

DAV PUBLIC SCHOOLS, ODISHA ZONE-II  
HALFYEARLY EXAMINATION-(2015-16)

CLASS-XI SUB: CHEMISTRY

QUESTION BANK

SECTION – A

**Very short answer type questions carrying 1 mark each.**

- How many atoms of oxygen are there in 3.42gms of cane sugar ( $C_{12}H_{22}O_{11}$ ) ? (1)
- Arrange the following in the order of increasing non-metallic character –  
B, C, Si, N, F (1)
- Calculate the bond order of  $N_2$  (1)
- What is Boyle's temperature ? (1)
- State the factors on which magnitude of surface tension depends. (1)
- The atomic mass of silver is 108u. What is the mass of one atom of silver. (1)
- Write the difference between atomic mass and mass number of an atom of an element. (1)
- Write the IUPAC name and symbol for the element with atomic number 119. (1)
- Out of  $CO_2$  and  $BF_3$ , which one of them will have a larger bond angle and why? (1)
- What do you mean by BOD? (1)
- Find the significant figure for the following calculations: (1)
  - $\frac{3.26 \times 0.05342}{6.1859}$
  - $5 \times 5.634$
- Name the 3<sup>rd</sup> series of line spectrum of Hydrogen. (1)
- Represent Lewis Structure of  $CO_3^{2-}$  (1)
- Define coefficient of viscosity (1)
- What is photo chemical smog? (1)
- How are 0.50 mol  $Na_2CO_3$  and 0.50 M  $Na_2CO_3$  different ? (1)
- What is the maximum number of emission lines when the excited electron of a H atom in  $n = 6$  drops to the ground state? (1)
- Which has the largest bond angle  $H_2S$  or  $H_2O$  and why ? (1)
- Why rain drops are spherical ? Which properties is responsible for this ? (1)
- Why fish cannot grow in warm water as well as in cold water ? (1)
- Which has more atoms; 1.0g of hydrogen or 1.0g of carbon? (1)
- Write the electronic configuration of  $O^{2-}$ . (1)
- An element has valence shell electronic configuration as  $ns^2 np^3$ . To which group does this element belongs? (1)
- What is the shape of  $ClF_3$  molecule? (1)
- When the pressure of 5L of  $N_2$  is doubled and its temperature is raised from 300k to 400k, then what is the final volume of the gas? (1)
- What is the maximum number of electrons in f subshell with same spin? (1)
- " $BeH_2$  molecule has zero dipole moment although the Be-H bonds are polar"  
Explain. (1)
- Though carbon dioxide is inert and harmless gas, it is thought to be a serious pollutant. Why? (1)
- What does the property of molecules of real gases is indicated by van der Waals constant 'a'? (1)
- Using periodic table, identify (1)
  - An element that would tend to gain two electrons.
  - An element that would tend to lose two electrons.
- Calculate the gram atoms in 12.8g of Oxygen (1)
- Write the electronic configuration of  $Fe^{2+}$  ion. (1)

33. What type of hybridisation is involved in carbon atoms in  $C_2H_4$  ? (1)
34. Why is it not possible to cool a gas to  $0^\circ K$ ? (1)
35. How many atoms are present in 2.24 litre of  $NH_3(g)$  at STP? (1)
36. Write the electronic configuration of  $Cr^{3+}$  ion. (1)
37. Arrange the following in the increasing order of ionic size  $K^+$ ,  $Ca^{2+}$ ,  $S^{2-}$ ,  $Cl^-$ ,  $P^{3-}$  ? (1)
38. How does multiplicity of bond affect the bond strength and bond length ? (1)
39. Define viscosity, how it varies with temperature. (1)
40. How many atoms of oxygen are present in 300g of  $CaCO_3$ ? (1)

### SECTION – B

#### **Short answer type question carrying 2 marks each.**

41. Define the following. (2)
- (a) Chlorosis (b) Green house effect
42. What is molality of 1M solution of sodium nitrate if its density is 1.25gm/ cc ? (2)
43. (a) State Aufbau's principle. (2)
- (b) What is the minimum value of n for g orbital to exist ?
44. Consider the following species. (2)
- $N^{3-}$ ,  $O^{2-}$ ,  $F^-$ ,  $Na^+$ ,  $Mg^{2+}$ ,  $Al^{3+}$
- (a) What is common in them ?
- (b) Arrange them in increasing order of radii
45. (a) State Charles's Law. (2)
- (b) Under what conditions do real gases show maximum deviation from ideal gas behaviour ?
46. The following data are obtained when  $N_2$  and  $O_2$  react together to form different (2)
- compounds :
- | Mass of $N_2$ | Mass of $O_2$ |
|---------------|---------------|
| (i) 14 g      | 16 g          |
| (ii) 14 g     | 32 g          |
| (iii) 28 g    | 32 g          |
| (iv) 28 g     | 80 g          |
- Which law of chemical combination is obeyed by the above experiment ? Write its statement.
47. a) The number of electrons, protons and neutrons in a species are equal to 18, 16 and 16 respectively. Assign the proper symbol to this species. (2)
- b) Why are Bohr's orbit called stationary states.
48. Define critical temperature. Critical temperature of ammonia and carbon dioxide are 405.5K and 304.10 K respectively. Which of these two gases will liquefy first when subjected to cooling and increase in pressure. Give reason in support of your answer. (2)
49. Which two assumption of kinetic theory do not hold good under all conditions of temperature and pressure. (2)
50. What is gram molecular mass? What is the gram molecular mass of  $O_2$  molecule? (2)
51. Calculate the wave number for the longest wavelength transition in the Balmer Series of atomic hydrogen. (2)
52. i. Write the IUPAC name of an element having atomic number 105. (2)
- ii. Find the atomic number of ununseptium.
53. Arrange the elements of 2<sup>nd</sup> period in the increasing order of I.E. Explain if any deviation found in the order. (2)
54. Fluorine is more electronegative than Hydrogen. But why  $NH_3$  has higher dipole moment than  $NF_3$ ? (2)
55. The density of 3 M solution of  $NaCl$  is  $1.25 \text{ g mL}^{-1}$ . Calculate molality of the solution. (2)

