CHEMISTRY

BOOKS - R SHARMA CHEMISTRY (HINGLISH)

CHEMICAL BONDING

Examples

1. Use the Lewis dot symbols to describe the formation of aluminium oxide (Al_2O_3).

Strategy: The Lewis dot symbols of Al and O are

$$: Al \cdot \qquad \cdot \underset{\cdot\,\cdot}{\overset{\cdot\,\cdot}{O}} \cdot$$

Thus, the common valency of Al is 3 while that of O is two. As a result, aluminium tends to form the trivalent cation $\left(Al^{3+}\right)$ and oxygen, the divalent anion $\left(O^{2-}\right)$. The transfer of electrons is from Al to O. There are three valence electrons in each Al atom, each O atom needs two electrons to form the O^{2-} ion, which is isoelectronic, with neon. Thus, the simplest neutralizing ratio of Al^{3+} to O^{2-} is $2:3$, two Al^{3+} ions have a total charge of $6+$

and three O^{2-} ions have a total charge of $6-$. Thus, the empirical formula of aluminium oxide is Al_2O_3.

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2. Draw a Lewis structure for nitrogen trichloride, NCl_3.

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3. Write the Lewis dot structure of CO molecule .

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4. Draw the Lewis structure of nitric acid, HNO_3.

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5. Draw a Lewis structure for the bicarbonate ion, HCO_3^-.

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6. Write the Lewis dot structure of the nitrite ion $\left(NO_2^{\Theta}\right)$.

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7. Draw the Lewis structure of $BeCl_2$.

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8. Draw a Lewis structure of nitric oxide, NO.

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9. Draw the Lewis structure for SF_6.

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10. Draw the Lewis structure of iodine pentafluoride, IF_5.

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11. Write the resonance structures for N_2O_4 which has an $N-N$ bond as suggested by experiments.

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Follow Up Test 1

1. Matter consists of

(i) elements

(ii) compounds

(iii) mixtures of elements

(iv) mixtures of compounds

A. (i), (ii)

B. (i), (ii), (iii)

C. (i), (ii), (iii), (iv)

D. (i), (ii), (iii)

Answer: C

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2. Two or more atoms of the same or different elements chemically combine to form a

(i) molecule of an element

(ii) molecule of a covalent compound

(iii) polyatomic ion

(iv) network solid

A. (i), (ii)

B. (i), (ii), (iii)

C. (i), (ii), (iv)

D. (i), (ii), (iii), (iv)

Answer: D

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3. During the formation of a chemical bond, the potential energy of the interacting atoms is lowered by at least _____ $kJmol^{-1}$.

A. 40

B. 50

C. 60

D. 30

Answer: A

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4. How many extreme types of chemical bonds exists in chemical species?

A. Two

B. Three

C. Four

D. Five

Answer: B

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5. According to the electronic theory of chemical bonding, developed independently by K ö $ssel$ and Lewis, the atoms of

representative elements can combine either by the transfer of valence electrons from one atom to another (gaining or losing) or by the sharing of valence electrons in order to have an octet in their _____. This is known as octet rule.

A. inner shell

B. penultimate hsell

C. antepenultimate shell

D. outermost shell

Answer: D

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Follow Up Test 2

1. An ionic bond is the electrostatic attraction between positive and negative ions which are formed by two different elements when

A. both have low negative electron gain enthalpy

B. both have high ionization enthalpy

C. one of the elements has low ionization enthalpy and the other has a high negative electron gain enthalpy

D. one of the elements has high $\Delta_1 H$ and the other has a low negative $\Delta_{eg} H$

Answer: C

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2. The electrovalency of the element is equal to the

A. number of electrons lost

B. number of electrons gained

C. number of electrons transferred

D. number of electrons lost or gained by the atom of the element during the formation of ions of ionic compound

Answer: D

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3. We cannot describe the shape and geometry of the formula units of ionic compounds because ionic bonds are

A. very strong

B. nondirectional

C. formed through exchange of electrons

D. very rare

Answer: B

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4. What is the coordination number of an ion in sodium chloride?

A. 6

B. 8

C. 4

D. 2

Answer: A

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5. The coordination number of ions in ionic solids is decided by the

A. magnitude of charge on the ions

B. number of electrons in the ions

C. ionic radii of ions

D. electronic configurations of ions

Answer: C

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6. Which of the following polar solvents has the highest dielectric constant?

A. H_2O

B. D_2O

C. CH_3OH

D. C_2H_5OH

Answer: A

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7. Lattice enthalpy is the change in energy that occurs when _____of an ionic solid is separated into isolated ions in the gas phase.

A. one gram

B. one mole

C. one gram atom

D. one gram molecule

Answer: B

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8. Which of the following ionic solids has the lowest melting point?

A. KCl

B. $NaCl$

C. LiF

D. $LiCl$

Answer: D

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9. Most of the monatomic ions of the representative elements are obtained by removing all the valence electrons from the atoms of metallic elements. Once these atoms have lost their valence electrons, they have stable noble gas or pseudo noble gas configurations.

Which of these elements forms a cation having pseudo noble gas configuration?

A. Mg

B. Ga

C. K

D. Al

Answer: B

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10. Group 13 elements show less tendency to form ionic compounds than do group 1 and 2 elements, which primarily form ionic compounds because

A. they are p-block elements

B. they fall after d-block elements

C. the loss of successive electrons from an atom requires increasingly more energy

D. none of these

Answer: C

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11. No compounds of representative elements are found with ions having charges greater than the group number because

A. these elements do not exhibit variable valency

B. once atoms of these elements have lost their valence electrons, they have stable noble gas or pseudo noble gas configurations

C. they are $s-$ and p-block elements

D. they have good shielding electrons

Answer: B

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12. There is a tendency for the elements of groups 13 to 15 of higher periods, particulary period 6, to form compounds with ions having a positive charge of _____less than the group number.

A. one

B. three

C. four

D. two

Answer: D

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13. The elements fo groups 16 and 17 whose atoms have the largest negative electron gain enthalpies would be expected to

form_____by gaining electrons to give_____configurations.

A. polyatomic ions, noble gas

B. polyatomic ions, pseudo noble gas

C. monatomic ions, noble gas, or pseudo noble gas

D. monoatomic ions, noble gas

Answer: C

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14. Although the electron gain enthalpy of $N\left(2s^2 2p63\right)$ is positive, the N^{3-} ion $\left(2s^2 2p^6\right)$ is stable in the presence of certain positive ions such as

A. Na

B. Li

C. K

D. Rb

Answer: B

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15. Which of the following cations posses neither noble gas nor pseudo noble gas configurations?

(i) Bi^{3+} (ii) Pb^{2+}

(iii) Sn^{2+} (iv) Tl^{+}

A. (ii), (iii)

B. (i), (iv)

C. (i), (ii), (iii)

D. (i), (ii), (iii), (iv)

Answer: D

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16. Many ions, particulary anions, are polyatomic. The atoms in these ions are held together by

A. electrovalent bonds

B. hydrogen bonds

C. covalent bonds

D. metallic bonds

Answer: C

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17. Cations are usually made from metals and anions are usually made from nonmetals, but there is one cation in ionic solids which is made from non metallic elements. The elements are

A. N and H

B. H and O

C. P and H

D. N and O

Answer: A

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18. Most transition metals from several cations having _____configurations.

A. pseudo noble gas

B. noble gas

C. both pseudo noble gas and noble gas

D. neither pseudo noble gas nor noble gas

Answer: A

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19. In forming ions, the atoms of transition metals generally lose the ns electrons first, then they may lose one or more $(n-i)d$ electrons. The $2+$ ions are common for the transition elements and are obtained by the

loss of the highest energy electrons from the atom except

A. Ni

B. Fe

C. Cu

D. Co

Answer: C

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20. Many transition elements also form $3+$ ions by losing one $(n-1)d$ electron in addition to the two ns electrons except

A. Sc

B. Cr

C. Fe

D. Ni

Answer: D

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21. In case of transition metals, certain atoms can lose different numbers of valence electrons, i.e., they show variable electrovalency. The more stable ion is the one which has more stable core except

A. Fe^{3+}

B. Cu^{2+}

C. Cu^{+}

D. Fe^{2+}

Answer: B

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22. Many ionic compounds in transition metal ions are colored because of the electronic transitions (in the visible range) involving d electrons, whereas the ionic compounds of the representative elements are usually colorless. Which of the following compounds is green in color?

