Multiple Choice Questions

Time: One Hour **Max Marks: 50**

1. A photon of frequency 'ν' has a momentum associated with it. If 'c' is the velocity of light, the momentum is:
   (A) hν/c (B) $h\nu/c^2$ (C) ν/c (D) hνc
2. Rest mass of a photon is
   (A) Zero (B) Infinite (C) Finite (D) Not known
3. Which of the following solutions of KCl will have maximum specific conductance?
   (A) 0.01N (B) 1.0 N (C) 0.1N (D) 0.001N
4. Decrease in atomic number is observed during
   (A) Alpha emission (B) Beta emission (C) Positron emission (D) Electron emission
5. The half-life period of a radioactive element is 150 days. After 600 days one gm of the element will be reduced to:
   (A) 15/16 g (B)1/8 g (C) 1/16 g (D)1/32 g
6. As per Franck-Condon principle which one of the following is the condition for the dissociation of the molecule
   (A) When the molecule is excited to a state which is unstable
   (B) When the molecule is excited to a stable state
   (C) When the molecule is raised from the lower rotational level to a higher vibrational level
   (D) None of the above
7. The degeneracy of energy level with energy equal to $6h^2/8ma^2$ is
   (A) 3 (B) 4 (C) 6 (D) 5
8. The monochromatic light of 400 nm wavelength produced by laser is completely absorbed by a reaction mixture. If the intensity of the radiation is 50 W, how many moles of photons are absorbed in 10 minutes?
   (A) 1 (B) 0.1 (C) 0.01 (D) 0.001
9. The first order reflections from the 100, 110 and 111 planes were found to occur at angles of 5.9°, 8.4° and 5.2° respectively. The crystal type is
   (A) FCC (B) BCC (C) Simple (D) End face centre
10. Each line in the vibration spectrum of HCl is found to split into doublet due to which of the following effect
    (A) Anharmonicity (B) Doppler's effect
    (C) Isotopic effect (D) None of these
11. The value of the commutator $\left[x, \frac{d}{dx}\right]$ is given by
    (A) $-2 + 4x\frac{d}{dx}$ (B) $-2 - 4x$
    (C) $1 - 2x$ (D) -1
12. If value of $l = 1$ and $m = 0$, then the angular wave function is given by
    (A) $\{\frac{3}{4\pi}\}^{1/2}\cos\theta$ (B) $\{\frac{3}{4\pi}\}^{1/2}\sin\theta$
    (C) $\{\frac{3}{4\pi}\}^{1/2}\cos\theta\sin\phi$ (D) $\{\frac{3}{4\pi}\}^{1/2}\sin\theta\cos\phi$
13. The various degrees of freedom for C_6H_6 molecule are
    (A) Tr = 3, Rot = 2, Vib = 31 (B) Tr = 3, Rot = 3, Vib = 30
    (C) Tr = 2, Rot = 2, Vib = 32 (D) Tr = 2, Rot = 3, Vib = 31
14. Under what conditions $C_v < 3R$ for solids
    (A) At low temperature (B) At moderate temperature
    (C) At high temperature (D) At all temperatures

15. An electron is confined to the 1D box of 0.2 nm width. The energy of the electron in its ground state will be

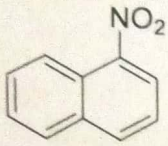
(A) 227 kJ/mol (B) 475 kJ/mol

(C) 907 kJ/mol (D) 1102 kJ/mol

16. Which electron configuration could correspond to a d-block metal ion that is colourless in solution?

(A) [Ar] $4s^2 3d^6$ (B) [Ar] $4s^2 3d^3$ (C) [Ar] $4s^2 3d^{10}$ (D) [Ar] $4s^2 3d^9$

17. The effect of $-NO_2$ on the λ_{max} value of the UV spectrum of Naphthalene is



(A) Hypsochromic Shift (B) Bathochromic Shift

(C) No effect (D) Will no longer be UV active

18. Cellulose is formed by interlinkage of glucose molecules by

(A) α-glycosidic linkage (B) β-glycosidic linkage

(C) α-amide linkage (D) β-amide linkage

19. Isoelectronic point refers to

(A) *p*H at which dipolar ion concentration is maximum

(B) *p*H at which dipolar ion concentration is minimum

(C) *p*H at which cation concentration is maximum

(D) *p*H at which anion concentration is minimum

20. Dansyl's method is for the

(A) C-terminal residue analysis in protein

(B) Amino acid count in proteins

(C) Analysing molecular weight of proteins

(D) N-terminal residue analysis in protein

21. Bakelite is a polymer of

(A) Aniline and Formaldehyde (B) Phenol and Benzaldeyde

(C) Phenol and Formaldehyde (D) Aniline and Benzaldehyde

22. The highest pK_a is observed in

(A) Acetylacetone (B) Acetone

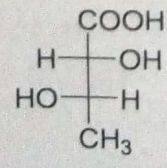
(C) Hexane (D) Phenol

23. The base catalysed condensation of esters is called

(A) Aldol condensation (B) Dieckmans condensation

(C) Claisencondenation (D) Schmidt condensation

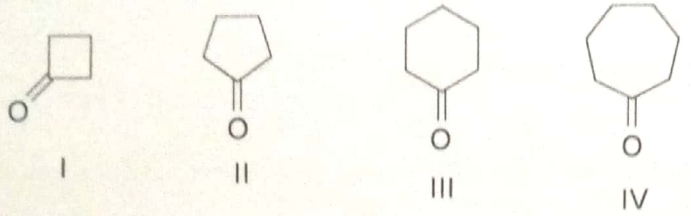
24. The following isomer can be called as