56. Calculate the concentration of nitric acid in moles per litre in a sample which has a density,  $1.41 \text{ g mL}^{-1}$  and the mass per cent of nitric acid in it being 69%. (2)
57. a) Why the energy of electron is negative ? (2)  
b) What is the percentage of probability of electron density in boundary ? (2)
58. a) What would be the IUPAC name and symbol for the element with atomic number 120 ? (2)  
b) Why melting point of *LiCl* lower than *NaCl* ?
59. a) Define electronegativity. How does it differ from electron affinity ? (2)  
b) Why do the alkali metals have lowest ionization enthalpy ?
60. Write the structure of  $\text{CO}_3^{2-}$  ion in terms of resonance. (2)
61. Calculate the wavelength of an electron moving with a velocity of  $2.05 \times 10^7 \text{ ms}^{-1}$ . (2)
62. Why the boiling point of  $\text{H}_2\text{O}$  is greater than that of  $\text{H}_2\text{S}$ ? (2)
63. Out of  $\text{NH}_3$  and  $\text{NF}_3$ , which is more polar and why? (2)
64. What is smog? How is classical smog different from photochemical smog? (2)
65. Carbon monoxide gas is more dangerous than carbon dioxide gas, why? (2)
66. Which of these electrons experience lowest effective nuclear charge? (2)  
The Br atom containing 35 electrons in which 6 electrons are in 2p orbital, 6 electrons in 3p orbital or 5 electrons in 4p orbital and why ?
67. a) How change in velocity of a moving particle change the wavelength of the particle? (2)  
b) Give the difference in the angular momentum of an electron present in 3p and 4p orbitals?
68. (a) What is the lowest value of n that allows g orbitals to exist? (2)  
(b) An electron is in one of the 3d orbitals, Give the possible values of n, l and ml for this electron.
69. Why the symbols of  ${}^{79}_{35}\text{Br}$  and  ${}^{80}_{35}\text{Ba}$  are not acceptable? (2)
70. Give reason: (2)  
a) F has lower electron gain enthalpy than Cl.  
b) Ionization enthalpy of N is higher than O.
71. How domestic waste can be used as manure? (2)
72. What will be the wavelength of a ball of mass 0.1 Kg moving with a velocity of  $10 \text{ ms}^{-1}$  (2)
73. What is ionisation enthalpy? Ionisation enthalpy of B is less than that of Be. Why? (2)
74. (a) Arrange the following in increasing order of their size (2)  
 $\text{N}^{3-}, \text{O}^{2-}, \text{F}^-, \text{Na}^+, \text{Mg}^{2-}, \text{Al}^{3+}$   
(b) Assign the position of element having outer electronic configuration  $(n-2)f^7(n-1)d^1ns^2$  for  $n=6$
75. What are the factors favour the covalent character of ionic bonds ? (2)
76. What is resonance? Draw the resonating structure of  $\text{O}_3$  ? (2)
77. Out of chlorine and fluorine which has higher electronic gain enthalpy and why? (2)
78. Calculate the momentum of a particle which has wavelength of  $2\text{Å}$ . (2)
79. What is the number of photons of light with wavelength  $4000 \text{ Å}$  that provides 1 joule of energy (2)
80. 2.746 gm of a compound gave on analysis 1.94 gm of silver, 0.268 gm of sulphur and 0.538 gm of oxygen, find the empirical formula of the compound (At. mass of Ag=108u, S= 32 u, O = 16u). (2)
81. Write two factors which affects formation of ionic bond ? (2)
82. What do you mean by a) Biological oxygen demand (BOD) b) Eutrophication (2)
83. i) Critical temperature of two gases A and B are 293K and 265K respectively. Which is more easily liquefiable and why? (2)  
ii) Define surface tension & what is its unit.

84. Write chemical reactions involved during the formation of photochemical smog. (2)
85. What would happen if green house gases were totally missing in earth's atmosphere? (2)

### SECTION – C

#### **Short answer type questions carrying 3 marks each.**

86. (a) State the Law of multiple proportion. (3)  
 (b) Calcium Carbonate reacts with aqueous HCl to give CaCl<sub>2</sub> and CO<sub>2</sub> according to the reaction  $\text{CaCO}_3(\text{s}) + 2\text{HCl}(\text{aq}) \rightarrow \text{CaCl}_2(\text{aq}) + \text{CO}_2(\text{g}) + \text{H}_2\text{O}(\text{l})$   
 What mass of CaCO<sub>3</sub> is required to react completely with 25ml of 0.75 M HCl ?
87. (a) Derive the de Broglie equation. (3)  
 (b) The work function for Caesium atom is 1.9 eV. Calculate threshold frequency. If the caesium element is irradiated with a wavelength of 500nm, calculate the Kinetic energy of the ejected photo electron.
88. a) Give the general electronic configuration of f-block elements. Give two characteristics. (3)  
 (b) Why do elements of second period show anomalous behaviour ?
89. On the basis of VSEPR theory predict the shape of following molecules. (3)  
 (a) ClF<sub>3</sub> (b) BrF<sub>5</sub> (c) IF<sub>7</sub>
90. a) Calculate the volume occupied by 8.8gms of CO<sub>2</sub> at 31.1°C and 1bar pressure (3)  
 (R=0.083bar LK<sup>-1</sup> mol<sup>-1</sup>)  
 (b) Give the physical significance of VanderWaal's parameters.
91. Give the postulates and drawbacks of Bohr's atomic model. (3)
92. a) Define limiting reagent. (3)  
 b) 3 g of H<sub>2</sub> react with 29 g of O<sub>2</sub> to yield H<sub>2</sub>O  
 i) What is the limiting reagent  
 ii) Calculate amount of H<sub>2</sub>O formed.
93. a) Define hybridisation. (3)  
 b) Show the hybridisation in the following  
 i) H<sub>2</sub>O ii) C<sub>2</sub>H<sub>2</sub>
94. a) Define critical temperature. (3)  
 b) Give the causes for the deviation of gases from the ideal behaviour.
95. a) Write the molecular orbital configuration of H<sub>2</sub>, H<sub>2</sub><sup>+</sup>, H<sub>2</sub><sup>-</sup>. Compare their relative stabilities indicates their magnetic properties. (3)
96. a) Out of Li & Be which is expected to have higher second ionization enthalpy and why ?  
 b) Give the group, period and block of the element with atomic no. 54.
97. a) Define coefficient of viscosity. (3)  
 b) Give reasons  
 i) Why vegetables are cooked with difficulty at hill stations ?  
 ii) Drops of liquid assumes spherical shape.
98. a) Define Molarity of a solution. (3)  
 b) Commercially available HCl has density 1.19 g ml<sup>-1</sup> and the mass percent of hydrochloric acid in it is 38%. Calculate the concentration of hydrochloric acid in moles per litre in the given sample.
99. Consider the reaction : (3)  

$$2\text{A}(\text{g}) + 4\text{B}(\text{g}) \longrightarrow 3\text{C}(\text{g}) + 4\text{D}(\text{g})$$
  
 When 5 moles of A and 6 moles of B are mixed together  
 a) Which one is the limiting reagent ?  
 b) Calculate the amount of 'C' formed.  
 c) Calculate the amount of non-limiting reagent left.
100. Calculate the molarity of a solution of ethanol in water in which the mole fraction (3)

of ethanol is 0.40.