A. $CuSO_4 5H_2O$

B. $K_2Cr_2O_7$

C. $NiCl_26H_2O$

D. $CoCl_{2.6}H_2O$

Answer: C

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23. Aqueous solutions of transition metal cations are also colored. Which of the following imparts pale yellow color?

A. Fe^{3+}

B. Fe^{2+}

C. Mn^{2+}

D. Cr^{3+}

Answer: A

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24. Which of the following catios forms colorless solution?

A. CO^{2+}

B. Ni^{2+}

C. Cu^{2+}

D. Zn^{2+}

Answer: D

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25. Which of the following transition metal catios have noble gas core?

(a) Sc^{3+} (b) Y^{3+}

(c) La^{3+} (d) Ac^{3+}

A. (i), (ii), (iii)

B. (i), (ii), (iii), (iv)

C. (i), (ii), (iv)

D. (ii), (iii), (iv)

Answer: B

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26. For the formation of ionic bond between two atoms, the electronegativity difference

between them should be greater than or equal to

A. 1.7

B. 1.9

C. 2.0

D. 2.5

Answer: C

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27. Although for Mg, $\Delta_i H\left(378kJmol^{-1}\right)$ is greater than $\Delta_i H_2\left(1450kJmol^{-1}\right)$, Mg prefers to form $MgCl_2$ rather than $MgCl$ because

A. Mg^{2+} ion has the noble gas configuration

B. Mg^{2+} ion is smaller than Mg^{+}

C. Mg^{2+} ion has higher charge than Mg^{+} ion

D. the lattice enthalpy of $MgCl_2$ is very high

Answer: D

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28. Although Na^{2+} has a higher charge and, therefore, $NaCl_2$ should have a greater lattice enthalpy, sodium prefers to form $NaCl$ rather than $NaCl_2$ because

A. $\Delta_i H_2$ of Na is very high

B. the lattice enthalpy of $NaCl_2$ is far too small to compensate for the energy required to produce the Na^{2+} ion

C. Na^{2+} does not have the noble gas electron configuration

D. the lattice enthalpy of $NaCl_2$ is less than the lattice enthalpy of $NaCl$

Answer: B

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Follow Up Test 3

1. A covalent bond results from the sharing of electrons between two atoms of

A. metallic elements

B. nonmetallic elements

C. metalloid elements

D. zero or relatively small electronegativity difference

Answer: D

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2. Pairs of nonmetal atoms share electron pairs to form covalent bonds because the result of this sharing is that each atom attains a more stable electron configuration, frequently the same as that of the

A. following noble gas

B. preceding noble gas

C. nearest noble gas

D. inert gas

Answer: C

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3. The total number of lone pairs in a chlorine molecule is

A. six

B. three

C. four

D. two

Answer: A

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4. Most covalent bonds involve the sharing of _____ electrons.

(i) three (ii) two

(iii) four (iv) six

A. (i), (ii), (iii), (iv)

B. (ii), (iii), (iv)

C. (i), (ii), (iii)

D. (ii), (iii)

Answer: B

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5. How many covalent bonds are present in a molecule of carbon dioxide?

A. Two

B. Four

C. Six

D. Three

Answer: B

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6. In a polyatomic ion such as the ammonium ion, NH_4^+, the atoms are held together by

A. ionic bonds

B. covalent bonds

C. both ionic and covalent bonds

D. nondirectional bonds

Answer: B

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7. Which of the follwing forms covalent compound?

A. Ca

B. Mg

C. Sr

D. Be

Answer: D

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8. Which of the following conditions are fulfilled by the Lewis dot structure for carbon tetrachloride?

(i) Each covalent bond is formed as a result of sharing of an electron pair between the atoms.

(ii) Each combining atom contributes at least one electron to the shared pair.

(iii) The combining atoms attain the noble gas configurations as a result of the sharing of electrons.

A. (i), (ii)

B. (ii), (iii)

C. (i), (iii)

D. (i), (ii), (iii)

Answer: D

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Follow Up Test 4

1. The nitrogen atom shows a maximum covalency of

A. six

B. five

C. four

D. three

Answer: C

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2. Carbon suboxide (C_3O_2) is a foul-smelling gas. Which of the following formulation represents the correct ground state Lewis structure for carbon suboxide?

A. $:O:C:C:C:O:$

B. $:O::C::C::C::O:$

C. $:O:C::C:C:O$

D. $:\ddot{O}::C::C::C::\ddot{O}:$

Answer: D

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3. BF_3 and NH_3 combine readily because of the formation of

A. a dative bond

B. an ionic bond

C. a hydrogen bond

D. a covalent bond

Answer: A

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4. Lewis formulas are not normally written for compounds containing_____elements.

(i) s-block (ii) p-block

(iii) d-block (iv) f-block

A. (ii), (iii), (iv)

B. (iii), (iv)

C. (ii), (iii)

D. (i), (ii), (iii)

Answer: B

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5. Which of the following is an electron-deficient compound?

A. $BeCl_2$

B. BCl_3

C. $AlCl_3$

D. All of these

Answer: D

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6. Which one of the following is not a hypervalent compound?

A. PF_5

B. SF_4

C. $SiCl_4$

D. IF_7

Answer: C

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7. Which of the following compounds does not follow the octet rule?

A. SF_2

B. CIF_3

C. NCl_3

D. CCl_4

Answer: B

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8. Which of the following compound contains ionic as well as covalent bonds?

A. KCN

B. $NaCl$

C. H_2O_2

D. MgO

Answer: A

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9. Maximum covalency shows by phosphorous is

A. 7

B. 6

C. 8

D. 5

Answer: B

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10. In the linear I_3^- (triiodide ion), the central iodine atom contains

A. two unpaired electrons

B. no unshared pair of electrons

C. four unshared pairs of electrons

D. three unshared pairs of electrons

Answer: D

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11. In the Lewis structure of acetic acid, there are

A. 18 shared and 6 unshared electrons

B. 16 shared and 8 unshared electrons

C. 14 shared and 10 unshared electrons

D. 12 shared and 12 unshared electrons

Answer: B

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12. Which of the following types of bonds are present in N_2O_5?

(i) Ionic

(ii) Coordinate

(iii) Coordinate covalent

(iv) Metallic

A. (i), (ii)

B. (ii), (iii)

C. (i), (ii), (iii)

D. (ii)

Answer: C

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13. The formal charges on the three O atoms in the O_3 molecule are

A. $0, +1, -1$

B. $0, 0, +1$

C. $0, 0, -1$

D. $0, -1, +1$

Answer: A

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14. Which of the following is the most likely Lewis structure of nitrosyl chloride, NOCl?

A. $\dot{\underset{\cdot\cdot}{\dot{C}}}l = \dot{N} - \dot{\underset{\cdot\cdot}{\dot{O}}}:$

B. $: \dot{\underset{\cdot\cdot}{\dot{C}}}l - \dot{N} = \dot{\underset{\cdot\cdot}{\dot{O}}}$

C. $\dot{\underset{\cdot\cdot}{\dot{C}}}l = N = \dot{\underset{\cdot\cdot}{\dot{O}}}$

D. $: \dot{\underset{\cdot\cdot}{\dot{C}}}l - N \equiv O:$

Answer: B

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15. In allene, C_3H_4, three C atoms are joined by

A. two sigma bonds and two pi bonds

B. two sigma bonds and one pi bond

C. three sigma bonds and three pi bonds

D. three pi bonds only

Answer: A

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Follow Up Test 5

1. Which of the following molecules has the longest nitrogen-nitrogen bond?

A. N_2H_4

B. N_2

C. N_2F_2

D. All have equal bond lengths

Answer: A

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2. Which of the following molecules has the maximum bond enthalpy?

