

T.Y.B.Sc. Sem. – V
December – 2020 Examination
(Sample Questions)
Physical Chemistry

Unit – III Nuclear Chemistry

1. Which of the following is not a charged particle?
 - a. α – particle
 - b. β – particle
 - c. γ – particle
 - d. Proton
2. Which of the following is not isotope of hydrogen?
 - a. ${}_1\text{H}^1$
 - b. ${}_1\text{D}^2$
 - c. ${}_1\text{T}^3$
 - d. ${}_1\text{L}^4$
3. Half life period ($t_{1/2}$) of radioelement is related with decay constant (λ) by.....
 - a. $t_{1/2} = 0.0592 / \lambda$
 - b. $t_{1/2} = 0.0693 / \lambda$
 - c. $t_{1/2} = 0.693 / \lambda$
 - d. $t_{1/2} = 0.592 / \lambda$
4. Transmutation reaction is represented as.....
 - a. Recoil Nucleus + Projectile \rightarrow Target Nucleus + Ejected Particle
 - b. Recoil Nucleus + Ejected Particle \rightarrow Target Nucleus + Projectile
 - c. Target Nucleus + Ejected Particle \rightarrow Recoil Nucleus + Projectile
 - d. Target Nucleus + Projectile \rightarrow Recoil Nucleus + Ejected Particle
5. Which of the following statement is incorrect for radioactive equilibrium?
 - a. It is attained by radioactive species of radioactive series
 - b. It is affected by external conditions
 - c. It is irreversible
 - d. It is attained after a considerable time
6. Which of the following statement is true for artificial radioactivity?
 - a. K-electron capture is observed in artificial radioactivity
 - b. There is no external control over artificial radioactivity
 - c. Radioactive series are observed
 - d. Light nuclei emit α – particles

7. For exoergic nuclear reactions, Q – value is.....
- Positive
 - Negative
 - Zero
 - May be positive or negative
8. Which of the following is the formula of Q- value of nuclear reaction?
- $Q = \Delta m \times 931 \text{ Mev}$
 - $Q = \Delta m \times 931 \text{ ev}$
 - $Q = \Delta m \times 0.931 \text{ Mev}$
 - $Q = \Delta m \times 0.931 \text{ ev}$
9. Fertile material (^{232}Th) is converted into fissile material (^{233}U) after successive emission of negative β - particles.
- One
 - Two
 - Three
 - Zero
10. Which of the fissionable material available in nature.....
- ^{235}U
 - ^{239}Pu
 - ^{233}U
 - ^{238}U
11. When fission of one atom of ^{235}U takes place then the energy released (Q value) will be nearly
- 200 Mev
 - 27 Mev
 - 550 Mev
 - 27 eV
12. Which particle is used to trigger the fission of a uranium nucleus?
- Neutron
 - Electron
 - Proton
 - Deuteron
13. Nuclear fusion means.....
- Combination of 2 or more lighter nuclei
 - Combination of target and projectile
 - Breaking of atom of an element
 - Breaking of heavier nucleus

- 14.Chain reaction means
- A reaction where protons release from one reaction used to cause carry further reactions and so on
 - A reaction where neutrons release from one reaction used to cause carry further reactions and so on
 - A reaction where electrons release from one reaction used to cause carry further reactions and so on
 - Joining of uranium atoms together in a long chain
- 15.Calculate Q-value for the reaction $^{10}\text{B} (n, \alpha) ^7\text{Li}$, if atomic masses in a.m.u. are $^{10}\text{B} = 10.012939$, $^1_0\text{n} = 1.0086654$, $^7\text{Li} = 7.016005$, $^4_2\text{He} = 4.0026036$.
- + 2.7883 Mev
 - 2.7883 eV
 - 2.7883 Mev
 - + 2.7883 eV
- 16.When a negative β – particle is emitted from a nucleus then Neutron-Proton Ratio
- Decreases
 - Increases
 - May increase or decrease depending on the nucleus
 - Remains same
- 17.Which of the following is not used as phosphor in Scintillation Counter?
- Oxygen gas in D_2O
 - Sodium iodide activated by thallium
 - Inert gases like argon, xenon or krypton
 - Diphenyl oxazole or terphenyl in toluenen or xylene
- 18.In age determination of the object of animal or plant origin, which of the following radioisotope of Carbon is used.....
- ^{12}C
 - ^{13}C
 - ^{14}C
 - ^{11}C
- 19.Which of the type of Nuclear Transmutation reaction, target and recoil nuclei have same atomic number?
- (p, n) type
 - (p, α) type
 - (p, d) type
 - (d, n) type