101. a) Which series of hydrogen spectrum lies in (3)  
(i) Visible region (ii) Ultraviolet region  
b) What is the energy and frequency of a photon emitted during a transition from  $n=5$  state to the  $n=2$  state in the hydrogen atom.  
( Given planks constant  $h = 6.63 \times 10^{-34}$  Js)
102. (a) The 4f sub shell of an atom contains 12 electrons. What is the maximum number (3)  
of electrons having the same spin in it?  
(b) Explain the meaning of  $4p^6$ .  
(c) Write the electronic configuration of the atom with atomic number 29.
103. (a) Calculate the total number of electrons present in one mole of methane. (3)  
(b) An atomic orbital has  $n = 3$ . What are the possible values of  $l$  and  $m_l$ ?
104. a) Where would you locate ( in terms of period and group) an element with atomic (3)  
number 42.  
b) Why do successive ionisation enthalpies of an element keep on increasing ?  
Explain with an example.  
c) What is the general electronic configuration of 4<sup>th</sup> period?
105. (i) How would you justify the presence of 18 elements in the 5th period of the (3)  
Periodic Table?  
(ii) Write the general electronic configuration of p-block and f-block elements
106. (i) Which of the following will have the most negative electron gain enthalpy and (3)  
which will have the least negative electron gain enthalpy?  
P, S, Cl, F. Explain your answer.  
(ii) Predict the formula of binary compound of  
(a) Aluminium and iodine  
(b) Lithium and oxygen
107. (a) Write the electronic configuration of  $O_2$  molecule and predict its bond order and (3)  
magnetic character.  
(b) Explain briefly intramolecular hydrogen bonding. Give an example.
108. a) Predict the hybridisation of and shape of the following molecules. (3)  
a)  $SF_6$  b)  $XeF_4$   
b)  $H_2O$  is a liquid while  $H_2S$  is a gas at room temperature. Why?
109. Give reasons: (3)  
(i) Evaporation causes cooling  
(ii) Falling liquids drops are spherical.  
(iii) Vapour pressure of acetone is less than that of ether at same temperature.
110. A certain particle carries  $2.5 \times 10^{-16}$  C of static electric charge. Calculate the (3)  
number of electrons present in it.
111. Predict shape for the following molecules using VSEPR model. (3)  
i.  $H_2S$  ii.  $SiCl_4$  iii.  $NH_3$
112. Write Vander waals equation. Explain the significance of Vander waals parameters (3)
113. Define Molarity and Molality. Explain whether they are temperature dependent or (3)  
not?
114. The quantum no. of six electrons are given below. Arrange them in order of (3)  
increasing energies.  
i.  $n=4, l=2, m_l = -2, m_s = -\frac{1}{2}$   
ii.  $n=3, l=2, m_l = +1, m_s = +\frac{1}{2}$   
iii.  $n=4, l=1, m_l = 0, m_s = +\frac{1}{2}$   
iv.  $n=3, l=1, m_l = -1, m_s = -\frac{1}{2}$   
v.  $n=3, l=0, m_l = 0, m_s = +\frac{1}{2}$   
vi.  $n=4, l=3, m_l = 0, m_s = +\frac{1}{2}$

115. What do you understand by green chemistry. How will it help in decreasing environmental pollution? (3)
116. Define electron gain enthalpy. How it varies along the period? Why the successive electron gain enthalpy is positive in nature. (3)
117. Give reasons for the following:- (3)
- $2^{\text{nd}}$  I.E. of Na is very high in comparison to  $1^{\text{st}}$  I.E.
  - Cations are smaller in size than their parent atoms.
  - Li shows diagonal relationship with Mg.
118. Consider the following species  $\text{N}^{3-}$ ,  $\text{O}^{2-}$ , F,  $\text{Na}^+$ ,  $\text{Mg}^{2+}$ ,  $\text{Al}^{3+}$  (3)
- What common in them?
  - Arrange them in order of increasing ionic radii ?
  - Name, the series of ions?
119. What is limiting reagent? Find the limiting reagent when 10 gms of  $\text{N}_2$  reacts with 10 gms of  $\text{H}_2$  to produce ammonia. (3)
120. What do you mean by intermolecular hydrogen bonding and ? Explain with suitable examples. (3)
121. A balloon is filled with 2 L of air at  $23.4^{\circ}\text{C}$  what will be the volume of the balloon when the temperature changes to  $26.1^{\circ}\text{C}$  at same pressure? (3)
122. a) Why do we regard the gaseous state of water as vapors while that of ammonia as gas ? (3)
- b) What is the basic difference between empirical and molecular formulas ?
- c) Why methane is regarded as the limiting reactant in the combustion of methane in presence of air ?
123. An ion with mass number 37 possesses one unit of negative charge. If the ion contains 11.1% more neutrons than the electrons, find the symbol of the ion. (3)
124. What transition in the hydrogen spectrum would have the same wavelength as the Balmer transition  $n = 4$  to  $n = 2$  of  $\text{He}^+$  spectrum ? (3)
125. a) Why size of noble gases are greater than corresponding halogen ? (3)
- b) Why first ionization energy of Magnesium is more than Aluminium ?
- c) Why Boron form  $[\text{BF}_4]^-$  but Al form  $[\text{AlF}_6]^{3-}$  ?
126. a) Which of the following species will have the largest and the smallest size ? (3)
- $\text{Mg}$ ,  $\text{Mg}^{2+}$ ,  $\text{Al}$ ,  $\text{Al}^{3+}$ .
- b) How would you explain the fact that the first ionization enthalpy of sodium is lower than that of magnesium but its second ionization enthalpy is higher than that of magnesium?
127. a) What is isoelectronic species ? Give one example. (3)
- b) Which of the following pairs of elements would have a more negative electron gain enthalpy?
- (i) O or F (ii) F or Cl
128. a) Which out of  $\text{NH}_3$  and  $\text{NF}_3$  has higher dipole moment and why ? (3)
- b) Out of  $\text{NaCl}$  and  $\text{MgO}$ , which has higher value of lattice energy ?
129. a) Density of a gas is found to be  $5.46 \text{ g/dm}^3$  at  $27^{\circ}\text{C}$  at 2 bar pressure. What will be its density at STP ? (3)
- b) What is the effect of pressure on a) Viscosity b) Surface tension ?
130. a) Why 1M solution has more concentration than 1m solution of same substance ? (3)
- b) Why is the atomic mass of some atom in fraction?
- c) Why is the value of Avogadro's number  $6.022 \times 10^{23}$  and not any other value ?
131. a) A neon-dioxygen mixture contains 70.6 g dioxygen and 167.5 g neon. If pressure of the mixture of gases in the cylinder is 25 bar. What is the partial pressure of dioxygen and neon in the mixture ? (3)
- b) Why is moist air lighter than dry air ?

