

Ph.D. Entrance Examination
November - 2022
Part - C
(Chemistry)
Time : 50 Minutes
Maximum Marks : 50
(Minimum Passing Marks : 25)

Note :

- (i) This question booklet comprises of 50 questions.
 - (ii) All questions are compulsory.
 - (iii) The question booklet along with answer sheet is to be handed over by the candidate to the Invigilator at the end of the examination.
 - (iv) There is no negative marking.
 - (v) Each question carries one mark.
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Multiple Choice Questions -

- 1. The approximate value of methyl proton in NMR is :
(a) 1.3 (b) 1.5 (c) 0.9 (d) 2.5
- 2. In NMR spectrum the nuclei in up field resonate at :
(a) High frequency (b) Low frequency
(c) Constant throughout the spectrum (d) It doesn't depend on chemical shift
- 3. Signal splitting in NMR arises from :
(a) Shielding effect (b) Spin-spin decoupling
(c) Spin-spin coupling (d) Deshielding effect
- 4. Which of the following solvent is not used in NMR?
(a) D₂O (b) CHCl₃ (c) CCl₄ (d) CDCl₃
- 5. In proton NMR spectroscopy, hydrogen bonding results in:
(a) Shielding effect (b) Deshielding effect
(c) Peak splitting (d) All the above

6. Equivalent protons in a molecule will have:
- (a) Same environment (b) Same chemical shift
(c) Same shielding effect (d) All of the above
7. Isotopes are mainly detected by:
- (a) Low field NMR (b) High resolution NMR
(c) Not by NMR (d) None of the above
8. Gyromagnetic ratio is the ratio of :
- (a) Magnetic moment to angular momentum
(b) Angular momentum to Magnetic moment
(c) Potential energy to angular momentum
(d) Potential energy to Magnetic moment
9. Which of the following proton exists more downfield in NMR?
- (a) Saturated (b) Aromatic (c) Vinylic (d) Allylic
10. Which of the following produces magnetic anisotropy?
- (a) Hydrogen bonding (b) Aromatic ring system
(c) Electronegativity (d) pH
11. Potassium crystallizes in a bcc lattice, hence the coordination number of potassium in potassium metal is :
- (a) 0 (b) 4 (c) 6 (d) 8
12. In zinc blende structure, zinc atoms fill up:
- (a) All octahedral holes (b) All tetrahedral holes
(c) Half the number of octahedral holes (d) Half the number of tetrahedral holes
13. The structure of Na_2O crystal is:
- (a) CsCl type (b) NaCl type (c) ZnS type (d) Antifluorite
14. The maximum radius of sphere that can be fitted in the octahedral hole of cubical closed packing of sphere of radius 'r' is :
- (a) $0.732 r$ (b) $0.414 r$ (c) $0.225 r$ (d) $0.155 r$
15. The number of atoms present in unit cell of a monoatomic substance of simple cubic lattice is:
- (a) 1 (b) 2 (c) 3 (d) 6

16. Ionic solids, with Schottky defects, contain in their structure :
- (a) Equal number of cation and anion vacancies
 - (b) Anion vacancies and interstitial anions
 - (c) Cation vacancies only
 - (d) Cation vacancies and interstitial cations
17. In which of the following manner the carbon layers are arranged in the graphite structure?
- (a) ABCABC
 - (b) AAAAAA
 - (c) CBACBA
 - (d) ABABAB
18. Amorphous substances are isotropic because :
- (a) They have same value of any property in all directions
 - (b) They have different values of physical properties in different directions
 - (c) They have definite geometrical shape
 - (d) None of the above
19. The amorphous solid among the following is:
- (a) table salt
 - (b) diamond
 - (c) Plastic
 - (d) graphite
20. There are ____ crystal systems :
- (a) 7
 - (b) 5
 - (c) 9
 - (d) 3
21. In photosynthesis, the predominant metal present in the reaction centre of photosystem II is:
- (a) Zn
 - (b) Cu
 - (c) Mn
 - (d) Fe
22. In oxygen transport, elements which are important are :
- (a) Fe and Cu
 - (b) Fe and Co
 - (c) Fe and Mg
 - (d) Fe and Mn
23. The inside of a cell is a :
- (a) Reducing medium
 - (b) Oxidising medium
 - (c) Neutral medium
 - (d) None of these
24. Degree of saturation for Mb is :
- (a) Lower than for Hb
 - (b) Same as for Hb
 - (c) Higher than for Hb
 - (d) None of these
25. O₂ binding in Hb is :
- (a) pH dependent
 - (b) pH independent
 - (c) Both of these
 - (d) None of these
26. The quaternary structure of human hemoglobin is best described as a :
- (a) Dimer of two myoglobin dimers
 - (b) Tetramer of identical subunits
 - (c) Tetramer of two different subunits
 - (d) Tetramer of four different subunits

