REV-01
BSP/01/05

2024/07

SET A

B.Sc. CHEMISTRY
FIRST SEMESTER
ORGANIC, INORGANIC & PHYSICAL CHEMISTRY I
BSC – 711 [SPECIAL REPEAT]

[USE OMR FOR OBJECTIVE PART]

Duration : 3 hrs. **Full Marks : 70**

Objective

Time : 30 min. **Marks : 20**

Choose the correct answer from the following: ***1×20=20***

1. Which of the following element has the smallest size in its group?
   a. sodium b. rubidium
   c. potassium d. lithium

2. In a surprisingly large number of their properties beryllium resembles aluminum, and boron resembles silicon. Such a relationship is called
   a. Amphoterism b. Allotropic relationship
   c. Diagonal relationship d. None of the above

3. What is the correct order of orbitals in which electrons are filled?
   a. 4s, 3d, 4p, 5s, 4d b. 3d, 4s, 4p, 4d, 5s
   c. 3d, 4p, 4s, 4d, 5s d. 5s, 4p, 3d, 4d, 5s

4. The ionization energy of an element is
   a. The same as the electron affinity of the element b. Equal in magnitude but of opposite sign to the electron affinity of the element
   c. The energy released when an electron is added to an atom of the element d. The energy required to remove the outermost electron of an atom of the element

5. Choose the correct statement
   a. Ionization energy and electron affinity increases across a period b. Ionization energy increases but electron affinity decreases along a period
   c. Ionization energy decreases but electron affinity increases d. Both decreases along a period

6. Which one of the following is incorrect statement?
   a. The ionisation potential of nitrogen is greater than that of oxygen b. The electron affinity of fluorine is greater than that of chlorine
   c. The ionisation potential of beryllium is greater than that of boron d. The electronegativity of fluorine is greater than that of chlorine

7. The conjugate acid of the base HSO_4^- is
   a. H_2SO_4 b. SO_4^{2-}
   c. H_2SO_3 d. All of the above

8. An example of nucleophile is
   a. Mg^{2+} b. CN^-
   c. NH_4^+ d. Na^+

9. The two carbon atoms in ethene are
   a. sp^3 hybridized b. sp hybridized
   c. sp^2 hybridized d. Unhybridized

10. Among the following compounds which is linear in shape
   a. Methane b. Ethane
   c. Ethene d. Acetylene

11. Hybridisation involves
   a. Mixing up of atomic orbitals b. Addition of an electron pair
   c. Removal of an electron pair d. Separation of orbitals

12. Which among the following formation is not an example of Covalent bond?
   a. CH_4 b. CaF_2
   c. CCl_4 d. H_2O

13. Electronegativity is defined as ability of an element to
   a. attract protons b. repel protons
   c. attract electrons d. repel electrons

14. The Boyle's law states that
   a. The volume of a gas is inversely proportional to the pressure of a gas at a constant temperature b. The volume of a gas is directly proportional to the temperature at constant pressure
   c. None of the above d. Both are correct

15. According to kinetic theory of gases, the energy per mole of a gases is equal to
   a. RT b. 1.5 RT
   c. 0.5 RT d. Cannot defined

16. For an ideal gas, the value of compressibility factor, Z is equal to
   a. 0 b. 1
   c. 2 d. None of the above

17. The S.I. unit of viscosity is
   a. Nms^{-1} b. $Nm^{-1}s^{-1}$
   c. $Nm^{-2}s$ d. Nm^{-2}

18. The number of atoms per unit cell of face-centered cubic structure is
   a. 1 b. 2
   c. 3 d. 4

19. The Miller indices of a material in a plane are proportional to
   a. The reciprocal of numerical parameters of the intercepts b. The square of unit cell dimensions
   c. The intercepts of the planes on the coordinate axes d. The interplanar spacing

20. Rain drops are spherical because of
   a. Viscosity
   b. Air resistance
   c. Surface tension forces
   d. Atmospheric pressure

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(Descriptive)

Time : 2 hrs. 30 min. **Marks : 50**

[Answer question no.1 & any four (4) from the rest]

1. a. What is effective nuclear charge? Express with the equation. How it varies from left to right across a period and top to bottom of a group. **3+3+3+1 =10**
   b. What is dipole moment? Give reason why the net diploe moment of CH_4 molecule is zero?
   c. How a gas can be liquefied. Explain. What is critical temperature and critical pressure of a gas.
   d. Write the Van der waals equation.

2. a. Arrange K, F, Ba, Pb, B and I in order of decreasing atomic radius. **2+2+3+3 =10**
   b. Show graphically the radial distribution curve for 6s and 3d orbital.
   c. What do you mean by quantum numbers? Describe in detail which information is obtained from all four quantum numbers?
   d. The first and second ionization energies of magnesium are both relatively low, but the third ionization energy requirement jumps to five times the previous level. Explain. What is the most likely ion for magnesium to become when it is ionized?

3. **a.** In hydrogen atom, an electron undergoes transition from second excited state to first excited state and then to the ground state. Identify the spectral series to which these transitions belong. Find out the ratio of wavelengths of the emitted radiations in the two cases. **2+3=5**

b. What is Bohr's Theory of hydrogen atom? Write the equation which shows the wave particle duality of subatomic particle. **3**

c. What is hybridization of orbitals? Mention the type of hybridization of the carbon atom marked by asterisk (*) in the following hydrocarbon. **2**

$\overset{*}{C}H_3CH_2CH=\overset{*}{C}H-CH_3$

4. **a.** Define Heisenberg's Uncertainty principle, Aufbau principle, Pauli's principle and Hund's rule. **4**

b. What are the laws of crystallography? Write three differences between crystalline and amorphous solids. **3+3=6**

5. **a.** Explain why the shape of methane molecule is tetrahedral? **2+3+2+3 =10**

b. Define H-bonding. Give reasons why o-nitrophenol is more volatile than p-nitrophenol.

c. What are electrophiles? Give two examples.

d. What is Lewis's concept of acids and bases? Explain with examples.

6. **a.** Explain the mechanism of Markownikoff's rule when HCl is added to propene molecule. **2+3+2+3 =10**

b. What are carbocations? Mention the different types of carbocations with their relative stabilities.

c. Define Huckel's (4n+2) rule. Which one of the following is aromatic compound?

(a)  (b)  (c)  (d) 

d. What is Wurtz method of synthesis of alkane? Write its mechanism

7. a. Explain the terms of unit cell, space lattice and Bravais lattice. KNO_3 crystallizes in orthorhombic system with the unit cell dimensions a=542 pm, b=917 pm, c=645 pm. Calculate the diffraction angles for the first order X-ray reflections from (100) planes using radiation with wavelength=154.1 pm. **3+3=6**

b. Write short notes on (i) Surface active agents (ii) Viscosity of a liquid **2+2=4**

8. a. Why real gases show deviations from ideal behavior. **3+3+4=10**
b. Write the postulates of kinetic theory of gases.
c. Calculate the temperature at which the root mean square velocity, the average velocity and the most probable velocity of oxygen gas all are equal to1500 m/s.

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