132. a) Why  $BeCl_2$  is linear where as  $SnCl_2$  is angular molecule ? (3)  
 b) Which end of  $ICl$  will be positive and which will be negative and why ? Is it covalent or ionic ?  
 c) Why is *o*-nitrophenol steam volatile where as *p*-nitro phenol is not ?
133. a) What is smog? How is classical smog different from photochemical smogs ? (3)  
 b) Carbon monoxide gas is more dangerous than carbon dioxide gas. Why ?
134. What is the empirical formula of the compound which has the following (3)  
 composition:  
 Carbon 80 %, hydrogen 20%? If the molecular mass is 30, find out its molecular formula.
135. (a) Define law of constant proportion. (3)  
 (b) 0.44g of hydrocarbon on complete combustion with oxygen gave 1.8g water and 0.88 g carbon dioxide. Show that these results are in accordance with the law of conservation of mass.
136. What is the maximum number of electrons that can be accommodated (3)  
 (i) In the shell with  $n=3$   
 (ii) In the subshell with  $l=3$   
 (iii) In an orbital with  $m_l=+3$
137. (a) Define Aufbau principle. (3)  
 (b) What are the atomic number of elements whose outermost electrons are represented by  
 (i)  $2p^4$  (ii)  $3s^1$   
 (c) Assign the orbital having  $n=4$  and  $l=2$ .
138. Define Hund's rule. (3)  
 (a) An atom of an element contains 29 electrons and 35 neutrons. Find out  
 (i) The number of protons and  
 (ii) The electronic configuration of the element.
139. (a) Define modern periodic law. (3)  
 (b) Arrange the following in the increasing order of their ionic radii  
 $N^{3-}$ ,  $O^{2-}$ ,  $F^-$ ,  $Na^+$   
 c) Electron gain enthalpy of Cl is more negative than that of F, why?
140. (a) Name the element which shows diagonal relationship with Be. (3)  
 (b) Out of Na ( $Z=11$ ) and Mg ( $Z=12$ ) which has higher second ionisation enthalpy and why?
141. What is meant by the term bond order? Write the molecular orbital configuration of  $N_2$ . Find out its bond order and magnetic character. (3)
142. (a) Give resonating structures of  $CO_3^{2-}$  ion. (3)  
 (b) Distinguish between intermolecular and intra molecular hydrogen bonding. Give one example of each type.
143. (a) Why Dalton's law of partial pressure is not applicable to a gaseous mixture of  $NH_3$  and  $HCl$ ? (3)  
 (b) Critical temperature for carbon dioxide and methane are  $31.1^\circ C$  and  $-81.9^\circ C$  respectively. Which of these has stronger intermolecular forces and why?
144. (a) Define Boyle's law. (3)  
 (b) What will be the minimum pressure required to compress  $500\text{ dm}^3$  of air at 1 bar to  $200\text{ dm}^3$  at  $30^\circ C$ ?
145. (a) Which of the following does not change with temperature: Molarity or Molality? (3)  
 (b) Calculate the molarity of 20% solution of KOH by mass whose density is  $1.02\text{ g ml}^{-1}$ .
146. (a) Write the general electronic configuration of d-block elements. (3)  
 (b) Account for the following :

- (i) Beryllium has slightly higher value of ionization enthalpy than that of boron.  
(ii) The ionization enthalpy of  $\text{Na}^+$  is more than that of Ne although they have same electronic configuration.
147. Define the following: (3)  
a) Critical temperature  
b) Avogadro law  
c) Charles Law
148. Write a brief note on the following environmental terms: (3)  
i) Acid rain  
ii) Eutrophication  
iii) Green Chemistry
149. Explain in brief for the following: (3)  
i) Anions are bigger in size than their parent atom.  
ii) Oxygen has lesser first ionization enthalpy than nitrogen  
iii) Fluorine has less negative electron gain enthalpy than chlorine
150. Explain the physical significance of van der Waals parameters. (3)
151. These people are not concerned with the health of other people. The first element in every group of representative elements shows properties different from the characteristic properties of the group. (3)  
a) Name three such elements.  
b) Give two abnormal properties of each one of them.
152. State (a) Hund's Rule of maximum Multiplicity (b) Aufbau Principle (c) n+1 rule (3)
153. a) Lifetimes of the molecules in the excited states are often measured by using pulsed radiation source of duration nearly in the nano second range. If the radiation source has the duration of 2ns and the number of photons emitted during the pulse source is  $2.5 \times 10^{15}$ , then calculate the energy of the source. (3)  
b) Calculate the wave number for the longest wavelength transition in the Balmer series of atomic hydrogen.
154. What do mean by gram atomic mass . One million silver atoms weigh  $1.79 \times 10^{16}$ g. (3)  
Calculate the gram atomic mass of silver.
155. Give reason: "Although geometries of ammonia and water molecules are distorted tetrahedral, bond angle in water is less than that of ammonia". (3)
156. Calculate the wavelength in nm, of visible light having a frequency of  $4.37 \times 10^{14} \text{ s}^{-1}$ . (3)
157. Give a note on: (3)  
i. Mist  
ii. Smoke  
iii. Fumes  
iv. Dust
158. Give the Lewis representation of: (3)  
i. Nitric acid  
ii. Ammonia  
iii. Ozone molecule
159. Which hybrid orbitals are used by carbon atoms in the following molecules? (3)  
(a)  $\text{CH}_3\text{-CH}_3$ ; (b)  $\text{CH}_3\text{-CH=CH}_2$ ; (c)  $\text{CH}_3\text{-CH}_2\text{-OH}$ ;
160. Calculate the amount of  $\text{KClO}_3$  needed to supply sufficient oxygen for burning 112L of CO gas at N.T.P . (3)
161. (a) Define Avogadro's law (3)  
(b) The reactant which is entirely consumed in a reaction is known as limiting reagent. In the reaction  $2A + 4B \rightarrow 3C + 4D$ , when 5moles of A react with 6 moles of B, then (i) Which is the limiting reagent?  
(ii) calculate the amount of C formed