20. Energy of slow or thermal neutrons used in nuclear reactor is nearly...
- 0.025 Mev
 - 2.5 Mev
 - 2500 Mev
 - 0.000025 Mev
21. Radioactive substances do not emit.....
- Helium nuclei
 - Proton
 - β^- particle
 - γ - rays
22. When radioactive nucleus emits β^- particle, then mass number of nucleus
- Increases by one
 - Decreases by one
 - Remains the same
 - Decreases by two
23. In Nuclear transmutation reaction, ${}_{11}\text{Na}^{23} (\text{p}, \text{n}) \text{X}$
Recoil nucleus 'X' will be
- ${}_{11}\text{Na}^{24}$
 - ${}_{11}\text{Na}^{22}$
 - ${}_{12}\text{Mg}^{23}$
 - ${}_{12}\text{Mg}^{24}$
24. Isotopes means.....
- Nuclei with same atomic number but different mass numbers
 - Nuclei with different atomic number but same mass numbers
 - Nuclei with same atomic number but same mass numbers
 - Nuclei with different atomic number but different mass numbers
25. Isobars means.....
- Nuclei with same atomic number but different mass number
 - Nuclei with different atomic number but same mass number
 - Nuclei with same atomic number but same mass number
 - Nuclei with different atomic number but different mass number

Unit – IV
Surface Chemistry
Colloidal State

1. Adsorption is a phenomenon,
 - a. Bulk
 - b. Surface
 - c. Interior
 - d. Scattered
2. Absorption is aphenomenon.
 - a. Bulk
 - b. Surface
 - c. Interior
 - d. Scattered
3. Which of the following statement is incorrect?
 - a. Activation of adsorbent is done to remove the impurities present
 - b. Activation of adsorbent is done to remove the previously adsorbed gases
 - c. Activation of adsorbent is done to increase the surface area of the adsorbent
 - d. Activation of adsorbent is done to decrease the surface area of the adsorbent
4. B.E.T equation of the following is
 - a. $\frac{P}{V(P^0-P)} = \frac{1}{V_m \cdot C} + \left(\frac{C-1}{V_m \cdot C}\right) \frac{P}{P^0}$
 - b. $\frac{P}{V(P-P^0)} = \frac{1}{V_m \cdot C} + \left(\frac{C-1}{V_m \cdot C}\right) \frac{P}{P^0}$
 - c. $\frac{P}{V(P^0-P)} = \frac{1}{V_m \cdot C} + \left(\frac{C-1}{V_m \cdot C}\right) \frac{P^0}{P}$
 - d. $\frac{P}{V(P^0-P)} = \frac{C-1}{V_m \cdot C} + \left(\frac{1}{V_m \cdot C}\right) \frac{P}{P^0}$
5. Which of the following statement is false?
 - a. Adsorption may be monolayer or multilayer
 - b. Amount of adsorption increases with increase in pressure
 - c. Particle size of adsorbent will not affect the amount of adsorption
 - d. Amount of adsorption may decrease with increase in temperature
6. Which of the following statement is incorrect for physical adsorption?
 - a. Physical adsorption decreases with increase in temperature
 - b. Physical adsorption is reversible
 - c. Physical adsorption is specific in nature
 - d. Physical adsorption involves Van der Waals forces