A. $N_2(g)$

B. $CO(g)$

C. $F_2(g)$

D. $HF(g)$

Answer: B

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3. Which of the following molecules has the highest value of carbon-carbon bond energy?

A. C_2H_4

B. C_3H_8

C. C_2H_2

D. C_2H_6

Answer: C

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4. Which of the following has the shortest bond length?

A. Br_2

B. F_2

C. Cl_2

D. I_2

Answer: B

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5. Which of the following bonds has the lowest bond enthalpy?

A. $O - O$

B. $N - N$

C. $H - H$

D. $C - C$

Answer: A

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6. In ethene, the carbon-carbon bond distance is

A. $154pm$

B. $120pm$

C. $134pm$

D. $142pm$

Answer: C

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7. The $H-O-H$ bond angle in water is

A. 109.5°

B. 107°

C. 102°

D. 104.5°

Answer: D

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Follow Up Test 6

1. Which of the following is incorrect regarding resonance?

A. The canonical forms have no real existence.

B. The molecule exists for a certain fraction of time in one canonical form and for other fractions of time in other canonical forms.

C. There is no such equilibrium between the canonical forms as we have between tautomeric forms (keto and enol) is tautomerism.

D. The molecule as such has a single structure which is the resonance hybrid

of the canonical forms and which cannot as such be depicted by a Lewis structure.

Answer: B

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2. A molecule is described by three Lewis structures having energies E_1, E_2, and E_3, respectively. The energies of these structures follow the order $E_1 > E_2 > E_3$, respectively.

If the experimental energy of the molecules is E_0, the resonance energy is

A. $E_0 - E_3$

B. $E_0 - E_1$

C. $E_0 - E_2$

D. $E_0 - (E_1 + E_2 + E_3)$

Answer: A

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3. How many resonance structures can be drawn for the nitrate ion, NO_3^- ?

A. Four

B. Two

C. Three

D. zero or relatively small electronegativity difference

Answer: C

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4. Which of the following ions has resonating structures?

A. SO_4^{2-}

B. PO_4^{3-}

C. SO_3^{2-}

D. All of these

Answer: D

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5. Which of the following can exhibit resonance?

(i) Oxygen (ii) Ozone

(iii) Allene (iv) Hydrogen peroxide

A. (i), (ii), (iii), (iv)

B. (ii), (iii)

C. (i), (ii), (iii)

D. (i), (ii)

Answer: C

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6. Which of the following resonating structures is not correct for CO_2?

$$\dot{\underset{\cdot\cdot}{\overset{\cdot\cdot}{O}}} - \underset{I}{C} \equiv \overset{+}{O}: \leftrightarrow :\overset{+}{\underset{\cdot\cdot}{O}} - \underset{II}{C} \equiv \underset{\cdot\cdot}{O}\dot{:} \leftrightarrow$$

$$\underset{\cdot\cdot}{\overset{\cdot\cdot}{O}} = \underset{III}{C} = \underset{\cdot\cdot}{\overset{\cdot\cdot}{O}} \leftrightarrow :\overset{+}{O} \equiv \underset{IV}{C} - \underset{\cdot\cdot}{\overset{\cdot\cdot}{O}}\dot{:} \leftrightarrow$$

A. I

B. II

C. III

D. IV

Answer: B

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7. How many resonating structures can be drawn for NO_2?

A. Six

B. Four

C. Five

D. Two

Answer: B

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Follow Up Test 7

1. The bond between two identical nonmetal atoms has a pair of electrons

A. with identical spins

B. transferred fully from one atom to another

C. equally shared between them

D. unequally shared between the two

Answer: C

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2. Which contains both polar and non-polar bonds ? .

A. H_2O_2

B. CH_4

C. HCN

D. NH_4Cl

Answer: A

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3. Carbon tetrachloride has no net dipole moment because of

A. similar electron affinites of C and Cl

B. its regular tetrahedral geometry

C. its planar geometry

D. similar sizes of C and Cl atoms

Answer: B

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4. Which of the following will have zero dipole moment?

A. trans-1, 2-Dichloroethylent

B. cis-1, 2-Dichloroethylene

C. 1, 1-Dichloroethylene

D. None of these

Answer: A

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5. Which of the following molecule is nonpolar?

(i) $PbCl_4$ (ii) BF_3

(iii) $SnCl_2$ (iv) CS_2

A. (i), (ii), (iii)

B. (i), (ii), (iii), (iv)

C. (i), (ii), (iv)

D. (ii), (iii), (iv)

Answer: C

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6. The most polar bond is

A. $O - H$

B. $C - H$

C. $N - H$

D. $F - H$

Answer: D

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7. Which of the following has the highest dipole moment?

A. o-Dichlorobenzene

B. m-Dichlorobenzene

C. p-Dichlorobenzene

D. All have equal values

Answer: A

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8. Both CO_2 and H_2O contain polar covalent bonds but CO_2 is nonpolar while H_2O is polar because

A. H atom is smaller than C atom

B. CO_2 is a linear molecule while H_2O is an angular molecule

C. $O - H$ bond is more polar than $C - O$ bond

D. CO_2 contains multiple bonds while H_2O has only single bonds

Answer: B

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9. Molecular size of ICI and Br_2 is nearly same but $b.\,pt.$ of ICI is about 40° higher than BR_2 . This is due to :

A. ICl is bigger than Br_2

B. $I-Cl$ is bond is stronger than $Br-Br$ bond

C. ICl is polar while Br_2 is nonpolar

D. IE of $Br > IE$ of I

Answer: C

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10. The observed dipole moment of HCl is $1.03D$. If the bond length of HCL is 1.3Å, then the percent ionic character of $H-Cl$ bond is

A. $17\ \%$

B. $34\ \%$

C. $40\ \%$

D. $10\ \%$

Answer: A

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11. According to Fajan's rules, the maximum ionic character is favored by

A. small cation, large anion, high charge on ions

B. large cation, large anion, low charge on ions

C. small cation, small anion, high charge on ions

D. small anion, large cation, low charge on ions

Answer: D

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12. Which of the following has the highest covalent character?

A. $BeCl_2$

B. $MgCl_2$

C. $CaCl_2$

D. $BaCl_2$

Answer: A

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Follow Up Test 8

1. Among the following, the linear molecule is

A. ClO_2

B. CO_2

C. NO_2

D. SO_2

Answer: B

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2. The species which has pyramidal shape is

A. NO_3^-

B. SO_3

C. PCl_3

D. CO_3^{2-}

Answer: C

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3. Which one of the following molecules is planar?

A. BF_3

B. PH_3

C. NCl_3

D. NF_3

Answer: A

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4. Which of the following has a geometry different from others?

A. BF_4^-

B. SO_4^{2-}

C. PH_4^+

D. XeF_4

Answer: D

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5. The shape of NH_2^- is like that of

A. $BeCl_2$

B. $SnCl_2$

C. NO_2^+

D. CS_2

Answer: B

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6. The molecule AB_n is planar with six pairs of electrons around A in the valence shell. The value of n is

A. 6

B. 3

C. 4

D. 2

Answer: C

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7. In which of the following pairs do the species have identical shapes?

A. XeO_3 and I_3^-

B. $SnCl_4$ and XeF_4

C. SO_2 and SO_3

D. $SnCl_2$ and O_3

Answer: D

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8. Which of the following has a square pyramidal shape?

A. $XeOF_4$

B. XeO_3F_2

C. $XeOF_2$

D. XeO_2F_2

Answer: A

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9. Which of the following is not linear?