162. (a) What is the difference between 0.5 M and 0.5 m of NaOH solution (3)  
 (b) What volume of 10M HCl and 3 M HCl should be mixed to get 1L of 6M HCl solution?
163. (a) State Pauli's exclusion principle. (3)  
 (b) Account for the following  
 (i) Chromium has electronic configuration  $3d^5 4s^1$  and not  $3d^4 4s^2$   
 (ii) Bohr's orbit are called stationary orbits
164. What is the energy in Erg required to shift the electron of Hydrogen atom from the first orbit to fifth orbit? What is the wavelength of light emitted when the electron returns to the ground state? The ground state electron energy is  $-2.18 \times 10^{-18}$  (3)
165. A photon of wavelength  $4.0 \times 10^{-7}$  m strikes on metal surface, the work function of metal being 2.13 ev. Calculate (i) the energy of photon in ev. (ii) The kinetic energy of emission. (3)  
 ( $1\text{eV}=1.602 \times 10^{-19}\text{J}$ ,  $h = 6.626 \times 10^{-34}\text{Js}$ )
166. Write the reason (3)  
 (a) Ionisation enthalpy of Nitrogen is more than that of Oxygen.  
 (b) A cation is always smaller than its parent atom.  
 (c) Nobel gas has larger positive electron gain enthalpy.
167. (a) Na and  $Mg^+$  have same number of electron but removal of electron from  $Mg^+$  requires more energy. (3)  
 (b) What are representative elements?
168. (a) Which out of  $NH_3$  and  $NF_3$  has higher dipole moment and why? (3)  
 (b) What is the shape of  $PCl_5$  according to VSPER theory and draw the structure.
169. (a) What is the total number of sigma and pi bonds in  $C_2H_4$ ? (3)  
 (b) What do you understand by bond pairs and lone pairs of electrons? Write the number of bond pairs and lone pairs in  $NH_3$ .
170. What do you mean by ideal gas and real gas? Why does real gas deviate from ideal behaviour? Derive Ideal gas equation. (3)
171. (a) Calculate the total pressure in a mixture of 8 g of Oxygen and 4 g of Hydrogen confined in a vessel of  $1\text{ dm}^3$  at  $27^\circ\text{C}$ .  $R=0.0083\text{ bar dm}^3\text{ K}^{-1}\text{ mol}^{-1}$ . ( $h = 6.626 \times 10^{-34}\text{Js}$ . Mass of an electron =  $9.1 \times 10^{-31}\text{Kg}$ ,  $\pi=3.142$ ) (3)  
 (b) What do you mean by Boyle temperature?
172. (i) What is the cause of acid rain? How is it harmful to the environment? (3)  
 (ii) What is green chemistry?
173. a) Define molarity of a solution. (3)  
 b) Conc. Sulphuric acid is 98% by mass and has density 1.84 g/cc. what volume of the concentrated acid is required to make 5 liter of 0.500 M  $H_2SO_4$  solution.
174. a) How many spherical nodal surfaces are there in i) 3s orbital and ii) 3p orbital. (3)  
 b) Give two points differences between 1s and 2s orbital.
175. a) Use molecular orbital theory to explain why  $Be_2$  molecule does not exist. (3)  
 b) Compare the relative stability of the following species and indicate which species is paramagnetic  $O_2$ ,  $O_2^{2-}$
176. a) Write the general electronic configuration of f-block elements. (3)  
 b) An element has atomic number 109. Write its IUPAC name and symbol. Predict the period and group to which it belongs and its block.
177. Give reason (3)  
 a) Bond angles of  $NH_3$  is less than that  $CH_4$   
 b) Boiling point of  $H_2O$  is more than that of  $H_2S$   
 c)  $CO_2$  is non-polar but  $H_2O$  polar
178. a) Bond angle of  $H_2O$  is less than  $NH_3$   
 b) The axial bond in  $PCl_5$  molecule is longer than equatorial bond  
 c)  $HF$  molecule has high boiling point than  $HCl$

179. Explain why (3)
- The 1<sup>st</sup> ionisation enthalpy of Mg is more than Al
  - The electron gain enthalpy of sulphur is more negative than that of oxygen.
  - Size of cation is smaller than that of neutral atom.
180. 50kg of N<sub>2</sub>(g) and 10 kg of H<sub>2</sub>(g) are mixed to produce NH<sub>3</sub>(g) (3)
- Calculate the mass of NH<sub>3</sub>(g) formed
  - Identify the limiting reagent
  - Calculate the amount of one reactant which remains unreacted
181. i) What do you mean by green chemistry ? How will it help to decrease environmental pollution? (3)
- ii) What do you mean by ozone hole ? What are its consequences.
182. a) What is diagonal relationship in periodic properties. Write its causes. (3)
- b) The chemical properties of the elements lying on same group are similar why.
183. a) State and explain Heisenberg's uncertainty principle (3)
- b) Calculate the uncertainty in position of a dust particle with mass equal to 1 mg, if uncertainty in its velocity is  $5.5 \times 10^{-20} \text{ ms}^{-1}$
184. a) Define law of multiple proportion (3)
- b) Carbon and oxygen are known to form two compounds. The carbon content in one of these is 42.9% while in the other is 27.03%. Show that this data is in agreement with law of multiple proportion.
185. a) What are smogs ? How classical smog and photochemical smog are different. (3)
- b) Carbon monoxide gas is more dangerous than carbon dioxide why ?