7. Freundlich adsorption isotherm holds good at low pressure but fails at.....
- Low temperature
 - Intermediate pressure
 - High pressure
 - Low concentration
8. A substance on the surface of which gas or liquid molecules are collected is called
- Sorbate
 - Adsorbent
 - Adsorbate
 - Absorbate
9. Mathematical expression for Freundlich adsorption isotherm is
- $x/m = KP^n$
 - $x/m = KP^{1/n}$
 - $x/m = P K^{1/n}$
 - $x/m = P K^{1/n}$
10. Which of the following is Langmuir adsorption isotherm?
- $\frac{x}{m} = \frac{ab}{1+b}$
 - $\frac{x}{m} = \frac{aP}{1+a}$
 - $\frac{x}{m} = \frac{1+b}{aP}$
 - $\frac{x}{m} = \frac{aP}{a+b}$
11. If in Freundlich adsorption isotherm value of $1/n = 1$, then $x/m = \dots\dots$
- KP
 - K
 - P
 - K/P
12. Type-I adsorption isotherm is the type of
- Monomolecular adsorption
 - Multimolecular adsorption with $E_1 > E_L$
 - Multimolecular adsorption with $E_1 < E_L$
 - Multimolecular adsorption with $E_1 = E_L$
13. Milk as an example of which type of colloid?
- Gel
 - Aerosol
 - Emulsion
 - Sol

14. Which of the following statement is correct for lyophilic colloids?
- Lyophilic colloids are less stable than lyophobic colloids
 - Lyophilic colloids are irreversible
 - Lyophilic colloids are difficult to coagulate
 - Lyophilic colloids are not covered with solvent layer
15. Charge on soap colloidal particles is developed by.....
- Self dissociation
 - Medium
 - Preferential adsorption
 - Addition of an electrolyte
16. Proteins in acidic medium are.....
- Positively charged
 - Negatively charged
 - Zwitter ion
 - No charge
17. Soap colloidal particles are.....
- Positively charged
 - Negatively charged
 - Zwitter ion
 - No charge
18. Helmholtz model of Electrical double layer is of
- Fixed nature
 - Diffused nature
 - Bulky nature
 - Scattered nature
19. Migration of colloidal particles under the influence of electric field is called...
- Electrophoresis
 - Streaming potential
 - Sedimentation potential
 - Electro-osmosis
20. Which of the following is not a colloidal electrolyte?
- Sodium palmitate
 - Potassium stearate
 - Sodium chloride
 - Congo Red

21. Sodium Stearate ($C_{17}H_{35}COONa$) is an example of
- Cationic surfactant
 - Anionic surfactant
 - Non-ionic surfactant
 - Zwitter ionic surfactant
22. Zwitter ionic surfactants have.....
- Cationic centers
 - Anionic centers
 - Both cationic and anionic centers
 - No cationic as well as anionic centers
23. Size of colloidal particles ranges from
- 1 nm to 100 nm
 - 1000 nm to 10000 nm
 - 1 Å to 10 Å
 - 10 Å to 100 Å
24. The relation between Zeta potential and Streaming potential is
- Directly proportional
 - Inversely proportional
 - No any relation between them
 - Zeta potential exactly twice of Sedimentation potential
25. What will be Langmuir equation at high pressure?
- $\frac{x}{m} = \frac{b}{a}$
 - $\frac{x}{m} = ap$
 - $\frac{x}{m} = \frac{aP}{1+bP}$
 - $\frac{x}{m} = \frac{a}{b}$

Unit 1

Molecular Spectroscopy

1. Any Bond which has degree of polarity has a definite dipole moment is called as-----
 - a) Bond moment
 - b) Group moment
 - c) Moment of Inertia
 - d) Dielectric constant

- 2) Nitro Painting the observed dipole moment is 6D expected value is -----D
 - a) 6.9D
 - b) 6.8 D
 - c) 6.7 D
 - d) 6.6D

- 3) BF_3 molecule has bond moment-----
 - a) Zero
 - b) 1
 - c) 2
 - d) 3

- 4) Bond Moment of Ortho - dichlorobenzene is-----
 - a) Zero
 - b) 2.6 D
 - c) 1.5 D
 - d) 1.7 D