A. ICl_2^-

B. N_3^-

C. NO_2^-

D. CN_2^-

Answer: C

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10. Which of the following has minimum bond angle?

A. SO_3

B. $NOCl$

C. NH_4^+

D. H_2Se

Answer: D

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Follow Up Test 9

1. Which of the following is not correct?

(i) There can be more than one sigma bond between two atoms.

(ii) Two p orbitals always overlap laterally.

(iii) A sigma bond has no free rotation around its axis.

A. (i), (ii)

B. (ii), (iii)

C. (i), (iii)

D. (i), (ii), (iii)

Answer: D

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2. Which of the following contains nondirectional bonds?

A. BCl_3

B. $BeCl_2$

C. $RbCl$

D. NCl_3

Answer: C

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3. The number of sigma (σ) and $pi(\pi)$ bonds present in a molecule of tetracyanoethene is

A. 9σ and 9π

B. 9σ and 7π

C. 5σ and 9π

D. 5σ and 8π

Answer: A

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4. Which of the following is incorrect about sigma bonds?

A. They result from the end-to-end overlap of orbitals.

B. In σ bonds, the electron density is concentrated above and below the bond axis.

C. The shape of the molecule is determined by the orientation of σ bonds.

D. All of these

Answer: B

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5. According to the valence bond theory, when a covalent bond is formed between two reacting atoms, the potential energy of the system becomes

A. negative

B. positive

C. minimum

D. maximum

Answer: C

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6. The strongest covalent bond is formed by the overlap of

A. s and p orbitals

B. s and s orbitals

C. p and d orbitals

D. p and p orbitals

Answer: D

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Follow Up Test 10

1. Which of the following is incorrect about hybridization?

A. The concept of hybridization is not applied to isolated atoms.

B. Hybridization is the mixing of at least two nonequivalent atomic orbitals.

C. The number of hybrid orbitals generated is more than the number of pure atomic orbitals that participate in the hybridization process.

D. Hybridization requires an input of energy.

Answer: C

 Watch Video Solution

2. Covalent bonds in polyatomic molecules are formed by the overlap of

A. pure atomic orbitals

B. hybrid orbitals

C. hybrid orbitals with unhybridized ones

D. both (2) and (3)

Answer: D

 Watch Video Solution

3. The hybridization state of the central atom in $HgCl_2$ is

A. sp

B. sp^2

C. sp^3

D. dsp^2

Answer: A

Watch Video Solution

4. The hybridization state of the central atom in AlI_3 is

A. dsp^2

B. sp^3

C. sp^2

D. sp

Answer: C

Watch Video Solution

5. Hybridization of the central atom in PF_3 is

A. sp

B. dsp^2

C. sp^2

D. sp^3

Answer: D

Watch Video Solution

6. In C_3O_2, the hybridization state of C is

A. sp^2

B. sp

C. sp^3

D. dsp^2

Answer: B

Watch Video Solution

7. What type of hybridization is involved in XeF_2?

A. sp^3d

B. dsp^3

C. sp^3d^2

D. d^3sp^3

Answer: A

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8. By hybridization, we mean the hybridization of

A. electrons

B. atomic orbitals

C. atoms

D. protons

Answer: B

 Watch Video Solution

9. In hydrazine (N_2H_4), nitrogen is_____hybridized.

A. dsp^2

B. sp^2

C. sp^3

D. sp

Answer: C

Watch Video Solution

10. In C_2H_6 (ethane), the $C-C$ sigma (σ) bond is formed by _____overlap.

A. $p-p$

B. $sp-s$

C. $s-s$

D. sp^3-sp^3

Answer: D

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Follow Up Test 11

1. Molecular orbitals energy level diagram consists of

A. bonding molecular orbitals

B. antibonding molecular orbitals

C. nonbonding molecular orbitals

D. molecular orbitals in order of increasing energy

Answer: D

Watch Video Solution

2. Which of the following is incorrect regarding the MO theory?

A. The number of molecular orbitals formed is always equal to the number of atomic orbitals combined.

B. The more stable the bonding molecular orbitals, the less stable the

corresponding antibonding molecular orbital.

C. In a stable molecule, the number of electrons in bonding molecular orbitals is always equal to that in antibonding molecular orbitals.

D. Like an atomic orbital, each molecular orbital can accommodate up to two electrons with opposite spins in

accordance with the Pauli exclusion principle.

Answer: C

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3. If the z-axis is the molecular axis, then πMOs are formed by the overlap of

(i) p_z and p_z (ii) p_y and p_y

(iii) s and p_z (iv) p_x and p_x

A. (ii), (iv)

B. (i), (iii)

C. (i), (ii)

D. (ii), (iii)

Answer: A

4. If the z-axis if taken as the internuclear axis, then which of the following combinations of atomic orbitals is a nonbonding combination?

A. s and p_y

B. p_x and d_{yz}

C. p_x and p_y

D. All of these

Answer: D

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5. If E is the total energy of the combining atomic orbitals, and E_b and E_a are the

energies of the bonding and antibonding molecular orbitals formed, respectively, then

A. $E - E_b < E_a - E$

B. $E - E_b = E_a - E$

C. $E - E_b > E_a - E$

D. Any of these depending upon the nature of combining atoms

Answer: A

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6. Which of the following MOs has more than one nodal plane?

A. π_{2p_y}

B. σ_{2s}

C. $\sigma^*_{2p_x}$

D. $\pi^*_{2p_y}$

Answer: D

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7. The bond order of a molecule in the excited state can be

A. positive

B. negative

C. zero

D. both (2) and (3)

Answer: B

 Watch Video Solution

8. Which of the following is the correct order of stability?

A. $H_2 > H_2^+ > He_2 > He_2^+$

B. $H_2 > He_2^+ > H_2^+ > He_2$

C. $H_2 > H_2^+ > He_2^+ > He_2$

D. $H_2 > He_2 > H_2^+ > He_2^+$

Answer: C

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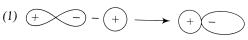
Follow Up Test 12

1. Which of the following linear combinations of atomic orbitals is incorrectly depicted?

A. 

B. 

C. 

D. 

Answer: D

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2. The strongest hydrogen bonding exists in

A. hydrogen sulphide

B. hydrogen fluoride

C. ammonia

D. water

Answer: B

Watch Video Solution

3. Which of the following has the highest boiling point?

A. H_2O

B. HF

C. NH_3

D. H_2Te

Answer: A

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4. Coordination number of hydrogen in a hydrogen bond is

A. 8

B. 4

C. 2

D. 1

Answer: C

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5. The length of H bonds is

A. same as that of covalent bonds

B. greater than that of covalent bonds

C. less than that of covalent bonds

D. less, greater, or same as that of covalent bonds depending upon the nature of substance

Answer: B

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6. Two ice cubes are pressed over each other until they unite to form one block. The force mainly responsible for holding them together is

A. van der Waals force

B. dipole-dipole interaction

C. H bonding

D. covalent bonding

Answer: C

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7. The vapor pressure of o-nitrophenol at any given temperature is predicted to be

A. higher than that of p-nitrophenol

B. lower than that of p-nitrophenol

C. same as that of p-nitrophenol

D. higher or lower depending upon the size of the vessel

Answer: A

Watch Video Solution

8. Which of the following hydeides has the lowest boiling point?

A. AsH_3

B. SbH_3

C. NH_3

D. PH_3

Answer: D

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Follow Up Test 13

1. The energy of σ_{2x}, is greater than that of σ^*_{1s} orbital because

A. σ_{2s} orbital is formed only after $1s$

B. σ_{2s} orbital is bigger than σ_{1s} orbital

C. σ_{2s} orbital has a greater value of n than σ^*_{1s}

D. σ_{2s} is a bonding orbital while σ_{2x}^{*} is an antibonding orbital.

Answer: C

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Question Bank Level I

1. The symbol for resonance is

A. $\leftrightarrow$

B. $\Leftrightarrow$

C. $=$

D. $\rightarrow$

Answer: A

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2. d^2sp^3 hybridization of atomic orbitals gives_____geometry.