#### SECTION – D

#### **Value based questionS carrying 4 marks each.**

186. One day Rohan & Amit discussing that vehicles on the road are increasing day by day. Emission levels of gases are very high which are leading to respiratory diseases. CNG & LPG are being used instead of diesel. So they decided to go to office through one car and use of CNG for driving the car instead of diesel. (4)
- What are technological options for reduction of harmful emissions?
  - Diesel vehicles should be taxed to more extent do you agree? Give reason.
  - What values are possessed by Rohan and Amit ?
187. Aman visited a dry cleaning factory and came to know that halogenated solvents was being used for dry cleaning clothes. As a science student, he immediately suggested an alternative chemical for dry cleaning .The dry cleaner also accepted this suggestion happily. (4)
- What values did Aman show by making the suggestion change the chemical?
  - Which other chemical can be used for dry cleaning and how is halogenated solvent harmful?
188. A student of Class XI , Mohan, developed a compost producing pit in his village. But the villagers put all bio degradable and non biodegradable garbage in the pit. Mohan requested them to not put non biodegradable substances in the pit rather to handover them to the vendors and also advised to cover the pit. (4)
- Why did Mohan asks people to cover the pit?
  - Why did he request the people not to put the non biodegradable substances in the pit?
  - Why did Mohan wish the villagers to handover the non biodegradable substances to the vendors?
  - What good qualities do you see in Mohan?
189. Mrs. Verma, a housewife,lives in Bhubaneswar . She disposes off domestic wastes in Bhubaneswar Municipal Corporation (BMC) dustbin. Mrs. Sharma throws away all types of wastes outside her house which create lot of problems for other residents. (4)

- i) Why should BMC separate biodegradable and non-biodegradable wastes ?
- ii) What should be done with non-biodegradable wastes ?
- iii) Why has Government banned plastic in Bhubaneswar ?
- iv) What values are possessed by Mrs. Verma and Mrs Sharma ?

190. In slum areas, in winter, people often burn coke angithis to heat up their rooms and then sleep there the whole night. Sometimes, cases of unconsciousness or deaths are reported from these houses, not because their houses catch fire but because of the poisonous gases accumulated in their rooms. Even in urban areas, in winter where people keep their electric heaters on the whole night, incident occur due to overheating of the electric heater or short-circuiting. (4)

After reading the above paragraph, answer the following

- (a) What values are expressed in the above paragraph?
- (b) How is poisoning caused by coke angithi?
- (c) Write any two steps that should be taken immediately as a part of treatment.

191. John was arrested by the custom officials as he was smuggling drugs and caught by x-raymachines. According to Roentgen when electrons strike a material in the cathode ray tube, it produces a ray which can cause fluorescence in the fluorescent material placed outside the cathode ray tubes. These rays were called x-rays. These were not deflected by electric and magnetic field. It was used as diagnostic tool in the treatment of diseases and bone fractures. (4)

- a) What is the approx. wavelength of x-rays?
- b) Why x-rays are used to screen luggage's in airports?
- c) How would you prevent smuggling?

192. Super dry cleaning owner Mr. Gupta was using tetra chloro ethane earlier as a solvent for dry cleaning. The compound contaminates the ground water and is also suspected carcinogenic. (4)

Mr Jindal owner of White dry cleaning is using liquefied CO<sub>2</sub> these days. Hydrogen peroxide is also being used for bleaching purpose .

- (i) What is the advantage of using liquid CO<sub>2</sub> with suitable detergent for dry cleaning?
- (ii) What is the advantage of using H<sub>2</sub>O<sub>2</sub> as bleaching agent?
- (iii) What is your responsibility as human being to protect environment?
- (iv) What values possessed by Mr. Zindal?

193. One day Seema's mother was cooking rice in an open vessel. Seema went to the kitchen and told her mother that she would cook the rice today. She cooked the rice in a pressure cooker instead of an open vessel. (4)

- a) Explain the scientific concept being applied by seema
- b) Which moral values would you associate with the above act?

### SECTION – E

**Long answer type questions carrying 5 marks each.**

194. a) Define Empirical formula and Molecular Formula. What is the relationship between them ? (5)

b) Carbon forms two oxides which contains 42.9 % and 27.3% of Carbon respectively. Show that this figures illustrates law of multiple proportion.

195. a) Explain Law of Multiple Proportion with examples. (5)

b) A compound containing carbon, hydrogen & oxygen. Given the following data. Carbon – 40%, Hydrogen – 6.67%. Calculate the molecular formula of the compound if its mass is 180.

196. a) Give postulates of VSEPR Theory. (5)

- b) What are the conditions for combination of atomic orbitals.  
 c) Show the hydrogen bonding in orthonitrophenol
197. a) Give reasons (5)  
 i)  $\text{BeH}_2$  molecule has 0 dipole moment.  
 ii) Water has a bent structure.  
 b) Show the formal charge of each oxygen atom on ozone.  
 c) Give the Lewis dot structure of CO.
198. a) Derive the ideal gas equation. (5)  
 b) A neon – dioxygen mixture contains 70.6 g dioxygen & 167.5g neon. If pressure of the mixture of gases in the cylinder is 25 bar, what is the partial pressure of dioxygen and neon.
199. a) State and derive Dalton's Law partial pressure. (5)  
 b) 34.05 ml of phosphorus vapour weigh 0.0625gm at  $546^\circ\text{C}$  and 0.1 bar pressure. What is the molecular mass of phosphorus.
200. (a) In astronomical observations signals observed from distant stars are generally weak. If the photon detector receives a total of  $3.15 \times 10^{-18}\text{J}$  from the radiations of 600 nm. Calculate the number of photons received by detector. (5)  
 (b) What do you mean by quantum mechanics ?  
 (c) State Zeeman effect.  
 (d) Why is line emission spectrum called finger prints of elements ?
201. (a) In an electron microscope used for obtaining highly magnified image of biological specimen, if the velocity of the electrons used in the microscope is  $1.6 \times 10^8\text{ms}^{-1}$ . Calculate the de-broglie wavelength associated with the electrons. ( $m_e = 9.1 \times 10^{-31}\text{kg}$ ) (5)  
 (b) Why the Bohr's orbits are also called stationary states ?  
 (c) What do you mean by 'quantum' ?  
 (d) What is the number of unpaired electrons in P (atomic number = 15) atom ?
202. a) Describe the change in hybridisation of Al atom in the reaction. (5)  

