

T.Y.B.Sc. Sem. – V
Examination Mission 2020
(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.....
 - a. Positive
 - b. Negative
 - c. Zero
 - d. May be positive or negative
8. Which of the following is the formula of Q- value of nuclear reaction?
 - a. $Q = \Delta m \times 931 \text{ Mev}$
 - b. $Q = \Delta m \times 931 \text{ ev}$
 - c. $Q = \Delta m \times 0.931 \text{ Mev}$
 - d. $Q = \Delta m \times 0.931 \text{ ev}$
9. Fertile material (^{232}Th) is converted into fissile material (^{233}U) after successive emission of negative β - particles.
 - a. One
 - b. Two
 - c. Three
 - d. Zero
10. Which of the fissionable material available in nature.....
 - a. ^{235}U
 - b. ^{239}Pu
 - c. ^{233}U
 - d. ^{238}U
11. When fission of one atom of ^{235}U takes place then the energy released (Q value) will be nearly
 - a. 200 Mev
 - b. 27 Mev
 - c. 550 Mev
 - d. 27 eV
12. Which particle is used to trigger the fission of a uranium nucleus?
 - a. Neutron
 - b. Electron
 - c. Proton
 - d. Deuteron
13. Nuclear fusion means.....
 - a. Combination of 2 or more lighter nuclei
 - b. Combination of target and projectile
 - c. Breaking of atom of an element
 - d. 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, ${}_{11}\text{Na}^{23} (p, n) X$
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?
- $\frac{x}{m} = \frac{ab}{1+bP}$
 - $\frac{x}{m} = \frac{aP}{1+ab}$
 - $\frac{x}{m} = \frac{aP}{1+bP}$
 - $\frac{x}{m} = \frac{aP}{a+bP}$
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

- 1) Nitro Painting the observed dipole moment is $6D$ expected value is -----D
 - a) $6.9D$
 - b) $6.8 D$
 - c) $6.7 D$
 - d) $6.6D$
- 2) 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 n
- 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. $\text{Kg mol}^{-1}\text{K}$
 - c. $\text{Kg}^{-1} \text{mol}^{-1} \text{K}^{-1}$
 - d. $\text{Kg}^{-1}\text{mol K}$

- 3) The depression in freezing point of solvent for 0.2 m aqueous KCL solution is----- K when molal elevation constant for water is $0.512 \text{ K Kg mol}^{-1}$. -----
 - 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 .-----

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

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 $5.0 \text{ K mol}^{-1} \text{ kg}$.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 cm^3 solution was found to be $344 \text{ Nm}^{-2} \text{ M}^{-2}$ at 276 K . Calculate molar mass of haemoglobin. -----

- 6.67×10^3
- 6.67×10^4
- 6.67×10^5
- 6.67×10^6

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) $Z = n_1 n_2 \sigma_{1,2}^2 \sqrt{8 \pi RT [M_1 + M_2/M_1 \cdot M_2]}$
- d) $Z = 2 n^2 \sigma^2 \sqrt{\pi RT/M}$

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) $Z = 2 n^2 \sigma^2 \sqrt{\pi RT/M}$
- b) $K = Z \cdot e^{-E_a/RT}$
- c) $K = A \cdot e^{-E_a/RT}$
- d) $Z = n_1 n_2 \sigma_{1,2}^2 \sqrt{8 \pi RT [M_1 + M_2/M_1 \cdot M_2]}$

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