

Subject: **Chemistry**
Paper name: **Physical Chemistry - III**
Paper No: **XI (T) (CHEM/6/CC/363)**
Semester: **VI**

A. Multiple Choice questions

1. The spectral emissive power (E) of a blackbody at any temperature is equal to

- (a) σT^3
- (b) σT^{-3}
- (c) σT^4
- (d) σT^{-4}

2. When $\int \Psi_n^* \Psi_m dt = 0$, the eigen functions are

- (a) arbitrary
- (b) diagonal
- (c) orthogonal
- (d) normalized

3. Wien's displacement law in case of a blackbody is given by

- (a) $\lambda_m \times b = T$
- (b) $\lambda_m \times T = b$
- (c) $\lambda_m \times b = T^2$
- (d) $\lambda_m \times b = T^{-1}$

4. Rayleigh-Jeans formulae for energy density between wavelengths λ and $\lambda + d\lambda$ in case of black-body

radiation is given by

- (a) $E_\lambda d\lambda = 8\pi kT/\lambda^2$
- (b) $E_\lambda d\lambda = 8\pi kT/\lambda^3$
- (c) $E_\lambda d\lambda = 8\pi kT/\lambda^4$
- (d) $E_\lambda d\lambda = 8\pi kT/\lambda^5$

5. The wave function (ψ) of the particle in 1D box lies in the region = ?, where 'a' is the width of the box.

- a) $x > 0$
 - b) $x < 0$
 - c) $0 < x < a$
 - d) $x > a$
6. The unit of molar absorption coefficient (ϵ) is
- (a) $\text{mol}^{-1} \text{dm}^3 \text{cm}^{-1}$
 - (b) $\text{mol dm}^3 \text{cm}^{-1}$
 - (c) $\text{mol dm}^{-3} \text{cm}$
 - (d) $\text{mol}^{-1} \text{dm}^3 \text{cm}$
7. Absorbance (A) of a solution and transmittance (T) are related as
- (a) $A = \log T$
 - (b) $A = -\log T$
 - (c) $\log A = T$
 - (d) $\log A = -T$
8. The free energy of a photochemical reaction
- (a) is always positive
 - (b) is always negative
 - (c) can be positive and negative
 - (d) is neither positive nor negative
9. One Einstein is the energy associated with
- (a) one molecule
 - (b) one photon
 - (c) Avogadro number of photons
 - (d) Faraday number of photons
10. Absorbance of a solution which absorb 90% of a certain wavelength of light beam passed through a 1 cm cell containing 0.25 M solution is
- (a) -1
 - (b) 1
 - (c) 0.08
 - (d) 0.01
11. Standard e.m.f. (E°) of a cell and equilibrium constant (K) are related as

- (a) $nFE^0 = RT \ln K$
- (b) $nFE^0 = KT \ln R$
- (c) $nFE^0 = KR \ln T$
- (d) $RFE^0 = nT \ln K$

12. At 0K, the cell potential is equal to

- (a) 0
- (b) E°
- (c) 1 V
- (d) $< E^\circ$

13. If $E = E^\circ$, then the equilibrium constant (K) =

- (a) 1
- (b) 10
- (c) 100
- (d) 1000

14. ΔG° is equal to

- (a) nFE°
- (b) $-nFE^0$
- (c) nFE
- (d) $-nFE$

15. The relationship between ΔS & emf of the cell =

- (a) $-nF[dE/dT]_P^\circ$
- (b) $-nF[dE/dT]_P$
- (c) $nF[dE/dT]_P$
- (d) $-nF [dE/dT]_P$

