

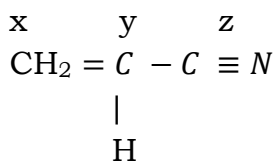
- Why do atoms combine together? Because
 - To have higher ionization potential.
 - To form a compound having lower energy.
 - To have low electro affinity.
 - To attain its lower electro negativity.
- Which of the following particle-particle interactions are arranged according to increasing order of strength of interaction?
 - Ion-dipole, ion-ion, dipole-dipole, induced dipole-induced dipole.
 - Ion-ion, dipole-dipole, ion-dipole, induced dipole-induced dipole.
 - Induced dipole-induced dipole, dipole-dipole, ion-dipole, ion-ion.
 - Dipole-dipole, induced dipole-induced dipole, ion-dipole, ion-ion.
- Which of the following pairs of atoms given below does not form ionic bonding?
 - Strontium and Oxygen
 - Sodium and nitrogen
 - Fluorine and Sulfur
 - Magnesium and Chlorine
- All of the following molecules possess hydrogen bonding, EXCEPT
 - CH₃CH₂-OH
 - H₂O
 - HCl
 - NH₃
- The number of lone pair and bonding pair electron existing in carbon disulfide (CS₂) molecule?
 - 3 bonding pairs and 2 lone pairs
 - 4 bonding pairs and 4 lone pairs
 - 4 bonding pairs and 8 lone pairs
 - 2 lone pairs and 2 bonding pairs.
- Two atoms A and B have the following electronic configuration 1s²2s²2p⁶3s² and 1s²2s²2p⁴ respectively. The atom A&B can form;
 - Ionic compound with formula AB₂
 - A covalent compound with formula AB
 - An ionic compound with formula AB
 - A covalent compound with formula A₃B₂
- Which of the following is a non-polar molecule possessing polar bond?
 - H₂
 - HCl
 - HF
 - CO₂
- In which of the following compound ionic, covalent and coordinate covalent bond exist?
 - NH₃
 - H₂O
 - BF₃
 - NH₄Cl
- Suppose that an element X is a member of group II A and element Y is member of group VA. The chemical formula of these compound is:
 - X₂Y₅
 - X₅Y₂
 - X₃Y₂
 - XY₃
- Which of the following substances does **NOT** conduct electricity
 - KCl (aq)
 - KCl(s)
 - Molten NaCl
 - potassium metal
- Which one of the following statements is **FALSE** about covalent compounds?
 - They are liquid or gaseous at ordinary condition
 - They are soluble in non polar solvent
 - They are made up of molecule
 - They are made up of oppositely charge ions
- Which one of the following atoms in its ground state has the greatest number of unpaired electrons?

- A. ${}_{13}\text{Al}$ B. ${}_{14}\text{Si}$ C. ${}_{15}\text{P}$ D. ${}_{16}\text{S}$
- Which compound contains both covalent and ionic bonds?
A. Sodium carbonate, Na_2CO_3 C. Dichloromethane, CH_2Cl_2
B. Magnesium bromide, MgBr_2 D. Ethanoic acid, CH_3COOH
 - Which molecule or ion does NOT have a tetrahedral shape?
A. XeF_4 B. SiCl_4 C. BF_4^- D. NH_4^+
 - Why are metals soft and malleable?
A. Because they are very shiny
B. Because of the presence of mobile electrons
C. Because they experience electrostatic repulsion
D. Because the metal cations can slip over each other fairly easily
 - How many π bonds are present in CO_2 ?
A. One B. Two C. Three D. Four
 - What is the correct molecular electronic configuration for the molecular ion, B_2^+ ?
A. $\sigma_{1s}^2\sigma_{1s}^*\sigma_{2s}^2\sigma_{2s}^*\sigma_{2p}^2$ C. $\sigma_{1s}^2\sigma_{1s}^*\sigma_{2s}^2\sigma_{2s}^*\sigma_{2p}^1\pi_{2px}^1$
B. $\sigma_{1s}^2\sigma_{1s}^*\sigma_{2s}^2\sigma_{2s}^*\pi_{2py}^2$ D. $\sigma_{1s}^2\sigma_{1s}^*\sigma_{2s}^2\sigma_{2s}^*\pi_{2px}\pi_{2py}$
 - Which of the following molecules or ions will exhibit delocalized bonding?
 NO_2^- , NH_4^+ , N_3^-
A. NO_2^- and N_3^- B. NH_4^+ and N_3^- C. NO_2^- D. NO_2^- and NH_4^+
 - Based on molecular orbital theory, the bond orders of H_2 , H_2^+ and H_2^- are _____ respectively.
A. 1, 0 and 0 B. 1, $\frac{1}{2}$, and 0 C. 1, 0, and $\frac{1}{2}$ D. 1, $\frac{1}{2}$, and $\frac{1}{2}$
 - How many 3d electrons are present in the ground state of chromium atom?
A. 4 B. 5 C. 6 D. 1
 - Which of the following ionic compounds is formed from the reaction between magnesium and nitrogen?
A. MgN_2 B. Mg_2N_2 C. Mg_2N_2 D. Mg_2N_3
 - Which of the following molecules represents a non-polar covalent bond?
A. B-Cl B. C-Cl C. Cl-Cl D. Mg-Cl
 - Which one of the following groups in the periodic table has paramagnetic atoms?
A. Group zero B. Group IIA C. Group IIB D. Group IVA
 - The total number of electrons participating in the bond formation of carbonate anion, CO_3^{2-} , in the molecule of carbonic acid are:
A. 16 B. 10 C. 8 D. 5
 - Which of the following crystals possess high electrical and thermal conductivities?
A. Ionic crystals B. Metallic crystals C. Molecular crystals D. Covalent network crystals
 - Which of the following molecules has a trigonalbipyramidal structure?
A. SF_4 B. IF_5 C. ICl_4 D. BrF_5
 - Which of the following hybrid orbitals is favoring the formation of trigonalbipyramidal?
A. sp^3d B. sp^3 C. sp^3d^2 D. sp^3d^3