27. The metal that is not prevalent in the biological system is :
 (a) Platinum (b) Manganese (c) Cobalt (d) Nickel
28. Which of the following has highest frequency?
 (a) Cosmic rays (b) X-rays (c) Radio waves (d) Micro waves
29. Which of the following catalyst is sensitive to temperature changes?
 (a) Fe (b) Pt (c) Ni (d) Enzyme
30. The law of relative lowering of vapour pressure was given by:
 (a) Vant Hoff (b) Ostwald (c) Lewis (d) Raoult
31. The molecular geometry of thionyl chloride is best described as:
 (a) T shaped (b) Tetrahedral
 (c) Trigonal pyramidal (d) Trigonal planar
32. Quantum dots are:
 (a) Three dimensional (b) One dimensional
 (c) Two dimensional (d) Zero dimensional
33. Which statement is incorrect about ferrocene?
 (a) Ferrocene can be nitrated by conc. HNO_3
 (b) Cyclopentadienyl rings in ferrocene are in eclipsed conformation.
 (c) Cyclopentadienyl rings in ferrocene are in staggered conformation.
 (d) Decamethylferrocene is staggered in solid state.
34. Which kind of Borane is B_5H_9 ?
 (a) Nido (b) Closo
 (c) Arachno (d) None of the above
35. Which of the following is the incorrect statement about Zeise's salt?
 (a) Ziese's salt is diamagnetic
 (b) Oxidation state of Pt in Ziese's salt is +2
 (c) C-C bond length of ethylene moiety is longer than free ethylene molecule
 (d) All the Pt-Cl bond lengths are equal

36. Which of the following methods is best suited for the separation of a mixture containing naphthalene and benzoic acid?

- (a) Crystallisation (b) Chromatography
(c) Sublimation (d) Distillation

37. The orientation of atomic orbitals depends on their :

- (a) spin quantum number (b) magnetic quantum number
(c) azimuthal quantum number (d) principal quantum number

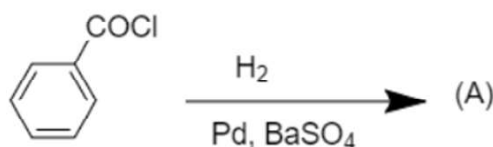
38. 3p orbital has ____ radial nodes :

- (a) three (b) two (c) one (d) none

39. The Clemmensen reduction of a ketone is carried out in the presence of:

- (a) Zn-Hg with HCl (b) LiAlH_4
(c) H_2 and Pt as catalyst (d) Glycol with KOH

40. A in the following reaction is:



- (a) $\text{C}_6\text{H}_5\text{OH}$ (b) $\text{C}_6\text{H}_5\text{COCH}_3$ (c) $\text{C}_6\text{H}_5\text{Cl}$ (d) $\text{C}_6\text{H}_5\text{CHO}$

41. Identify the chiral molecule among the following:





- (a) Isopropyl alcohol (b) 2-pentanol
(c) 1-bromo 3-butene (d) Isobutyl alcohol

42. If there is no rotation of plane polarized light by a compound in a specific solvent, thought to be chiral, it may mean that :

- (a) The compound may be a racemic mixture
(b) The compound is certainly chiral
(c) The compound is certainly meso
(d) There is no compound in the solvent

43. The mutarotation of glucose is characterized by :

- (a) change from aldehyde to ketone structure
(b) change from specific rotation from a (+) to a (-) value
(c) the presence of an intramolecular bridge structure
(d) the irreversible change from α - D to the β - D form

44. Which of the following compounds is not an aromatic compound ?
- (a)  (b)  (c)  (d) 
45. The delocalized π system in benzene is formed by a cyclic overlap of 6 orbitals:
- (a) s (b) p (c) sp (d) sp^2
46. For reactions of ethylbenzene, the ethyl group is considered:
- (a) ortho-directing (b) ortho-para directing
(c) meta-directing (d) ortho-meta directing
47. Toluene undergoes oxidation to give :
- (a) Benzyl alcohol (b) Quinone (c) Benzaldehyde (d) Benzoic acid
48. In the ground state of a cobalt atom there are _____ unpaired electrons and the atom is ____.
- (a) 3, paramagnetic (b) 5, paramagnetic
(c) 2, diamagnetic (d) 0, diamagnetic
49. The maximum number of electrons that can be accommodated in a sublevel for which $l = 3$ is:
- (a) 2 (b) 10 (c) 6 (d) 14
50. The magnetic quantum number specifies:
- (a) Size of orbitals (b) Shape of orbitals
(c) Orientation of orbitals (d) Nuclear Stability