A. square planar

B. triangular

C. tetragonal

D. octahedral

Answer: D

Watch Video Solution

3. A coordinate bond is a dative bond. Which of the following is true?

A. Two atoms bond by sharing electrons from third atom.

B. Two atoms form bond by sharing their electrons.

C. Two atoms form bond and one of them provides both electrons.

D. Three atoms form bond by sharing their electrons.

Answer: C

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4. The total number of electrons that take part in forming the bond in N_2 is

A. 10

B. 6

C. 4

D. 2

Answer: B

 Watch Video Solution

5. Which of the following is covalent?

A. H_2

B. KCl

C. Na_2S

D. CaO

Answer: A

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6. The number of lone pairs of electrons present on the central atom of CIF_3 is

A. 3

B. 1

C. 2

D. 0

Answer: C

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Question Bank Level Ii

1. Which of the following contains both ionic and covalent bonding?

A. $NaBr$

B. PCl

C. $Ba(CN)_2$

D. CH_3CH_2OH

Answer: C

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2. Which of the following species is hypervalent?

A. ClO_4^-

B. PO_4^{3-}

C. SO_3^{2-}

D. All of these

Answer: D

Watch Video Solution

3. Which of the following molecules is formed without following the octet rule?

A. SF_6

B. IF_7

C. $BeCl_2$

D. All of these

Answer: D

 Watch Video Solution

4. Which of the following is not correct about the concept of resonance?

A. Resonance involves several different acceptable Lewis fomulas with the same arrangement of atoms.

B. Resonance structures differ only in the arrangements of electron pairs, and never in the position of the atom.

C. The actual structure of the molecule or ion exhibiting resonance is the average,

or composite, of its resonance structures, but this does not mean that the electrons are moving from one place to another.

D. The average structure is less stable than any of the individual resonance structures.

Answer: D

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5. According to valence bond theory, sharing of electrons during the formation of covalent bond results from the _____of orbitals from two reacting atoms

A. addition

B. substraction

C. both (1) and (2)

D. overlap

Answer: D

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6. In the compound $HC \equiv C - CH = CH_2$, the hybridizations of $C-2$ and $C-3$ carbons are, respectively,

A. sp^3 and sp^3

B. sp^2 and sp^3

C. sp^2 and sp

D. sp^3 and sp

Answer: C

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7. Hybridization of central atom in NH_3 is

A. sp^3

B. sp

C. sp^2

D. dsp^2

Answer: A

Watch Video Solution

8. Shape and hybridization of IF_5, respectively, are

A. pentagonal pyramidal, sp^3d^3

B. square pyramidal, sp^3d^2

C. seesaw, sp^3d

D. trigonal bipyramidal, sp^3d

Answer: B

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9. The calculated bond order of superoxide ion $\left(O_2^-\right)$ is

A. 2.5

B. 1.5

C. 2

D. 1

Answer: B

Watch Video Solution

10. $BaSO_4$ is water insoluble although it is an ionic compound because

A. it has high hydration energy

B. it has low lattice energy

C. its hydration energy is more than lattice energy

D. its lattice energy is more than hydration energy

Answer: D

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11. The magnetic moment of KO_2 at room temperature is ---------- BM.

A. 1.73

B. 1.41

C. 2.64

D. 2.23

Answer: A

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12. Which of the following is correctly based on molecular orbital theory for peroxide ion?

A. Its bond order is two and it is paramagnetic.

B. Its bond order is two and it is diamagnetic.

C. Its bond order is one and it is diamagnetic.

D. Its bond order is one and it is paramagnetic.

Answer: C

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13. Which of the following is paramagnetic with bond order 0.5?

A. O_2^-

B. H_2^+

C. B_2

D. N_2

Answer: B

Watch Video Solution

14. In the of the following pairs of molecules /ions both the species are not likely to exist?

A. H_2^{2+}, He_2

B. H_2^{+}, He_2^{2-}

C. H_2^-, He_2^{2+}

D. H_2^-, He_2^{2-}

Answer: A

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15. The hydrogen bond is the strongest in

A. $O - H \ldots . N$

B. $O - H \ldots . . S$

C. $F - H \ldots . . F$

D. $F - H \ldots\ldots O$

Answer: C

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16. The charge/size ratio of a cation determines its polarizing power. Which one of the following sequences represents the increasing order of the polarizing power of the cationic species, $K^+, Ca^{2+}, Mg^{2+}, Ba^{2+}$?

A. $Be^{2+} < K^{+} < Ca^{2+} < Mg^{2+}$

B. $K^{+} < Ca^{2+} < Mg^{2+} < Be^{2+}$

C. $Mg^{2+} < Be^{2+} < K^{+} < Ca^{2+}$

D. $Ca^{2+} < Mg^{2+} < Be^{2+} < K^{+}$

Answer: B

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17. In XeF_2, XeF_4, and XeF_6, the number of lone pairs on Xe is, respectively,

A. $4, 1, 2$

B. $1, 2, 3$

C. $2, 3, 1$

D. $3, 2, 1$

Answer: D

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18. In which of the following species the underlined C atom has sp^3 hybridization?

A. $CH_2 = \underline{C}H - CH_3$

B. $CH_3\underline{C}H_2OH$

C. $CH_3\underline{C}OCH_3$

D. $CH_3\underline{C}OOH$

Answer: B

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Question Bank Level Iii

1. Which of the following oxides of nitrogen is ionic?

A. N_2O_5

B. N_2O_3

C. N_2O_4

D. NO

Answer: A

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2. Which of the following is the correct electron-dot structure of N_2O molecule?

A. $:N=N=\dot{\underset{\cdot\cdot}{\overset{\cdot\cdot}{O}}}:$

B. $:N\equiv\overset{+}{N}-\dot{\underset{\cdot\cdot}{\overset{\cdot\cdot}{O}}}:^{-}$

C. $:N=N=\dot{O}:$

D. $\dot{\underset{\cdot\cdot}{\overset{\cdot\cdot}{N}}}=\dot{N}=\dot{O}:$

Answer: B

Watch Video Solution

3. Which of the following has the highest bond dissociation enthalpy?

A. F_2

B. Br_2

C. Cl_2

D. I_2

Answer: C

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4. The bond dissociation energy of $B-F$ bond in BF_3 is $kJmol^{-1}$ whereas that of $C-F$ in CF_4 is $515kJmol^{-1}$. The correct reason for higher $B-F$ bond dissociation energy as compared to that of $C-F$ is

A. lower degree of ppi-ppi interaction between B and F in BF_3 than that between C and F

B. significant ppi-p pi interaction between B and F in BF_3 whereas there is no

possibility of such interaction between C and F in CF_4

C. stonger σ bond between B and F in BF_3 as compared to that between C and F in CF_4

D. smaller size of B atom as compared to that of C atom.

Answer: B

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5. Using MO theory predict which of the following sepcies has the shortest bond length ?

A. O_2^{2+}

B. O_2^{+}

C. O_2^{-}

D. O_2^{2-}

Answer: A

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6. RbO_2 is

A. peroxide and diamagnetic

B. superoxide and paramagnetic

C. peroxide and paramangetic

D. superoxide and diamagnetic

Answer: B

 Watch Video Solution

7. The bond angle and dipole moment of water respectively are :

A. $102.5^\circ, 1.56D$

B. $107.5^\circ, 1.56D$

C. $109.5^\circ, 1.84D$

D. $104.5^\circ, 1.84D$

Answer: D

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8. The number of nodal planes present in a σ^* antibonding orbital is

A. 2

B. 3

C. 1

D. 0

Answer: C

Watch Video Solution

9. Which one of the following constitutes a group of the isoelectronic species ?

A. C_2^{2-}, O_2^-, CO, NO

B. N_2, O_2^-, NO^+, CO

C. $CN^-, N_2, O_2^{2-}, C_2^{2-}$

D. $NO^+, C_2^{2-}, CN^-, N_2$

Answer: D

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10. Which of the following is not paramangnetic?