28. Which one of the following molecules/molecular ions is paramagnetic according to the molecular orbital theory?
A. O_2^{2-} B. O_2 C. F_2 D. O_2^{2+}
29. Which of the following molecules has a dipole moment?
A. XeF_4 B. H_2S C. SO_3 D. CH_4
30. Which of the following element has the highest melting point?
A. Iodine B. Tungsten C. mercury D. Bromine
31. Which of the following is a chemical formula that represents an amino acid?
A. CH_4 B. CH_3NH_2 C. CH_3COOH D. NH_2CH_2COOH
32. Which term describes the units that make up compounds with covalent bonds?
A. Ions B. Acids C. Salts D. Molecules
33. There is a strong covalent bond between the N atoms in nitrogen gas, N_2 . Why, then, does nitrogen have such a low boiling point of $-196^\circ C$?
A. The bond between the N-atoms is triple
B. N is very electronegative, only next to F and O
C. The strong bond, and intermolecular one, determines the boiling point of the substance
D. Boiling point is determined by intermolecular force, which in this case is weak as the molecule is non-polar
34. Which of the statement below best explains why atoms react chemically with each other?
A. When atoms react, they gain protons and are more stable
B. When atoms react, they lose all their electrons and become more stable
C. When atoms react, they lose, gain, or share electrons and are then less stable
D. When atoms react, they lose, gain, or share electrons to attain a full outer energy level and are then more stable.
35. Which of the following species has the smallest H-X-H bond angle where X is the central atom?
A. H_2O B. NH_3 C. CH_4 D. BH_3
36. What is the hybridization of phosphorus atom in PCl_5 ?
A. sp^3d B. sp^3d^2 C. sp^3 D. sp^2
37. Which molecule has a Lewis structure that does NOT obey the octet rule?
A. NO B. CS_2 C. PF_3 D. HCN
38. Which of the following explains why, at room temperature, I_2 is a solid, Br_2 is a liquid and Cl_2 is a gas?
A. Ionic bonding C. Hydrogen bonding
B. Hybridization D. London dispersion forces
39. Which molecule listed below has two sigma (σ) bonds?
A. N_2 B. C_2H_4 C. N_2F_2 D. HCN
40. Which one of the following is NOT true of metallic bonding?
A. It gives rise to excellent electrical conductivity