- 5) Rotational spectrum observed differences in frequency between the consecutive spectral lines is always constant that is-----
 - a) 2B
 - b) 4B
 - c) 6B
 - d) 8B

- 6) Following Symmetric diatomic molecules have $\mu = 0$, So they are microwave inactive -----
 - a) H_2 , CO_2 , Cl_2
 - b) H_2 , CO_3 , Cl_2
 - c) H_2 , CCl_4 , Cl_2
 - d) H_2 , O_2 , Cl_2

- 7) Which of the following is correct-----
 - a) $B = \frac{h}{8\pi^2 I C}$
 - b) $I = \frac{h}{8\pi^2 B C}$
 - c) $B = \frac{h^2}{8\pi^2 I C}$
 - d) None

- 8) Which of the following statement is correct-----?
- a) The magnitude of the dipole moment of polar molecule depends on difference in electronegativities between bonding atoms
 - b) In rotational spectra the frequency separation between two successive line is $4B$
 - c) P- branch lines in vibrational- rotational spectra are on higher frequency side than the R -branch lines on lower frequency side.
- 9) For Stoke Lines Raman shift is -----
- a) Positive
 - b) Negative
 - c) Zero
 - d) Infinity
- 10) Non linear molecule benzene shows----- vibrational degrees of freedom.
- a) 40
 - b) 30
 - c) 29
 - d) 31
- 11) Dipole moment is-----
- a) Extensive property
 - b) Intensive property
 - c) vector quantity
 - d) Denoted by μ
- 12) The molecule will possess maximum number of modes of vibration motion which may be either $3N-5$ or -----
- a) $3N-6$
 - b) $3N-7$
 - c) $3N-8$
 - d) $3N-9$
- 13) Spring and ball model is also called as -----
- a) Harmonic oscillator
 - b) Unharmonic oscillator
 - c) Both
 - d) None
- 14) In plane bending vibration vibrations are-----
- a) Rocking twisting
 - b) Rocking scissoring
 - c) Scissoring Wagging
 - d) Twisting wagging

15) The unit of moment of inertia for rotating molecule is-----

- a) Kg m^2
- b) $\text{Kg}^2 \text{m}^2$
- c) Kg m
- d) $\text{Kg}^2 \text{m}^3$

16) Which of the following is true -----

- a) Sir CV Raman received Nobel Prize in 1931 in chemistry for discovering Raman effect .
- b) Sir CV Raman received Nobel Prize in 1930 in chemistry for discovering Raman effect
- c) Sir CV Raman received Nobel Prize in 1930 in Physics for discovering Raman effect

17) Rayleigh scattering takes place when-----

- a) $\lambda_i > \lambda_s$
- b) $\lambda_i < \lambda_s$
- c) $\lambda_i = \lambda_s$

18) The ratio of the fundamental, the first and the second overdrawn bands are roughly in the ratio -----

- a) 1:2:3
- b) 2:3:4
- c) 3:4:5
- d) 4:5:6

19) Basic equation of spectroscopy is-----

- a) $\nu = \Delta E/h$
- b) $\mu = m_1 m_2 / m_1 + m_2$
- c) $E = h \nu$
- d) $I = h / 8\pi^2 B_0 C$

20) The selection rule for rigid rotor is-----

- a) $\Delta J = \pm 1$
- b) $\Delta V = \pm 1$
- c) $\Delta J = +1$
- d) $\Delta V = +1$

21) Vibration rotation spectrum of diatomic molecule contains two groups of closely spaced lines known as -----

- a) P and Q branches
- b) P and R branches
- c) P and T branches
- d) None of the above

22) -----help to decide whether a particular mode of vibration will be observed in the IR and Raman spectra

- a) The rule of mutual exclusion
- b) Selection Rule
- c) Aufbau's Rule
- d) None

23) Using the wavelength of 400 nm the first stoke line appears at a spacing of $3.5 \times 10^4 \text{ m}^{-1}$ from Rayleigh line. Calculate the wavelength of first anti stoke line.-----