A. NO

B. H_2^+

C. CO

D. O_2

Answer: C

Watch Video Solution

11. Which of the following has transient existence?

A. He

B. H_2^+

C. H

D. H^+

Answer: B

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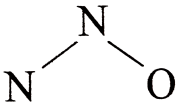
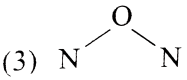
12. Which of the following is the structure of N_2O which is isoelectronic with CO_2 and N_3^- ?

A. $N - N - O$

B. (2) 

C. (3) 

D. $N - O - N$

Answer: A

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13. Which one of the following molecules is expected to exhibit diamagnetic behaviour?

(i) N_2 (ii) O_2

(iii) S_2 (iv) C_2

A. (i), (ii), (iii), (iv)

B. (ii), (iii)

C. (i), (iii)

D. (i), (iv)

Answer: D

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14. The percentage of p-character in the orbitals forming $p - p$ bonds in P_4 is

A. 75

B. 50

C. 25

D. 33

Answer: A

 Watch Video Solution

15. The species having bond order different from that in CO is

A. NO^+

B. NO^-

C. N_2

D. CN^-

Answer: B

Watch Video Solution

16. Among the following , the paramagnetic compound is :

A. N_2O

B. Na_2O_2

C. O_3

D. KO_2

Answer: D

Watch Video Solution

17. In which of the following ionixation processes , the bond order has increased and the magnetic behaviour has changed ?

A. $O_2 \rightarrow O_2^+$

B. $NO \rightarrow NO^+$

C. $N_2 \rightarrow N_2^+$

D. $C_2 \rightarrow C_2^+$

Answer: B

Watch Video Solution

18. How many types of $F - S - F$ bonds are present in SF_4?

A. 5

B. 4

C. 2

D. 3

Answer: C

Watch Video Solution

19. Which among the following has smallest bond angle ?

A. H_2S

B. H_2O

C. NH_3

D. SO_2

Answer: A

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Question Bank Level Iv

1. The molecule of sulphuric acid contains

A. ions, covalent, and coordinate bonds

B. ionic and covalent bonds

C. covalent and coordinate bonds

D. only covalent bonds

Answer: D

Watch Video Solution

2. The number of water molecule(s) derectly bonded to the metal centre in $CuSO_{4.5}H_2O$ is

A. 2

B. 3

C. 4

D. 5

Answer: D

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3. The correct order of stabilities of the following resonance structures is :

(I) $H_2C = \overset{\oplus}{N} = \overset{\ominus}{N}$

(II) $H_2\overset{\oplus}{C} - N = \overset{\ominus}{N}$

(III) $H_2\overset{\ominus}{C} - \overset{\oplus}{N} \equiv N$

(IV) $H_2\overset{\ominus}{C} - N = \overset{\oplus}{N}.$

A. $(III) > (I) > (IV) > (II)$

B. $(I) > (III) > (II) > (IV)$

C. $(I) > (II) > (IV) > (III)$

D. $(II) > (I) > (III) > (IV)$

Answer: B

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4. How many sigma and pi bonds are present in the linear chain compound which has the formula C_5H_4 and contains both double and triple bonds?

A. 6 sigma and 6 pi

B. 8 sigma and 2 pi

C. 6 sigma and 4 pi

D. 8 sigma and 4 pi

Answer: D

Watch Video Solution

5. Stability of the species Li_2, Li_2^-, Li_2^+ increases in the order of

A. $Li_2 < Li_2^+ < Li_2^-$

B. $Li_2^- < Li_2 < Li_2^+$

C. $Li_2 < Li_2^- < Li_2^+$

D. $Li_2^- < Li_2^+ < Li_2$

Answer: D

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6. A square planar complex is formed by hybridisation of which atomic oritals?

A. s, p_x, p_y, d_{xy}

B. s, p_x, py, d_{z^2}

C. $s, p_x, p_y, d_{x^2-y^2}$

D. s, p_x, p_y, d_{yz}

Answer: C

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7. Number of sigma bonds in P_4O_{10} is :

A. 16

B. 17

C. 7

D. 6

Answer: A

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Archives

1. Which one of the following molecules contains no π - bond ?

A. H_2O

B. SO_2

C. NO_2

D. CO_2

Answer: A

Watch Video Solution

2. Which of the following is a polar moleule ?

A. SF_4

B. SiF_4

C. XeF_4

D. BF_3

Answer: A

Watch Video Solution

3. Which of the following is paramagnetic?

A. O_2^-

B. CN^-

C. NO^+

D. CO

Answer: A

Watch Video Solution

4. XeF_2 is isostructural with

A. ICl_2^-

B. $SbCl_3$

C. $BaCl_2$

D. TeF_2

Answer: A

Watch Video Solution

5. In which of the following molecules/ions in the central atom sp^2-hybridized?

A. NH_2^- and H_2O

B. NO_2^- and H_2O

C. BF_3 and NO_2^-

D. NO_2^- and NH_2^-

Answer: C

Watch Video Solution

6. According to MO theory which of thhe following lists makes the nitrogen species in terms of increasing bond order?

A. $N_2^{2-} < N_2^- < N_2$

B. $N_2 < N_2^{2-} < N_2^-$

C. $N_2^- < N_2^{2-} < N_2$

D. $N_2^- < N_2 < N_2^{2-}$

Answer: A

Watch Video Solution

7. In the case of alkali metals, the covalent character decreases in the order.

A. $MF > MCl > MBr > MI$

B. $MF > MCl > MI > MBr$

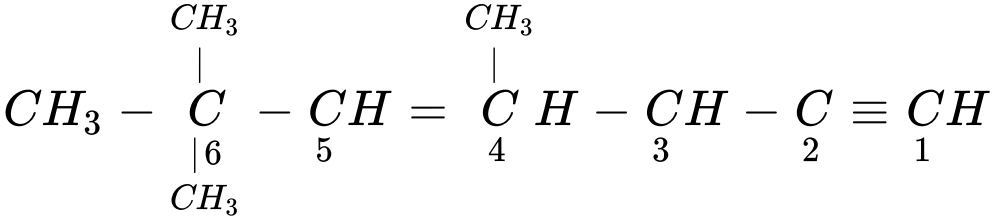
C. $MI > MBr > MCl > MF$

D. $MCl > MI > MBr > MF$

Answer: C

Watch Video Solution

8. The state of hybridization of C_2, C_3, C_5, and C_6 of the hydrocarbon



is in the following sequence:

A. sp^3, sp^2, sp^2, and sp

B. sp, sp^2, sp^2, and sp^3

C. sp, sp^2, sp^3, and sp^2

D. sp, sp^3, sp^2, and sp^3

Answer: D

Watch Video Solution

9. Arrange the following ions in the order of decreasing $X - O$ bond length where X is the central atom:

A. $ClO_4^-, SO_4^{2-}, PO_4^{3-}, SiO_4^{4-}$

B. $SiO_4^{4-}, PO_4^{3-}, SO_4^{2-}, ClO_4^-$

C. $SiO_4^{4-}, PO_4^{3-}, ClO_4^-, SO_4^{2-}$

D. $SiO_4^{4-}, SO_4^{2-}, PO_4^{3-}, ClO_4^-$

Answer: B

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10. The enolic form of butanone contains

A. 12σ bonds, 1π bond, and 2 lone pairs of electrons

B. 11σ bonds, 1π bond, and 2 lone pairs of electrons

C. 12σ bonds, 1π, and 1 lone pair of electrons

D. 10σ bonds, 2π bond, and 2 lone pairs of electrons

Answer: A

Watch Video Solution

11. Four diatomic species are listed in different sequence .Which of these represent the correct order of their increasing bond order?