(A) Meso 2,3-dihydroxybutanoic acid (B) Erythro 2,3-dihydroxybutanoic acid

(C) Threo 2,3-dihydroxybutanoic acid (D) D- 2,3-dihydroxybutanoic acid

25. The correct order of IR absorption in following set of compounds is



I II III IV

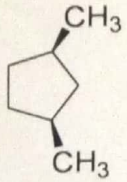
(A) I > II > III > IV
(B) IV > III > II > I
(C) II > III > I > IV
(D) III > II > I > IV

26. Diamagnetic anisotropy is exhibited by
(A) Hexane
(B) Cyclohexane
(C) Hexa-1,3,5-triene
(D) Benzene

27. What will be the splitting pattern of protons on the carbon marked with * in the following example

(A) Doublet
(B) Quartet
(C) Singlet
(D) Quintet

28. How many ^1H NMR signals are expected in the following compound?



(A) One
(B) Two
(C) Three
(D) Four

29. The reason for broadness of N-H and O-H peaks in an IR spectrum is
(A) Strength of these bonds
(B) Greater electronegativity of N and O atoms
(C) Exchangeable nature of protons
(D) None of the above

30. All tests are positive for lactose except
(A) Benedict
(B) Barfoed
(C) Molisch
(D) Osazone

31. Which naturally occurring α-amino acid is achiral?
(A) Glycine
(B) Glutamine
(C) Leucine
(D) Serine

32. Which of (A)-(D) is complementary to the DNA segment 5'-ACGTAATC-3'?
(A) 5'-TGCATTCG-3'
(B) 5'-TGCATTAG-3'
(C) 5'-TGCATAAG-3'
(D) 5'-TGACTTAG-3'

33. The order of increasing cabonyl frequency is
(A) Acetone<Acetophenone<chloroacetone<Ethylacetate
(B) Acetophenone<Acetone<chloroacetone<Ethylacetate
(C) Acetone<chloroacetone<Acetophenone<Ethylacetate
(D) Acetophenone<Acetone<Ethylacetate<chloroacetone

34. Which of the following has highest CFSE?
(A) $[TiF_6]^{3-}$
(B) $[Mn\ (H_2O]^{2+}$
(C) $[FeCl_4]^{2-}$
(D) $[Cr\ (H_2O)_6]^{3+}$

35. In which of the following configuration, the orbital contribution is quenched in octahedra field?
(A) $t_{2g}{}^4 e_g{}^2$
(B) $t_{2g}{}^6 e_g{}^1$
(C) $t_{2g}{}^4$
(D) $t_{2g}{}^5 e_g{}^2$

36. Which of the following ion is expected to show $\mu_{S.O.}$ close to 2.84 B.M.
(A) V^{3+} (B) Mn^{3+} (C) Fe^{2+} (D) Cu^{2+}

37. Which of the following elements has been extremely studied for square planar substitution reactions.
(A) Pd(II) (B) Ni(II) (C) Pt(II) (D) Au(II)

38. Which of the following has strongest trans-effect?
(A) py (B) SCN^- (C) Br^- (D) Cl^-

39. The term hard and soft acid and base was given by:
(A) Bronsted (B) Lewis (C) Pearson (D) Franklin

40. Hg^{2+} is classified as:
(A) Soft acid (B) Hard acid (C) Soft base D) Hard base

41. Oxymyoglobin contains
(A) O_2 at trans position to histidine chain. (B) O_2 in the hole of porphyrin.
(C) O_2 bonded by coordinate bond to Mg(II) (D) Does not contain O_2

42. The colour of the complex ion, $[Ti(H_2O)_6]^{3+}$ is due to
(A) Presence of water molecules.
(B) Intermolecular vibrations.
(C) Excitation of electron from t_{2g} to e_g energy level.
(D) Excitation of electron from 3d to 4s energy level.

43. For Laport forbidden transitions,
(A) $\Delta l=0$ (B) $\Delta S=0$ (C) $\Delta l= -1$ (D) $\Delta l= \pm 1$

44. Which of the following electronic arrangement has maximum number of microstates?
(A) d^5 (B) d^3 (C) d^6 (D) d^9

45. The ground state term symbol for d^3 is
(A) $^4F_{9/2}$ (B) $^4F_{3/2}$ (C) $^4D_{5/2}$ (D) $^4P_{3/2}$

46. The number of unpaired electrons in $[NiCl_4]^{2-}$ (t(D) are
(A) Two (B) Zero (C) One (D) Four

47. The CFSE for a low spin d^4 octahedral complex ion is
(A) -16 D_q (B) +16 D_q (C) -12 D_q (D) -10 D_q

48. In the hydrogenation of alkenes using Wilkinson's catalyst, the active catalyst is $RhCl(PPh_3)_2$ (or $RhCl(PPh_3)_2$(solvent)). The first step in the catalytic cycle is:
(A) Alkene coordination (B) Oxidative addition of H_2
(C) Loss of PPh_3 (D) Loss of Cl^-

49. Which of the following compounds is a 16-electron species and is an active catalyst?
(A) $HCo(CO)_3$ (B) $HRh(CO)(PPh_3)_3$
(C) $[Rh(CO)_2I_4]^-$ (D) $Pd(PPh_3)_4$

50. Ziegler-Natta catalysis is associated with:
(A) Alkene hydrogenation (B) Alkene polymerization
(C) Hydroformylation of alkenes (D) Alkyne metathesis