

**B.SC. CHEMISTRY  
THIRD SEMESTER  
ORGANIC, INORGANIC & PHYSICAL CHEMISTRY I  
BSC – 731 [SPECIAL REPEAT]  
[USE OMR SHEET FOR OBJECTIVE PART]**

**SET  
A**

Duration: 3 hrs.

Full Marks: 70

**(PART-A: Objective)**

Time: 30 min.

Marks: 20

*Choose the correct answer from the following:*

**1X20=20**

- 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
- 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
- The correct relation among  $C_p$ ,  $\langle C \rangle$  and  $\langle C^2 \rangle^{1/2}$  is  
a.  $C_p : \langle C \rangle : \langle C^2 \rangle^{1/2} = 1.00 : 0.92 : 0.82$   
b.  $C_p : \langle C \rangle : \langle C^2 \rangle^{1/2} = 0.92 : 1.00 : 0.82$   
c.  $C_p : \langle C \rangle : \langle C^2 \rangle^{1/2} = 0.82 : 0.92 : 1.00$   
d. None of the above
- 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  $6.023 \times 10^{22}$ .  
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
- 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.
- 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
- (1 1 1)
  - (3 2 3)
  - (2 3 2)
  - (2 1 1)
8. Which one of the following statement is correct about Amorphous solids?
- Amorphous solid has no sharp melting point
  - Amorphous solid has sharp melting point
  - Amorphous solid has regular geometry
  - Plastics are not amorphous solid
9. S. I. unit of viscosity is
- $\text{Nm}^{-2}\text{s}$
  - $\text{Nm}^{-1}\text{s}$
  - $\text{Nm}^{-2}\text{s}^{-2}$
  - $\text{Nm}^{-1}\text{s}^{-1}$
10. Clausius-Clapeyron equation is used to describe
- Viscosity
  - Vapour pressure
  - Surface tension
  - None of the above
11. The two carbon atoms in acetylene are
- $\text{sp}^3$  hybridized
  - $\text{sp}^2$  hybridized
  - $\text{sp}$  hybridized
  - Unhybridized
12. Which species do not have  $\text{sp}^3$  hybridization?
- Ammonia
  - Methane
  - Water
  - Carbon dioxide
13. In the Bronsted-Lowry system, a base is defined as
- a proton donor
  - a hydroxide donor.
  - an electron-pair acceptor.
  - a proton acceptor.
14. Which of the following is not correct for dipole moment?
- The difference in electronegativities of combining atoms can lead to the dipole moment.
  - the dipole moment is a vector quantity
  - $\text{CO}_2$  molecule has no dipole moment since C-O bonds are nonpolar
  - None of the above
15. Which of the following is an application of inductive effect?
- Bond length
  - Dipole moment
  - Strength of carboxylic acid
  - All of the above
16. As long as electron stays in its own orbit-
- It absorbs energy.
  - It emits energy.
  - It neither absorbs nor emits energy.
  - None of the above.

17. The intensity of electromagnetic radiation is determined by the number of
- Number of photons striking unit area in unit time.
  - Number of electrons striking unit area in unit time.
  - Number of neutrons striking unit area in unit time.
  - None of the above.
18. The red end in the spectrum corresponds to
- Lower energy but longer wave length.
  - Higher energy and longer wave length
  - Lower energy and shorter wave length.
  - 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
  - b. Write two differences between amorphous and crystalline solids. =10
  - 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
  - b. Derive the Avogadro's Law and Boyle's Law from kinetic molecular theory of gases. =10
  - 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
  - b. Write the equation of Maxwell distribution of molecular velocities in three dimension. Explain it graphically. =10
  - c. For H<sub>2</sub> 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
  - b. State Huckel's rule of aromaticity. =10
  - 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<sub>2</sub>O (l) are  $1.03 \times 10^5 \text{ Nm}^{-2}$  and  $0.9947 \times 10^4 \text{ Nm}^{-2}$  respectively. What is the enthalpy of vapourization of water?
6. a. Define electrophile and nucleophile with examples. Draw resonating structures of CO<sub>3</sub><sup>2-</sup>. 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<sub>3</sub> has higher boiling point than PH<sub>3</sub> 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

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