds $[Co(NH_3)_5(Br)]SO_4$ and $[Co(NH_3)_5SO_4]Br$ are examples of

a) geometrical isomerism

b) linkage isomerism

c) ionization isomerism

d) optical isomerism

Answer :

Ans : (c)

23) In $[Co(NH_3)_6]Cl_3$ the number of covalent bonds is

a) 6

b) 3

c) 9

d) 18

Answer :

Each NH_3 molecule has 3-covalent bonds

Ans : (d)

24) Which of the following statements is incorrect?

a) in $K_3[Fe(CN_6)$ the ligand has satisfied only the secondary valency of ferric ion

b) in $K_3[Fe(CN_6)$ the ligand has satisfied both primary and secondary valencies of ferric ion

c) in $K_4[Fe(CN_6)$ the ligand has satisfied both primary and secondary valencies of ferrous ion

d) in $[Cu(NH_3)_4]SO_4$, the ligand has satisfied only the secondary valency of copper ion

Answer :

CN^- negative ligand satisfies both primary as well as secondary valency of Fe^{+3}

Ans : (a)

25) Among $[Ni(CO)_4]$, $[Ni(CN)_4]^{-2}$ and $[NiCl_4]^{-2}$ species, the hybridisation states at the Ni atom are respectively

a) sp^3, dsp^2, dsp^2

b) sp^3, dsp^2sp^3

c) sp^3, sp^3, dsp^2

d) dsp^2, sp^2, sp^3

Answer :

CO and CN^- are strong field ligands while Cl^- is a weak.

In $[Ni(CO)_4]$ Ni $3d^8 4s^2$ shifts to $3d^{10} 4s^\circ$ and has sp^3 hybridisation.

In $[Ni(CN)_4]^{-2}$, Ni^{+2} $3d^8$ shifts to aquiring dsp^2 hybridisation.

In $[Ni\ Cl_4]^{-2}$ $3d^8$ retains the configuration and is sp^{3-} hybridised.

Ans : (b)

26) Which of the following is not an atomic orbital?

a) s

b) p

c) f

d) σ

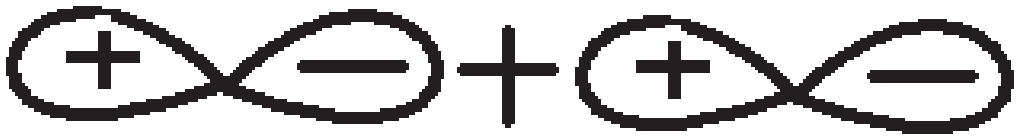
Answer :

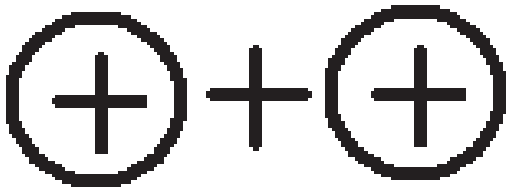
σ It is a molecular orbital

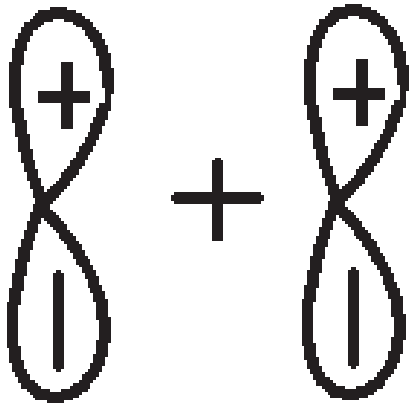
Ans : (d)

27) In the following set ups which will give ABMO?

a) 

b) 

c) 

d) 

Answer :

ABMO are formed when lobs of opposite signs overlap

Ans : (b)