A. $O_2^- < NO < C_2^{2-} < He_2^+$

B. $NO < C_2^{2-} < O_2^- < He_2^+$

C. $C_2^{2-} < He_2^+ < NO < O_2^-$

D. $He_2^+ < O_2^- < NO < C_2^{2-}$

Answer: D

Watch Video Solution

12. The angular shape of none molecule (O_3) consists of

A. 1 sigma and 2 pi bonds

B. 2 sigma and 2 pi bonds

C. 1 sigma and 1 pi bonds

D. 2 sigma and 1 pi bonds

Answer: D

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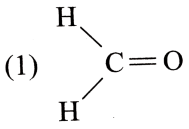
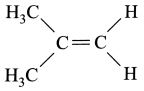
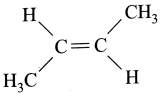
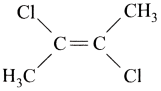
13. Which has the highest dipole moment?

A. 

B. (2) 

C. (3) 

D. (4) 

Answer: A

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14. The hybridization of oxygen atom in H_2O_2 is

A. sp^3d

B. sp

C. sp^2

D. sp^3

Answer: D

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15. Which one of the following pairs consists of only paramagnetic species

A. O_2, NO

B. O_2^+, O_2^{2-}

C. CO, NO

D. NO, NO^+

Answer: A

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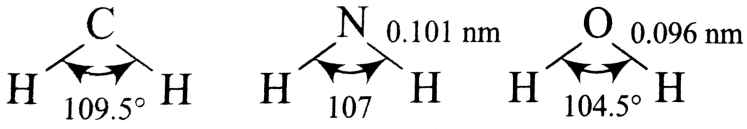
16. The bond lengths and bond angles in the molecules of methane, ammonia, and water are given below:



This variation in bond angle is a result of

(i) the increasing repulsion between H atoms as the bond length decreases

(ii) the number of nonbonding electron pairs in the molecule

(iii) a nonbonding electron pair having a greater repulsive force than a bonding electron pair

A. (i), (ii), and (iii) are correct

B. (i) and (ii) are correct

C. (ii) and (iii) are correct

D. only (i) is correct

Answer: C

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17. The correct order of bond order values among the following

(i) NO^- (ii) NO^+

(iii) NO (iv) NO^{2+}

(v) NO^{2-}

A. (i) lt (iv) lt (iii) lt (ii) lt (v)

B. (iv) = (ii) lt (i) lt (v) lt (iii)

C. (v) lt (i) lt (iv) = (iii) lt (ii)

D. (ii) lt (iii) lt (iv) lt (i) lt (v)

Answer: C

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18. A coordinate bond is a dative bond. Which of the following is true?

A. Three atoms form bond by sharing their electrons.

B. Two atoms form bond by sharing their electrons.

C. Two atoms form bond and one of them provides both electrons.

D. Two atoms form bond by sharing electrons obtained from the third atom.

Answer: D

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19. In $TeCl_4$, the central tellurium involves the hybridization

A. sp^3

B. sp^3d

C. sp^3d^2

D. dsp^2

Answer: B

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20. In which of the following pairs are the two species isostructural?

A. BrO_3^- and XeO_3

B. SF_4 and XeF_4

C. SO_3^{2-} and NO_3^-

D. BF_3 and NF_3

Answer: A

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21. The number of σ and π- bonds in allyl isocyanide are

A. $9\sigma, 3\pi$

B. $9\sigma, 9\pi$

C. $3\sigma, 4\pi$

D. $5\sigma, 7\pi$

Answer: A

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22. The energy of hydrogen bond is of the order of

A. $4kJmol^{-1}$

B. $40kJmol^{-1}$

C. $400kJmol^{-1}$

D. $4000kJmol^{-1}$

Answer: A

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23. Which of the following has the least bond angle?

A. H_2O

B. H_2S

C. H_2Se

D. H_2Te

Answer: B

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24. Match the list I and II and choose the correct matching:

$List I (Species)$	$List II (Geometry)$
$A.\ H_3O^+$	$1.\ Planar$
$B.\ H_2C = NH$	$2.\ Angular$
$C.\ ClO_2^-$	$3.\ Tetrahedral$
$D.\ NH_4^+$	$4.\ Trigonalbipyramidal$
$E.\ PCl_5$	$5.\ Pyramidal$

A. $A-2, B-1, C-3, D-5, E-4$

B. $A-1, B-5, C-2, D-3, E-4$

C. $A-5, B-1, C-2, D-3, E-4$

D. $A-3, B-1, C-4, D-5, E-2$

Answer: C

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25. The decreasing order of the boiling points of the following hydrides

(i) NH_3 (ii) PH_3

(iii) AsH_3 (iv) SbH_3

(v) H_2O is

A. $(v) > (iv) > (i) > (iii) > (ii)$

B. $(v) > (i) > (ii) > (iii) > (iv)$

C. $(ii) > (iv) > (iii) > (i) > (v)$

D. $(iv) > (iii) > (i) > (ii) > (v)$

Answer: A

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26. Which of the following molecule is planar?

A. CH_4

B. NH_3

C. C_2H_4

D. $SiCl_4$

Answer: C

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27. In $\left[Ag(CN)_2\right]^-$, the number of π bonds is

A. 2

B. 3

C. 4

D. 6

Answer: A

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28. Which of the following is not a correct statement?

A. Every AB_5 molecule has square pyramidal structure.

B. Multiple bonds are always shorter than the corresponding single bonds.

C. The electron-deficient molecules can act as Lewis acids.

D. The cannonical structure has no real existence.

Answer: A

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29. The number of unpaired electrons in a parmamagnetic diatomic molecule of an element with atomic number 16 is :

A. 4

B. 1

C. 2

D. 3

Answer: A

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30. Which of the following is not isostructural with $SiCI_4$?

A. PO_4^{3-}

B. NH_4^+

C. SCl_4

D. SO_4^{2-}

Answer: C

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31. Which of the following species has a linear shape ?

A. NO_2^+

B. O_3

C. NO_2^-

D. SO_2

Answer: C

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32. In which of the following molecules all the bonds are not equal ?

A. AlF_3

B. NF_3

C. CIF_3

D. BF_3

Answer: A

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33. The electronegaivity difference between N and F is greater than that between N and H yet the dipole moment of NH_2 (1 .5 D) is

larger than that of $NF_3(0.2D)$. This is because :

A. in NH_3 as well in NF_3, the atomic dipole and bond dipole are in opposite directions

B. in NH_3, the atomic dipole and bond dipole are in the opposite directions whereas in NF_3, these are in the same direction

C. in NH_3 as well as in NF_3 the atomic dipole and bond dipole are in the same direction

D. in NH_3, the atomic dipole and bond dipole are in the same direction whereas in NF_3 these are in opposite directions

Answer: C

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34. Which of the following statements is true?

A. The dipole moment of NF_3 is zero.

B. The dipole moment of NF_3 is less than NH_3.

C. The dipole moment of NF_3 is more than NH_3.

D. The dipole moment of NF_3 is equal to NH_3.

Answer: B

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35. Which of the following is correct?

A. The number of electrons present in the valence shell of S in SF_6 is 12.

B. The rate of ionic reaction is very low.

C. According to $VSEPR$ theory, $SnCl_2$ is a linear molecule.

D. The correct order of stability to form ionic compounds among Na^+, Mg^{2+},

and Al^{3+} is $Al^{3+} > Mg^{2+} > Na^{+}$.

Answer: A

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36. Which of the following molecule is linear?

A. $BeCl_2$

B. H_2O

C. SO_2

D. CH_4

Answer: A

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37. The $H - O - H$ bond angle in water is

A. 120°

B. 109.5°

C. 107°

D. 104.5°

Answer: D

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38. The correct order of the lattice energies of the following ionic compounds is

A. $NaCl > MgBr_2 > CaO > Al_2O_3$

B. $NaCl > CaO > MgBr_2 > Al_2O_3$

C. $Al_2O_3 > MgBr_2 > CaO > NaCl$

D. $Al_2O_3 > CaO > MgBr_2 > NaCl$

Answer: D

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39. In which of the following molecules does the central atom not follow the octet rule?