16. The relation between entropy 'S' of a given system and the thermodynamic probability 'W' is given by

- (a) $S = k \ln W$
- (b) $W = k \ln S$
- (c) $k = S \ln W$
- (d) $S = W \ln k$

17. The unit of partition function is

- (a) Joule
 - (b) cm^{-1}
 - (c) Kelvin
 - (d) Dimensionless
18. The electronic partition function of H-atom in the ground electronic state is
- (a) 4
 - (b) 2
 - (c) 1
 - (d) 3
19. The number of ways of arranging 6 different particles among three energy levels such that each energy levels has two particles each is
- (a) 30
 - (b) 60
 - (c) 90
 - (d) 120
20. As temperature increases, partition function
- (a) Decreases
 - (b) Increases
 - (c) Remains the same
 - (d) None of these
21. The rotational energy change during transition $J \rightarrow J+1$, when $J=0$ is
- (a) $2B \text{ cm}^{-1}$
 - (b) $4B \text{ cm}^{-1}$
 - (c) $6B \text{ cm}^{-1}$
 - (d) $8B \text{ cm}^{-1}$
22. In Raman spectrum when the scattered radiations have frequencies lower than the incident radiation, it is called
- (a) Rayleigh line
 - (b) Stokes line
 - (c) Anti-stokes line
 - (d) None of these

23. The wave number of a transition is 2000 cm^{-1} . In what part of electronic spectrum does this come?

- (a) Ultraviolet
- (b) Radio-wave
- (c) Microwave
- (d) Infrared

24. Saturated compounds containing atoms with lone pair of electrons are capable of the transition

- (a) $n \rightarrow \pi^*$
- (b) $n \rightarrow \sigma^*$
- (c) $\pi \rightarrow \pi^*$
- (d) $\sigma \rightarrow \sigma^*$

25. The frequency of a transition is $5.4 \times 10^{15} \text{ Hz}$. The corresponding wavelength is

- (a) 18000 cm^{-1}
- (b) 650 nm
- (c) $5.6 \times 10^{-8} \text{ m}$
- (d) $5.6 \times 10^{-6} \text{ m}$

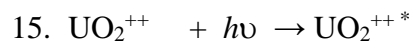
B. Fill up the Blanks

1. The total probability of finding the particle in 3D space must be _____.
2. The square of the magnitude of the wave function, ψ^2 , of a particle is called _____.
3. For a perfectly black body, the total emissive power or emissivity (ϵ) is given by _____.
4. The cell potential of a Galvanic cell is a _____ property.
5. For the half - cell reaction $\text{O}_2 (\text{g}) + 2\text{H}_2\text{O} (\text{l}) + 4 \text{e}^- = 4 \text{OH}^- (\text{aq})$, $-\Delta G^\circ / FE^\circ =$ _____
6. The standard electrode potential of hydrogen electrode in neutral solution and 298 K is _____
7. The number of microstates corresponding to its macrostate is known as its _____.
8. At a given temperature the fraction of total number of molecules at equilibrium which possess energy E is given by _____.
9. According to the multiplication theories, the total partition function 'q' of a molecule is equal to _____.
10. Rotational spectra are shown by molecules which is having permanent _____.
11. Raman spectroscopy deals with the _____ of light not with its absorption.

12. According to Born-Oppenheimer approximation, the total energy E of a molecule is given by_____.

13. Photochemistry begins with the absorption of radiation in the_____ of the spectrum.

14. Photosensitizer act as a_____in photochemical reaction.



Key Answer

A. Multiple Choice questions

1. (c)

2. (c)

3. (b)

4. (c)

5. (c)

6. (a)

7. (b)

8. (c)

9. (c)

10. (b)

11. (a)

12. (b)

13. (a)

14. (b)

15. (c)

16. (a)

17. (d)

18. (b)

19. (c)

20. (b)

21. (a)

22. (b)

23. (d)

24. (b)

25. (c)

B. Fill up the Blanks

1. Unity

2. Probability density

3. 1

4. an intensive

5. 4

6. 0 volt

7. thermodynamic probability

8. boltzman distribution

9. $q_{tr} \times q_r \times q_{vib} \times q_{el}$

10. dipole moment

11. scattering

12. $E_{tr} + E_r + E_{vib} + E_{el}$

13. Visible and near UV

14. Carrier of energy

15. CO₂