28) Number of nodal planes in **π^*2p_x orbitals are**

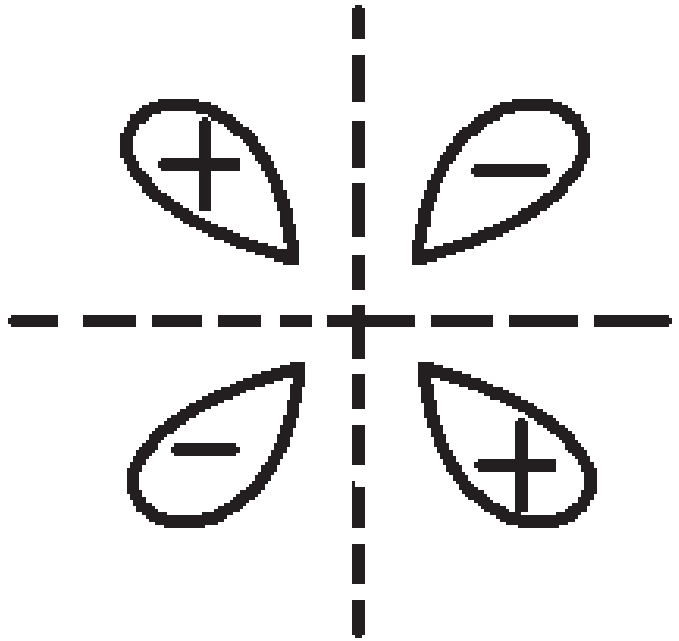
a) 1

b) 2

c) 3

d) zero

Answer :



π^*2p_x

Ans : (b)

29) The diagram

shows

a) σns

b) σ*ns

c) σnpz

d) σ*npz

Answer :

Ans : (d)

30) The electron probability density ψ^2 BMO is higher than that for individual atomic orbitals $\left(\psi_A^2 + \psi_B^2\right)$ by a factor of

a) $2\psi_A$

b) $2\psi_B$

c) $2\psi_A\psi_B$

d) $\left(\psi_A^2 \ \psi_B^2\right)$

Answer :

For BMO $\left(\psi_A + \psi_B\right)^2 = \psi_{BMO}^2$

$$\psi_A^2 + \psi_B^2 + 2\psi_A\psi_B = \psi_{BMO}^2$$

Difference

$$\psi_{BMO}^2 - \left(\psi_A^2 + \psi_B^2\right) = 2\psi_A\psi_B$$

Ans : (c)

31) What is wrong w.r.t molecular orbital?

a) It is polycentric in nature

b) The electron cloud spreads around the nuclei of combining atoms

c) The shapes are complex than atomic orbitals

d) All are wrong

Answer :

Ans : (d)

32) Which of the following is not correct w.r.t bond order?

a) Bond length is inversely proportional to bond order

b) Bond energy is directly proportional to bond order

c) Bond order is always a whole number

d) Bond formation requires N_B to be greater than N_A

Answer :

Bond order may be a fraction also

Ans : (c)

33) O_2 molecule is para magnetic because of

a) $[\pi 2P_x]^1$ and $[\pi 2P_y]^1$

b) $\pi^* 2Px_1$ and $\pi^* 2Py^1$

c) $\sigma 2P_z^1$ and $\sigma^* 2P_z^1$

d) $\sigma^* 2P_z^1$ and $\pi^* 2P_z^1$

Answer :

Ans : (b)

34) Which of the following is paramagnetic?

a) O_2

b) O_2^-

c) O_2^+

d) All of these

Answer :

Ans : (d)

35) Which of (I) CO (II) N_2 and (III) CN^- have the same bond order?

a) I and II
b) II and III
c) I and II
d) All I, II and III

Answer :

All CO, N_2 and CN^- have 14 electrons. Hence bond order same.

Ans : (d)

36) Which of the following is correct with respect to the stability order of H_2, H_2^+ and H_2^-?

a) $H_2 > H_2^- > H_2^+$

b) $H_2 > H_2^+ > H_2^-$

c) $H_2 > H_2^+ = H_2^-$

d) $H_2 = H_2^+ = H_2^-$

Answer :

Eventhough both H_2^+ & H_2^- have same bond order in H_2^- more electronis in ABMO $\sigma^*$is which makes it less stable

Ans : (b)

37) Which of the following is paramagnetic?

a) N_2

b) O_2

c) O_2^{-2}

d) O_2^{+2}

Answer :

It has two unpaired electrons

Ans: b

38) During the changes N_2 to N_2^{+2} and O_2 to O_2^{+2} the bond lengths in respective cases:

a) increases in both

b) decreases in both

c) increases in first case and decrease in second

d) decrease in first case and increases in second

Answer :

For N_2 to N_2^{+2} B. O changes from 3 to 2. Hence bond length increases.