A. CO_2

B. BF_3

C. H_2O

D. PCl_3

Answer: B

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40. The correct order of increasing covalent character is :

A. $BeCl_2 < NaCl < LiCl$

B. $NaCl < LiCl < BeCl_2$

C. $BeCl_2 < LiCl < NaCl$

D. $LiCl < NaCl < BeCl_2$

Answer: B

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41. Which of the following would have permanent dipple moment ?

A. BF_3

B. SF_4

C. SiF_4

D. XeF_4

Answer: B

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42. The correct order in which the $O-O$ bond length increases in the following :

A. $O_3 < H_2O_2 < O_2$

B. $O_2 < O_3 < H_2O_2$

C. $O_2 < H_2O_2 < O_3$

D. $H_2O_2 < O_2 < O_3$

Answer: C

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43. $O-O-H$ bond angle in H_2O_2 is approximately_____.

A. $127^\circ 28'$

B. $109^\circ 28'$

C. 104.5°

D. 97°

Answer: D

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44. Among the compounds BF_3, NCI_3, H_2S, SF_4 and $BeCI_2$., identify the ones in which the central atom has the same type of hybridisation

A. BF_3, NCl_3, and H_2S

B. H_2S and $BeCl_2$

C. NCl_3 and H_2S

D. BF_3 and NCl_3

Answer: C

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45. If molecule MX_3 has zero dipole moment, the sigma bonding orbitals used by M (atomic number $< 2l$) are

A. pure p

B. sp hybrid

C. sp^2 hybrid

D. sp^3 hybrid

Answer: C

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46. In BrF_3 molecule, the lone pair occupies equatorial position minimize

A. lone pair-bond pair repulsion only

B. bond pair-bond pair repulsion only

C. lone pair-lone pair repulsion and lone pair-bond pair repulsion

D. lone pair-lone pair repulsion only

Answer: C

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47. In an octahedral structure , the pair of d orbitals involved in d^2sp^2 hybridization is

A. $d_{x^2-y^2}, dz^2$

B. $d_{xz}, d_{x^2-y^2}$

C. d_{z^2}, d_{xz}

D. d_{xy}, d_{yz}

Answer: A

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48. In a regular octahedral molecule MX_6 the number of $X - M - X$ bonds at 180° is

A. three

B. two

C. six

D. four

Answer: A

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49. Among the following the pair in which the two species are not isostuctural is

A. SiF_4 and SF_4

B. IO_3^- and XeO_3

C. BH_4^- and BH_4^+

D. PF_6^- and SF_6

Answer: A

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50. The statement true for N_3^- is

A. it has a nonlinear structure

B. it is called a pseudohalogen

C. the formal oxidation state of nitrogen in this anion is -1

D. it is isoelectronic with NO_2

Answer: B::C

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51. Which of the following is arranged in the increasing order of enthalpy of vaporization?

A. NH_3, PH_3, AsH_3

B. AsH_3, PH_3, NH_3

C. NH_3, AsH_3, PH_3

D. PH_3, AsH_3, NH_5

Answer: D

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52. The dipole moment is the highest for

A. trans-but-2-ene

B. 1,3-dimethyl benzene

C. acetophenone

D. ethanol

Answer: C

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53. The ONO bond angle is maximum in

A. NO_3^-

B. NO_2^-

C. NO_2

D. NO_2^+

Answer: D

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54. Shape of O_2F_2 is similar to that of

A. C_2F_2

B. H_2O

C. H_2F_2

D. C_2H_2

Answer: B

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55. Which of the following is a correct set with respect to molecule, hybridization, and shape?

A. $BeCl_2$, sp^2, linear

B. $BeCl_2$, sp^2, triangular

C. BCl_3, sp^3, triangular planar

D. BCl_3, sp^3, tetrahedral

Answer: C

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56. Which of the following is diamagnetic?

A. superoxide ion

B. carbon molecule

C. unipositive ion of nitrogen molecule

D. oxygen molecule

Answer: B

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57. H_2S is more acidic than H_2O. The reason is

A. $O-H$ bond is stronger than $S-H$ bond

B. O is more electronegative than S

C. $H-S$ bond is stronger than $O-H$ bond

D. $O-H$ bond is weaker than $H-S$ bond

Answer: A

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58. Maximum bond angle is present in case of

A. BBr_3

B. BCl_3

C. BF_4

D. same in all

Answer: D

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59. Which of the following statement is not correct for sigma and pi- bonds formed between two carbon atoms ?

A. A sigma bond is stronger tha a pi bond.

B. Bond energies of sigma and pi bonds are of the order of $264kJmol^{-1}$ and $347kJmol^{-1}$, respectively.

C. Free rotation of atoms about a sigma bond is allowed but not in case of a pi bond.

D. A sigma bond determines the direction between C atoms but a pi bond has no primary effect in this regard.

Answer: B

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60. Number of π electrons present in naphthalene is

A. 6

B. 3

C. 4

D. 5

Answer: D

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61. The electronegativities of F, Cl, Br, and I are $4.0, 3.0, 2.8,$ and 2.5, respectively. The hydrogen halide with a high percentage of ionic character is

A. HF

B. HCl

C. HBr

D. HI

Answer: A

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62. Dipole moment is shown by

A. $1, 4 -$ dichlorobenzene

B. $cis - 1, 2 -$ dichloroethene

C. $\tan s - 1, 2 -$ dichloroethene

D. $trans - 2, 3 -$ dichlorobut$-2 - e \neq$

Answer: B

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63. Which of the following does not contain coordinate bond?

A. BH_4^-

B. NH_4^+

C. CO_3^{2-}

D. H_3O^+

Answer: C

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64. In OF_2, the number of bond pairs and lone pairs of electrons are respectively,

A. $2, 6$

B. $2, 8$

C. $2, 10$

D. $2, 9$

Answer: B

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65. In NO_3^- ion, the number of bond pair and lone pair of electrons no N-atom are :

A. $2, 2$

B. $3, 1$

C. $1, 3$

D. $4, 0$

Answer: D

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66. Which of the following has $p\pi - d\pi$ bonding?

A. NO_3^-

B. SO_3^{2-}

C. BO_3^{3-}

D. CO_3^{2-}

Answer: B

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67. Which of the following is soluble in water

A. CS_2

B. C_2H_5OH

C. CCl_4

D. $CHCl_3$

Answer: B

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68. Which pair among the following is isostructural?

A. XeF_2, IF_2^-

B. NH_3, BF_3

C. CO_3^{2-}

D. PCl_3, ICI_5

Answer: A

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69. The main axis of diatomic molecule is z. The orbitals p_x and p_y overlap to form

A. π molecular orbital

B. σ molecular orbital

C. δ molecular orbital

D. no bond will be formed

Answer: D

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70. Sideways overlap of $p - p$ orbitals forms

A. sigma bond

B. pi bond

C. coordinate bond

D. H bond

Answer: B

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71. The shape of ClO_3^- is

A. triangular pyramidal

B. tetrahedral

C. triangular planar

D. triangular bipyramidal

Answer: A

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72. The correct order of bond angles in the molecules, H_2O, NH_3, CH_4, and CO_2 is

A. $H_2O > NH_3 > CH_4 > CO_2$

B. $H_2O < NH_3 < CO_2 < CH_4$

C. $H_2O < NH_3 > CO_2 > CH_4$

D. $CO_2 > CH_4 > NH_3 > H_2O$

Answer: D

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73. Fluorine molecule is formed by

A. the axial $p - p$ overlap

B. the sideways $p - p$ overlap

C. the axial $s - p$ overlap

D. the overlap of two sp^2 hybrid orbitals

Answer: A

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