B.SC. CHEMISTRY
THIRD SEMESTER
ORGANIC, INORGANIC & PHYSICAL CHEMISTRY I
BSC – 731 [REPEAT]

SET A

[USE OMR SHEET FOR OBJECTIVE PART]

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

PART-A: Objective

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

Choose the correct answer from the following: ***1X20=20***

1. At constant temperature the product of pressure and volume of a given amount of a gas is constant this is – – – – –.
   a. Gay-Lussac law
   b. Charles' law
   c. Boyle's law
   d. None of these

2. The Most probable velocities is defined by
   a. $\sqrt{\frac{2RT}{M}}$
   b. $\sqrt{\frac{8RT}{\pi M}}$
   c. $\sqrt{\frac{3RT}{M}}$
   d. None of the above

3. The correct relation among C_p, $< C >$ and $< C^2 >^{1/2}$ is
   a. $C_p : < C > : < C^2 >^{1/2} = 1.00 : 0.92 : 0.82$
   b. $C_p : < C > : < C^2 >^{1/2} = 0.92 : 1.00 : 0.82$
   c. $C_p : < C > : < C^2 >^{1/2} = 0.82 : 0.92 : 1.00$
   d. None of the above

4. There are two statements
   Statement A. Equal volumes of all gases at the same temperature T and pressure P contain an equal no of molecules.
   Statement B. The no of molecules in one mole of any gas is 6.023×10^{22}.
   Which one of the following is correct?
   a. A and B both are correct statements
   b. Only A is correct statement
   c. Only B is correct statement
   d. A and B both are incorrect

5. Cooking gas containers are kept in a truck moving with uniform speed. The temperature of the gas molecules inside will
   a. Increase
   b. Decrease
   c. Remain the same
   d. Decrease for some while the increase for others.

6. Bravais three dimensional lattices are of
   a. 7
   b. 14
   c. 2
   d. 10

7. The Miller indices of the crystal plane which cuts through axes at (2a, 3b, 2c) is
   a. (1 1 1)
   b. (3 2 3)
   c. (2 3 2)
   d. (2 1 1)

8. Which one of the following statement is correct about Amorphous solids?
   a. Amorphous solid has no sharp melting point
   b. Amorphous solid has sharp melting point
   c. Amorphous solid has regular geometry
   d. Plastics are not amorphous solid

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

10. Clausius-Clapeyron equation is used to describe
   a. Viscosity
   b. Vapour pressure
   c. Surface tension
   d. None of the above

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

12. Which species do not have sp^3 hybridization?
   a. Ammonia
   b. Methane
   c. Water
   d. Carbon dioxide

13. In the Bronsted-Lowry system, a base is defined as
   a. a proton donor
   b. a hydroxide donor.
   c. an electron-pair acceptor.
   d. a proton acceptor.

14. Which of the following is not correct for dipole moment?
   a. The difference in electronegativities of combining atoms can lead to the dipole moment.
   b. the dipole moment is a vector quantity
   c. CO_2 molecule has no dipole moment since C-O bonds are nonpolar
   d. None of the above

15. Which of the following is an application of inductive effect?
   a. Bond length
   b. Dipole moment
   c. Strength of carboxylic acid
   d. All of the above

16. As long as electron stays in its own orbit-
   a. It absorbs energy.
   b. It emits energy.
   c. It neither absorbs nor emits energy.
   d. None of the above.

17. The intensity of electromagnetic radiation is determined by the number of
    a. Number of photons striking unit area in unit time.
    b. Number of electrons striking unit area in unit time.
    c. Number of neutrons striking unit area in unit time.
    d. None of the above.

18. The red end in the spectrum corresponds to
    a. Lower energy but longer wave length.
    b. Higher energy and longer wave length
    c. Lower energy and shorter wave length.
    d. None of the above.

19. With increase in atomic number, ionic radii
    a. Increases along a period.
    b. Decreases along the group
    c. Increases along the group
    d. None of the above.

20. The electronegativity
    a. Increases along a group
    b. Decreases along a period.
    c. Increases along a period.
    d. None of the above.

-- --- --

PART-B : Descriptive

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

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

1. **a.** Write the postulates of kinetic molecular theory of gases. 3+2+2+3 =10

   b. Write two differences between amorphous and crystalline solids.

   c. What do you mean by conjugation and resonance?

   d. Give a brief account of the line spectra of hydrogen atom

2. **a.** Discuss the crystal structure of NaCl with proper diagram. 3+4+3 =10

   b. Derive the Avogadro's Law and Boyle's Law from kinetic molecular theory of gases.

   c. At constant temperature and pressure, 6.00 L of a gas is known to contain 0.975 mol. If the amount of gas is increased to 1.90 mol, what new volume will result?

3. **a.** Derive the Kinetic gas equation $PV = (1/3)\, mNc^2$ 4+3+3 =10

   b. Write the equation of Maxwell distribution of molecular velocities in three dimension. Explain it graphically.

   c. For H_2 gas, calculate the (i) root mean square velocity, (ii) average velocity and (iii) most probable velocity at 0 °C.

4. **a.** What are the laws of crystallography? Explain in details. Write down the Bragg's equation and define each term involve in the equation. 3+2+3+2 =10

   b. State Huckel's rule of aromaticity.

   c. Describe stability of primary, secondary and tertiary carbocations in terms of hyperconjugation.

5. a. Describe capillary rise method for the determination of surface tension. Consider two liquids A and B such that A has half the surface tension and twice the density of B. If liquid A rises to a height of 2.0 cm in a capillary, what will be height of B liquid rise in same capillary? 5+3+2 =10

b. What do you mean by vapour pressure of a liquid? How does vapour pressure depend upon intermolecular force and temperature of a liquid?

c. At 373.6 K and 372.6 K, the vapour pressure of H_2O (l) are 1.03×10^5 Nm^{-2} and 0.9947×10^4 Nm^{-2} respectively. What is the enthalpy of vapourization of water?

6. a. Define electrophile and nucleophile with examples. Draw resonating structures of CO_3^{2-}. 2+3=5

b. Write structure of the following molecules. 2+3=5
2,2,3,3-tetramethylbutane and 2,2,6,6,7-pentamethyloctane.
What is tautomerism and write the differences between resonance and tautomerism.

7. a. Explain why NH_3 has higher boiling point than PH_3 at normal temperature and pressure. 2+4+4 =10

b. What is covalent radii? How and why does it vary along a group and a period?

c. How did Pauling define electronegativity of an element? Explain why the electronegativity decreases along the group with increase in atomic number.

8. a. State and explain de Broglie wave equation. 5+5=10

b. Write notes on Heisenberg's uncertainty principle

= = *** = =