- B. Electrons are free to move throughout the structure
 C. The strength of metallic bonds increases down a group.
 D. The strength of metallic bonding affects the boiling point of metals.
41. All of these are characteristics of most ionic compounds in the solid phases EXCEPT,
 A. High melting point C. high electrical conductivity
 B. Solubility in water D. insolubility in organic solvents
42. Which one of the following does NOT form hydroxide ions when placed in water?
 A. Ionic hydrides B. Ionic metal oxide C. nonmetal oxides D. ionic nitrides
43. Which set contains only covalently bonded molecules?
 A. $\text{BCl}_3, \text{SiCl}_4, \text{PCl}_5$ B. $\text{Br}_2, \text{N}_2, \text{HBr}$ C. $\text{I}_2, \text{H}_2\text{S}, \text{NaI}$ D. $\text{Al}, \text{O}_3, \text{As}_4$
44. Which of the following compounds would be expected to have the highest melting point?
 A. BaF_2 B. BaCl_2 C. BaBr_2 D. BaI_2
45. Which one of the compounds below is most likely to be ionic?
 A. CCl_4 B. NO_2 C. SCCl_3 D. ClO_2
46. When the following substances are arranged in order of increasing melting point (lowest melting point first), the correct order is:
 A. $\text{CH}_3\text{CH}_2\text{CH}_3, \text{CH}_3\text{COCH}_3, \text{CH}_3\text{CH}_2\text{CH}_2\text{OH}$
 B. $\text{CH}_3\text{CH}_2\text{CH}_3, \text{CH}_3\text{CH}_2\text{CH}_2\text{OH}, \text{CH}_3\text{COCH}_3$
 C. $\text{CH}_3\text{COCH}_3, \text{CH}_3\text{CH}_2\text{CH}_2\text{OH}, \text{CH}_3\text{CH}_2\text{CH}_3$
 D. $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{OH}, \text{CH}_3\text{CH}_2\text{CH}_3, \text{CH}_3\text{COCH}_3$
47. The type of compound that is MOST likely to contain a covalent bond is one that is
 A. a solid metal
 B. composed of only nonmetals
 C. composed of a metal from the far left and a non metal from far right of the periodic table
 D. held together by the electrostatic forces between oppositely charged ions
48. How many sigma and pi bonds are present in the following molecule?
 $\text{H}_3\text{C}-\text{CH}=\text{CH}-\text{CH}_3$
 A. 8 σ bonds and 1 π bond C. 8 σ bonds and 2 π bond
 B. 10 σ bonds and 2 π bond D. 11 σ bonds and 1 π bond
49. How many orbital's are there in an atom with $n = 4$?
 A. 2 B. 8 C. 16 D. 25
50. What hybridization change does the carbon atom undergo in the combustion of methane?
 $\text{CH}_4(\text{g}) + 2\text{O}_2(\text{g}) \rightarrow \text{CO}_2(\text{g}) + 2\text{H}_2\text{O}(\text{g})$
 A. $\text{sp} \rightarrow \text{sp}^2$ B. $\text{sp}^2 \rightarrow \text{sp}^3$ C. $\text{sp}^3 \rightarrow \text{sp}$ D. $\text{sp}^2 \rightarrow \text{sp}$
51. Which of the following ionic compounds has the greatest lattice energy?
 A. LiF B. LiCl C. LiBr D. LiI
52. How many unpaired electrons are there in the Lewis structure of a N^{3-} ion?

- A. 0 B. 1 C. 2 D. 3
53. Which one following compound does NOT follow the octet rule?
A. CS₂ B. PBr₃ C. IBr D. BrF₃
54. The molecular geometry of the H₃O⁺ ion is
A. Linear B. tetrahedral C. bent D. trigonal pyramidal
55. What is the hybridization of sulfur atom in SF₆?
A. Sp² B. Sp³ C. sp³ d D. sp³d²
56. Which of the following electron transition required the smallest energy to be absorbed by the hydrogen atom?
A. From n=4 to n=5 B. From n=3 to n=4 C. From n=2 to n=3 D. From n=1 to n=2
57. Which of the following molecules has a dipole moment?
A. XeF₂ B. IF₃ C. BF₃ D. SF₅⁺
58. The dissolution of water in octane (C₈H₁₈) is prevented by
A. dipole- dipole attraction between octane molecules
B. hydrogen bonding between water molecules
C. London dispersion forces between octane molecules
D. repulsion between like charged water and octane molecules
59. Which one of the following is NOT a form of chemical bonding?
A. Covalent bonding B. Metallic bonding C. Ionic bonding D. Hydrogen bonding
60. Which of the following statement is NOT true about covalent bonding?
A. Covalent bonds are least likely to be formed between atoms of the element.
B. Covalent bonds are least likely to be formed between atoms of different elements on the right side of periodic table
C. Covalent bonds are least likely to be formed between an element in Group 1 and an element in Group VII
D. Covalent bonds are least likely to be formed by head of the group elements with high ionization energies
61. Formic acid, which is released by ants, has a molecular formula of HCOOH. What are the possible hybridizations that exist in the molecule?
A. sp² and sp³ B. sp and sp³ C. sp, sp² and sp³ D. sp and sp²
62. What would happen to the O₂ molecule upon ionization to O₂⁺?
A. The bond length will increase and the bond energy will increase
B. The bond length will increase and the bond energy will decrease
C. The bond length will decrease and the bond energy will increase
D. The bond length will decrease and the bond energy will decrease
63. How many bonding pairs and lone pairs, respectively does the ion ICl₄ have?
A. 3, 2 B. 4, 2 C. 5, 1 D. 4, 1
64. Which of the following molecules does NOT have a tetrahedral central atom?
A. SF₄ B. AlH₄ C. BF₄ D. SiCl₄
65. Acrylonitrile has the following Lewis structure with designation of x, y and z for each carbon atom:



What will be the value of the bond angle and geometry of y

- A. 109° , tetrahedral B. 120° , trigonal pyramidal C. 180° , linear D. 90° , T-shaped
66. Which of the following molecule does NOT have a trigonal bipyramidal electron-pair geometry?
 A. SF_4 B. ClF_3 C. XeF_2 D. BrF_5
67. How many atomic orbitals are required for an sp^3 hybridization?
 A. 2 B. 6 C. 4 D. 8
68. A neutral molecule having the general formula AB , has two unshared pair of electrons on A. What is the hybridization of A?
 A, sp B, sp^2 C, sp^3 D. sp^3
69. Which of following contains an sp^2 hybridized atom?
 A, CH_2Cl B. H_2O C. N_2 D. H_2CCH_2
70. What is the electron set and molecular geometry of BrO_2 ?
 A, Trigonal planner, trigonal planar B. Tetrahedral, trigonal planner
 X. Trigonal pyramidal, linear D. Tetrahedral, bent
71. According to VSEPR theory, what is the geometry of PCl_3 molecule?
 A. Linear B. Trigonal planner C. Trigonal pyramidal D. Tetrahedral
72. What is the geometry of the molecular compound formed by the reaction of sulfur with hydrogen?
 A. Linear B. Trigonal planner C. Trigonal pyramidal D. Tetrahedral
73. Which combination of atoms is more likely to produce an ionic compound?
 A. Al and F B. P and H C. Si and O D. S and Br
74. What are the ions present in KHCO_3 ?
 A. KH^+ and CO_3 B. K^+ , H^+ , C^{4+} and O^+ C. K^+ , HCO_3^+ D. KH^{2+} , CO_3^{2-}
75. Which of the following substances contains an atom that obeys the octet rule?
 A. PCl_3 B. AlF_3 C. SF_4 D. NO_2
76. Which of the following has formed coordinate covalent bond?
 A. H_2O B. NH_4 C. CO_3^{2-} D. Na_2O
77. Which of the following elements will form an ionic bond with chlorine?
 A. Magnesium B. Oxygen C. Phosphorous D. Silicon
78. The perchloric acid molecule contains
 A. 8 lone pairs, no π bonds, and 5σ bonds B. 9 lone pairs, 2π bonds, and 5σ bonds
 C. 8 lone pairs, 3π bonds, and 5σ bonds D. 2 lone pairs, 3π bonds, and 4σ bonds
79. When a student draws a plausible Lewis structure for hydrazine molecule (N_2H_4), how many lone pairs of electrons are available? A. 2 B. 1 C. 3 D. 4
80. The number of resonance structures for CO_3^{2-} are:
 A. 3 B. 2 C. 6 D. 9