- a) 394.5 nm
- b) 394.5 nm
- c) 394.5 nm
- d) 394.5 nm

24) The vibrational frequency of the -OH bond is $3.6 \times 10^5 \text{ m}^{-1}$. Calculate the force constant (k) of the bond-----

- a) $7.2 \times 10^2 \text{ Nm}^{-1}$
- b) $7.2 \times 10^3 \text{ Nm}^{-1}$
- c) $7.2 \times 10^4 \text{ Nm}^{-1}$
- d) $7.2 \times 10^5 \text{ Nm}^{-1}$

25) The fundamental frequency of vibration of $^1\text{H}^{35}\text{Cl}$ is $2.988 \times 10^5 \text{ m}^{-1}$. If ratio of reduced masses of $\mu_{^1\text{H}^{35}\text{Cl}} / \mu_{^2\text{H}^{35}\text{Cl}}$ is 1.946. Then calculate the fundamental frequency of vibration of $^2\text{H}^{35}\text{Cl}$.-----

- a) $2.143 \times 10^5 \text{ m}^{-1}$
- b) $21.43 \times 10^5 \text{ m}^{-1}$
- c) $214.3 \times 10^5 \text{ m}^{-1}$
- d) $2.143 \times 10^5 \text{ m}^{-1}$

Unit 2

2.1 Chemical thermodynamics

2.2 Chemical kinetics

- 1) Osmotic pressure is-----
 - a) Directly proportional to volume
 - b) Inversely proportional to volume
 - c) Volume does not affect the osmotic pressure.

- 2) Unit for K_b is-----
 - a. Kg mol K
 - b. Kg mol⁻¹K
 - c. Kg⁻¹ mol⁻¹ K⁻¹
 - d. Kg⁻¹mol K

- 3) The depression in freezing point of solvent for 0.2 m aqueous KCL solution is----- K when molal elevation constant for water is 0.512 K Kg mol⁻¹ . -----
 - a) 0.1024
 - b) 0.01024
 - c) 0.1002
 - d) 0.1240

- 4) Which of the following is not a colligative property?-----
 - a) Vapour pressure
 - b) Elevation of boiling point
 - c) Osmotic pressure
 - d) Depression in freezing point

- 5) The freezing point of the solvent _____
 - a) will increase on adding a solute
 - b) will decrease on adding a solute
 - c) will not change on adding a solute

- 6) In Reverse Osmosis solvent molecules move across a semi permeable membrane-----
 - a) From solvent to solution.
 - b) From solution to solvent
 - c) in both direction
 - d) does not flow at all

- 7) The boiling point of 0.1 molar aqueous solution of non volatile. non electrolyte will be-----
 - a) 273.052 K
 - b) 373.052 K
 - c) 100.052 K
 - d) 473.052 K

- 8) The boiling point of a solution is a temperature at which vapour pressure is equal to the-----
- Atmospheric pressure
 - Surrounding Pressure
 - System Pressure
 - Solution Pressure

- 9) The relative lowering of vapour pressure is equal to the----- of the solute in a solution
- Mole fraction
 - Molarity
 - Normality
 - Formality

- 10) Rast Method makes the use of the fact that molal depression constant of camphor is very high ie -----
- 40.00 K
 - 41 .00K
 - 39.00K
 - 38.00K

- 11) Following expression is used to determine molecular weight from Boiling Point of Elevation of a solution when non volatile solute is added to it .-----

- $M_2 = \frac{K_f W_2 \times 10}{W_1 \times \Delta T_b}$
- $M_2 = \frac{K_b W_2 \times 1000}{W_1 \times \Delta T_b}$
- $M_1 = \frac{K_b W_2 \times 1000}{W_1 \times \Delta T_b}$
- $M_1 = \frac{K_f W_2 \times 1000}{W_1 \times \Delta T_b}$