$$\text{AlCl}_3 + \text{Cl} \longrightarrow \text{AlCl}_4^-$$
  
 b) Although  $\text{NH}_3$  and  $\text{H}_2\text{O}$  both have distorted tetrahedral geometries, bond angle in water is less than ammonia. Why ?  
 c) Why  $\text{BeCl}_2$  have zero dipole moment although Be – Cl bonds are polar?  
 d) Write the molecular orbital configuration of  $\text{N}_2$  and  $\text{N}_2^+$ . Also calculate their bond order.
203. a) Draw orbital overlap diagram showing the triple bond formation in ethyne. (5)  
 b) On the basis of VSEPR theory predict the shape of  $\text{XeF}_4$  and  $\text{ClF}_3$ .  
 c) Explain the different types of hydrogen bond with examples
204. a) Using the equation  $pV = nRT$  ; show that at a given temperature density of a gas is proportional to gas pressure p. (5)  
 b) Pressure of 1g of an ideal gas A at  $27^\circ\text{C}$  is found to 2 bar. When 2 g of another ideal gas B was introduced in the same flask at same temperature the pressure become 3 bar. Find the relationship between their molecular masses.
205. a) Using van der Waal's equation of state, calculate the pressure exerted by 8.5g of  $\text{NH}_3$  contained in 0.5L vessel at 300K. For Ammonia,  $a = 4.0\text{atm L}^2\text{mol}^{-2}$  and  $b = 0.036\text{L mol}^{-1}$  (5)  
 b) Give reasons:  
 (i) Evaporation causes cooling  
 (ii) Falling liquids drops are spherical.  
 (iii) Vapour pressure of acetone is less than that of ether at same temperature.
206. Write the electronic structure and indicate the number of unpaired electrons in the following elements:- (5)  
 i. P(Z=15) ii. Si(Z=14) iii. Zn(Z=30) iv. Fe(Z=26) V. Kr(Z=36)

207. i. What is Hund's rule of maximum multiplicity? (5)  
 ii. Write the electronic configuration of the element having atomic number 24 & 29.  
 iii. How many subshells and orbitals are present in each of the above elements.
208. i. Express the molecular orbital configuration of  $N_2$  and  $O_2^+$  (5)  
 ii. Calculate their bond order.  
 iii. Indicate whether they are paramagnetic or diamagnetic in nature.
209. i. What is meant by hybridisation of atomic orbitals? (5)  
 ii. Describe the shape of  $Sp^3$  and  $Sp^2$  hybrid orbitals.  
 iii. Draw diagram to show the formation of ethane.
210. i. Define Ideal gas equation. (5)  
 ii. Explain Boyle's law and Charles Law using kinetic molecular theory of gases.  
 iii. What is surface tension ?
211. i. What is Dalton's Law of partial pressure? (5)  
 ii. A mixture of hydrogen and oxygen at one bar pressure contains 20% by mass of Hydrogen. Calculate the partial pressure of Hydrogen.  
 iii. What is viscosity?
212. a) (i) How many sub-shells are associated with  $n = 4$  ? (5)  
 (ii) How many electrons will be present in the sub-shells having ms value of  $-\frac{1}{2}$  for  $n = 4$  ?  
 b) What is the main difference between the electromagnetic wave theory and Planck's quantum theory ?  
 c) Two particles  $A$  and  $B$  are moving with same velocity but wave length of  $A$  is found to be double of  $B$ . What do you conclude ?  
 d) Why Pauli's exclusion principle is called exclusion principle ?
213. a) Using  $s, p, d$  notations, describe the orbital with the following quantum numbers. (5)  
 (i)  $n=1, l=0$ ; (ii)  $n = 3; l=1$  (iii)  $n = 4; l=2$ ; (iv)  $n=4; l=3$ .  
 b) Why Hund's rule is called rule of maximum multiplicity ?  
 c) What will happen to the wave length associated with a moving particle if its velocity is doubled ?  
 d) What is the difference between a quantum and a photon ?
214. a) What is Ideal gas and derive ideal gas equation. (5)  
 b) Using the equation of state  $pV = nRT$ ; show that at a given temperature density of a gas is proportional to gas pressure  $p$ .  
 c) In terms of Charles' law explain why  $-273^\circ C$  is the lowest possible temperature.  
 d) Why  $H_2O$  has high boiling point than  $H_2S$  ?
215. a) Derive combine gas equation. (5)  
 b) Explain the physical significance of van der Waals parameters.  
 c) Why ice float in water ?  
 d) *What are the conditions where real gas deviate from ideal behavior ?*
216. a) What is meant by the term bond order ? Calculate the bond order of : (5)  
 $N_2, O_2, O_2^+$  and  $O_2^-$ .  
 b) Although geometries of  $NH_3$  and  $H_2O$  molecules are distorted tetrahedral, bond angle in water is less than that of ammonia. Discuss.
217. a) Compare the relative stability of the following species and indicate their magnetic properties;  $O_2, O_2^+, O_2^-$  (superoxide),  $O_2^{2-}$  (peroxide) (5)  
 b) Explain why  $BeH_2$  molecule has a zero dipole moment although the  $Be-H$  bonds are polar.