81. In the following equation, what type of hybridization change, if any, occurs at the Xe atom?

$$\text{XeF}_2(\text{s}) + \text{F}_2(\text{g}) \longrightarrow \text{XeF}_4(\text{s})$$
 A. sp^3d to sp^3 B. sp^2 to sp^3 C. sp^3d to sp^3d^2 D. sp^3 to sp^3d
82. What is (are) the bond angle(s) in SF_6 ?
 A. 180° B. 109.5° C. 90° and 109.5° D. 90°
83. Which of the following statements about oxygen and fluorine is NOT correct?
 A. O and F have the same number of core electrons.
 B. O has a smaller atomic radius than F.
 C. O has a smaller electron affinity than F.
 D. O^{2-} has a larger ionic radius than F^-
84. What will be the charges on the ions formed when silicon reacts with nitrogen?
 A. Si^{2+} , N^{2-} B. Si^{4+} , N^{3-} C. Si^{3+} , N^{3+} D. Si^{4+} , N^{2-}
85. Which of the following compounds does NOT contain an ionic bond?
 A. K_2S B. NaOH C. HCl D. LiH
86. Which of the following molecular orbital diagram is correct for the carbide ion (C_2^{2-})?
 A. $\sigma 1s^2 \sigma^* 1s^2 \sigma 2s^2 \sigma^* 2s^2 \pi 2p^4$ C. $\sigma 1s^2 \sigma^* 1s^2 \sigma 2s^2 \sigma^* 2s^2 \pi 2p^4 \sigma 2p^2 \pi^* 2p^4$
 B. $\sigma 1s^2 \sigma^* 1s^2 \sigma 2s^2 \sigma^* 2s^2 \pi 2p^4 \sigma 2p^2 \pi^* 2p^2$ D. $\sigma 1s^2 \sigma^* 1s^2 \sigma 2s^2 \sigma^* 2s^2 \pi 2p^4 \sigma 2p^2$
87. Which of the following is not the decomposition product of HNO_3 ?
 A. N_2O_4 B. NO_2 C. O_2 D. H_2O
88. From CO_2 , H_2O , BeCl_2 and N_2O which have the same molecular geometry?
 A. CO_2 , BeCl_2 and N_2O C. CO_2 , H_2O and N_2O
 B. CO_2 and BeCl_2 only D. H_2O and N_2O only
89. How many electrons are present in the $\sigma 2p$ molecular orbital of N_2^+ ?
 A. 1 B. 4 C. 3 D. 2
90. Give the following AF_n species, BF_3 , BeF_2 , CF_4 , NF_3 , OF_2 , what is the correct order of F-A-F bond angles?
 A. $\text{OF}_2 < \text{BeF}_2 < \text{NF}_3 < \text{BF}_3 < \text{CF}_4$ C. $\text{OF}_2 < \text{NF}_3 < \text{CF}_4 < \text{BF}_3 < \text{BeF}_2$
 B. $\text{CF}_4 < \text{BF}_3 < \text{NF}_3 < \text{BeF}_2 < \text{OF}_2$ D. $\text{BeF}_2 < \text{OF}_2 < \text{NF}_3 < \text{BF}_3 < \text{CF}_4$
91. Which of the following molecules has the largest dipole moment?
 A. HF B. HCN C. HCl D. CO
92. Arrange the following molecules in the order of increasing stability.
 A. $\text{N}_2^+ < \text{N}_2 < \text{N}_2^- < \text{N}_2^{2-}$ C. $\text{N}_2^{2-} < \text{N}_2^- < \text{N}_2 < \text{N}_2^+$ B. $\text{N}_2 < \text{N}_2^+ = \text{N}_2^- < \text{N}_2^{2-}$ D. $\text{N}_2^{2-} < \text{N}_2^- = \text{N}_2^+ < \text{N}_2$
93. Which of the following statements is correct about nitrosyl chloride (NOCl)?
 A. It has a trigonal planar geometry with O a central atom
 B. It has a bent or angular geometry with O a central atom
 C. It has a trigonal planar geometry with N a central atom
 D. It has a bent or angular geometry with N a central atom
94. What hybridization change, if any occurs at the underlined atom in the following reaction?

$$\text{CO}_2 + \text{H}_2\text{O} \longrightarrow \text{H}_2\text{CO}_3$$
95. sp^2 to sp^3 B. sp to sp^2 C. sp^3 to sp^3d D. No hybridization change
96. What is the molecular shape of ICl_4^- ?

- A. Octahedral B. T-shaped C. Trigonal bipyramidal D. Square planar
97. Which one of the following types of bonding exists between atoms with very different electronegativities?
- A. Ionic bonding C. Network covalent bonding
B. Hydrogen bonding D. Metallic bonding
98. Considering only resonance structures that are major contributors to the overall bonding in PF_5 , which of the following statements is correct?
- A. There are no resonance structures that involve ionic contributions.
B. Only three resonance structures can be drawn for PF_5
C. One resonance structure contains five P-F bonds.
D. In each resonance structure, the P atom carries a positive charge.
99. Which groups in the periodic table form ionic bonds?
- A. Groups IA and VIIB, Groups IIA & VIB
B. Groups IA and 17(VIIA), Group IIA & 16(VIA)
C. Group IA & 18(VIIA), Groups IVB & 14 (IVA)
D. Groups IIIB & VB, Group IVB & 14 (IVA)
100. There is a progressive decrease in the bond angle in the series of molecules CCl_4 , PCl_3 and H_2O . According to the VSEPR model, this is best explained by:
- A. Increasing electronegativity of the central atom
B. increasing number of lone pair electrons
C. Decreases the size of the central atom
D. decreasing bond strength
101. Which of the following compounds does not contain both ionic and covalent bond?
- A. NH_4NO_3 B. Na_2CO_3 C. NH_4Cl D. $\text{CH}_3\text{CO}_2\text{H}$