- 12) Solution containing 0.32 g of unknown solute in 100 g of carbon tetrachloride gave a boiling point elevation of 0.65 K . If the molal elevation constant of a carbon tetrachloride is 5.0 2K mol⁻¹ kg .Calculate molecular weight of the solute ?-----
- 24.71
 - 26.71
 - 28.71
 - 30.71

- 13) The Osmotic pressure of a solution containing 5 g of haemoglobin in 500 cm³ solution was found to be 344 Nm⁻²M⁻² at 276 K . Calculate molar mass of haemoglobin. -----
- 6.67 x 10³
 - 6.67 x 10⁴
 - 6.67 x 10⁵
 - 6.67 x 10⁶

14) What concentration of Urea in water is needed so that resulting solution was at 373.12 K?

$K_b = 0.512 \text{ K Kg mol}^{-1}$ -----

- a) 0.2322 molal
- b) 0.2344 molal
- c) 0.2366 molal
- d) 0.2388 molal

15) A solution containing 0.097 g of Urea in 50 g of water was found to freeze at - ----- 0.06° C. Calculate the molecular weight of the urea .The freezing point of the water is 0° C $K_f = 1.86$

K Kg mol^{-1} -----

- a) 6.014 g mol^{-1}
- b) 60.14 g mol^{-1}
- c) 601.4 g mol^{-1}
- d) 6014 g mol^{-1}

16) In Reverse Osmosis system ,the solution from which pure water is obtained is called as-----

- a) Feed water
- a) Permeate
- b) Reject stream
- c) Raw water

17) Organic substitution reactions like Bromination of Phenols and amines are examples of

- a) Fast reaction
- b) Ultra fast reaction
- c) Moderate reaction
- d) Slow reaction

18) The minimum energy requirement that must be met for a chemical reaction to occur is called as-----

- a) Energy of activation
- b) Reaction energy
- c) Kinetic energy
- d) Potential energy

19) Reactions with rate constants (K) about $10^{11} \text{ K dm}^3 \text{ m}^{-1} \text{ S}^{-1}$ are called as-----

- a) Fast reaction
- b) Ultra fast reaction
- c) Moderate reaction
- d) Slow reaction

20) In a Flash Photolysis technique , a photolysis flash for producing a short pulse of high intensity with energies per flash ranging from ----- in a time interval of 1 -100 micro seconds .

- a) 2 -3000J
- b) 3 -2000 J
- c) 3 -3000J
- d) 2 -2000 J

21) Expression for fundamental equation of collision theory for bimolecular reactions is-----

a) $K = Z \cdot e^{-E_a/RT}$

b) $K = A \cdot e^{-E_a/RT}$

c) $Z = n_1 \cdot n_2 \cdot \sigma_{1.2}^2 \cdot \sqrt{(8 \pi RT [M_1 + M_2/M_1 \cdot M_2])}$

d) $Z = 2 n^2 \sigma^2 \cdot \sqrt{(\pi RT/M)}$

22) In Modified Expression for fundamental equation of collision theory i.e. $K = P Z \cdot e^{-E_a/RT}$ the term P is called as -----

a) Steric factor

b) Boltzmann factor

c) Frequency factor

d) Correction factor

23) Expression for the number of collisions per second cubic meter in any gas is given by kinetic theory of gas is written as -----

a) $Z = 2 n^2 \sigma^2 \cdot \sqrt{(\pi RT/M)}$

b) $K = Z \cdot e^{-E_a/RT}$

c) $K = A \cdot e^{-E_a/RT}$

d) $Z = n_1 n_2 \sigma_{1.2}^2 \cdot \sqrt{(8 \pi RT [M_1 + M_2/M_1 \cdot M_2])}$

24) Activation energy of a reaction at a given temperature is found to be $2.303 RT$ J/mol . The rate constant to the Arrhenius factor is-----

a) 0.1

b) 0.01

c) 0.001

d) 0.001

25) The rate constant of a reaction-----

a) Decreases with increasing E_a

b) Increases with decreasing E_a

c) is independent of E_a

26) F. A Lindeman applied collision theory to -----reactions

a) Simple

b) Unimolecular

c) Bimolecular

d) Complex