218. (a) Why falling liquid drops are spherical? (5)  
 (b) Out of  $N_2$  and  $NH_3$ , which one will have greater value for Vander waals constant and which one will have greater value for Vander waals constant 'b'? Give reason for your answer.  
 (c) Using gas law, derive the ideal gas equation  $PV = nRT$ .
219. (a) What are the condition under which gases deviate from ideality? (5)  
 (b) Write any two differences between ideal gas and real gas.  
 (c) Using the equation of state  $PV = nRT$ , show that at a given temperature, the density of the gas is proportional to the gas pressure P.
220. (a) Which series of hydrogen spectrum appears in the visible region of electromagnetic spectrum? (5)  
 (b) State Zeeman effect?  
 (c) Calculate the mass of a photon with wavelength  $3.6 \text{ \AA}$ .
221. (a) What are the degenerate orbitals? (5)  
 (b) Define photoelectric effect.  
 (c) The threshold frequency  $\nu_0$  for a metal is  $7.0 \times 10^{14} \text{ s}^{-1}$ . Calculate the kinetic energy of an electron emitted when radiation of frequency  $\nu = 1.0 \times 10^{15} \text{ s}^{-1}$  hits the metal.
222. (a) How do you express the bond strength in terms of bond order? (5)  
 (b) Why  $He_2$  molecule does not exist?  
 (c) What is hybridisation? Explain the formation of ethyne ( $C_2H_2$ ) molecule on the basis of hybridisation.
223. (a) What is lattice enthalpy? (5)  
 (b) Why the axial bonds are longer than the equatorial bonds in  $PCl_5$  molecule?  
 (c) Compare the relative stability of the following species and indicate their magnetic properties (diamagnetic or paramagnetic)  $O_2, O_2^+, O_2^-, O_2^{2-}$  ions.
224. (i) The unpaired electrons in Al and Si are present in 3p orbital. Which electrons will experience more effective nuclear charge from the nucleus? (5)  
 (ii) Indicate the number of unpaired electrons in: (a) P, (b) Si, (c) Cr, (d) Fe
225. State photo electric effect. The work function for caesium atom is 1.9 eV. Calculate (5)  
 (a) the threshold wavelength and (b) the threshold frequency of the radiation. If the caesium element is irradiated with awavelength 500 nm, calculate the kinetic energy and the velocity of the ejected photoelectron.
226. Define octet rule. Write its significance and limitations. (5)
227. What is the difference between empirical and molecular formula? A compound (5)  
 contains 4.07 % hydrogen, 24.27 % carbon and 71.65 % chlorine. Its molar mass is 98.96 g. What are its empirical and molecular formulas?
228. What is the cause of the periodicity in the properties of the elements? How do the (5)  
 following properties vary in (a) a group and (b)in a period (i) electronegativity (ii) ionisation enthalpy (iii) Atomic size
229. (a)A mixture of dihydrogen and dinitrogen at 1 bar pressure contains 20% by (5)  
 weight of  $H_2$ . Calculate partial pressure of  $H_2$ .  
 (b)What will be minimum pressure required compressing  $500 \text{ dm}^3$  of air at 1 bar to  $200 \text{ dm}^3$  at  $30^\circ \text{ C}$ ?
230. (a) What is meant by dual nature of electrons? (5)  
 (b) Calculate the wavelength of an electron moving with a velocity of  $2.05 \times 10^{-7} \text{ ms}^{-1}$   
 (c) Write two important features of Plank's quantum theory.
231. (a) Explain  $(n + l)$  rule with examples. (5)  
 (b) Write main features of quantum mechanical model of atom

232. (a) Justify the following. (5)  
 (i) Co – valent bonds are directional bonds while ionic bonds are non – directional.  
 (ii) Water molecule is bent structure but CO<sub>2</sub> is linear.  
 (iii) Nitro phenol is steam volatile where as p – nitro phenol is not steam volatile.  
 (b) What are the required conditions for linear combination of atomic orbital?
233. (a) What is meant by hybridisation? (5)  
 (b) Differentiate between bonding and anti bonding molecular orbitals.  
 (c) Explain why N<sub>2</sub> has greater bond dissociation energy than N<sub>2</sub><sup>+</sup>
234. (a) State Boyle's law (5)  
 (b) What will be the minimum pressure required to compress 500dm<sup>3</sup> of air 1 bar to 200dm<sup>3</sup> at 30°C.  
 (c) What is critical temperature? Critical temperature of carbon dioxide and water are 31.1°C and – 81.9°C respectively. Which of these has greater molecular force and why?
235. (a) What is significance of Vander Waal's constants 'a' and 'b'? (5)  
 (b) Using the equation of state  $PV = nRT$ , show that at a given temperature, the density of a gas is proportional to gas pressure P.  
 (c) State Charl's law.
236. a) Distinguish between sigma bond and  $\pi$ -bond. (5)  
 b) Define  
 (i) Bond enthalpy (ii) Bond order.  
 c) What do you mean by hybrid orbital. Explain the formation of CO<sub>2</sub> molecule with orbital diagram
237. a) Write the difference between atomic orbital and molecular orbital. (5)  
 b) Write the resonating structures of CO<sub>3</sub><sup>2-</sup> ion.  
 c) Explain the hybridisation of acetylene(C<sub>2</sub>H<sub>2</sub>) molecules with orbital diagram
238. a) Calculate the energy required for the process (5)  

$$\text{He}^+(\text{g}) \longrightarrow \text{He}^{2+}(\text{g}) + e$$
 If the I.E. of hydrogen atom in the ground state is  $2.18 \times 10^{-18}$  j/atom  
 b) State stark effect  
 c) What is the lowest value of 'n' that allows 'g' orbital to exist.
239. a) What transition in the hydrogen spectrum would have the same wavelength as the Balmer transition n=4 to n=2 of He<sup>+</sup> spectrum (5)  
 b) Write all the possible subshell whose n+1=5  
 c) Why +2 oxidation state in Mn is quite stable while same is not true for Fe (Atomic number of Mn=25, Fe=26)
240. a) A student forgot to add the reaction mixture to the round bottomed flask at 27<sup>0</sup>C (5)  
 but put it on the flame. After a lapse of time, he realized his mistake. By using a pyrometer, he found that temperature of the flask was 477<sup>0</sup>C. What fraction of air would have been expelled out ?  
 b) Why raindrops are spherical?  
 c) Write Vanderwaal's equation for n mole of gas.
241. a) An iron tank contains helium at a pressure of 2.5 atmospheres at 25<sup>0</sup>C. The tank withstands a maximum pressure of 10 atm. The building in which tank has been placed catches fire predict whether the tank will blow up first or melt (The m.p. of iron=1535<sup>0</sup>c). (5)  
 b) Why Dalton's law of partial pressure is not applicable for the mixture of NH<sub>3</sub>(g) and HCl(g)  
 c) Out of N<sub>2</sub> and NH<sub>3</sub> which one will have greater value for Vanderwaal's constant a and which has greater value for b.

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