For O_2 to O_2^{+2} bond order changes from 2 to 3 Hence bond length decreases

Ans : (c)

39) In which of the following ionization process the bond order has increased and the magnetic behavior is changed?

a) $N_2 \rightarrow N_2^+$

b) $C_2 \rightarrow C_2^+$

c) $NO \rightarrow NO^+$

d) $O_2 \rightarrow O_2^+$

Answer :

NO has 15 electrons with B. O. = 2.5 paramagnetic NO^+ has 14 electrons with B. O. = 3 and diamagnetic.

Ans : (c)

40) The bond lengths in the species O_2, O_2^+ and O_2^- ions are in the order

a) $O_2^+ > O_2 > O_2^-$

b) $O_2^+ > O_2^- > O_2$

c) $O_2 > O_2^+ > O_2^-$

d) $O_2^- > O_2 > O_2^+$

Answer :

Bond order $O_2^- = 1.5$

$O_2 = 2$

$O_2^+ = 2.5$

Less the bond order more will be the bond length

Ans : (d)

41) Bond order value of C-C bond in benzene is expected to be

a) 0.5

b) 1

C) 1.5

D) 2

Answer :

Total 9 bonds for 6 carbon atoms

Average BO = $\frac{9}{6}$ =1.5

Ans : (c)

42) The stability order of O_2 and its ions is

a) $O_2^{+2} > O_2^{+} > O_2 > O_2^{-} > O_2^{-2}$

b) $O_2^{+2} = O_2^{-2} > O_2^{+} > O_2^{-} > O_2$

c) $O_2^{+2} = O_2^{+} > O_2^{-2} > O_2^{-} > O_2$

d) $O_2^{-2} > O_2^{-} > O_2 > O_2^{+} > O_2^{+2}$

Answer :

B. O. are

$O_2^{+2} = 3$,

$O_2^{+} = 2.5$,

$O_2 = 2$,

$O_2^{-} = 1.5$

$O_2^{-2} = 1$

Ans : (a)

43) Which of the following statements is correct?

a) sigma molecular orbitals are symmetrical about internuclear axis

b) pi-molecular orbitals are not symmetrical about internuclear axis

c) Diatomic species having equal number of total electrons have equal bond order.

d) All of the above

Answer :

Ans : (d)

44) Which of the following species has unpaired electrons?

a) N_2
b) N_2^{2+}
c) N_2^{-2}
d) O_2^{-2}

Answer :

N_2^{-2} KK σy^2 $\sigma^* y^2$ $\pi 2P_x^2$ $\pi 2P_y^2$ $\pi 2P_z^2$..... $\pi^* 2P_x^1 \pi^* 2P_y^1$

Ans : (c)

45) Which of the following is correct w.r.t. metallic bond?

a) Metal ions occupy lattice points
b) It is non directional bond
c) It is a force of attraction between metal cations and delocalized electrons of the electron sea.
d) All of the above

Answer :

Ans : (d)

46) Metallic luster is due to

a) Absorption and re-emission of photons by oscillating electrons
b) Attraction between kernels and electrons of the electron sea
c) Reflection of incident light
d) Coating of the surface by some reflecting polish

Answer :

Ans : (a)

47. The bond order of NO is 2.5 while that of NO^+ is 3. Which of the following statements is true for these two species?

(a) Bond Length of NO is greater than NO^+.

(b) Bond Length of the NO^+ is greater than NO.

(c) Bond length of NO^+ is equal to that of NO.

(d)Bond length is unpredictable.

Answer:

$$\text{Bond Length } \alpha \frac{1}{B.O}$$

Ans : (a)

48) Number of molecular orbitals formed is,

a) Equal to number of combining atomic orbitals.

b) Less than number of combining atomic orbitals

c) More than the number of combining atomic orbitals.

d) Half the number of combining atomic orbitals.

Answer:

Ans: (a)

49) Which of the following is paramagnetic and also has bond order equal to 0.5,

a) O_2
b) N_2
c) He_2
d) H_2^+

Answer:

Ans: (d)

49) A mettalic bond is,

a) Ionic
b) Polar Covalent
c) Non-Polar Covalent
d)Electrostatic

Answer:

Ans: (d)