



Ph.D. COMMON ENTRANCE TEST JANUARY 2024

SUBJECT – CHEMISTRY

PART B

Roll No:

Duration: 60 minutes

Maximum Marks: 50

Instructions:

1. This entrance test question paper is not to be taken out of the examination hall
2. Question paper consists of Section A and Section B
3. Section A consists of 30 MCQs carrying 1 Mark each. Write the Alphabet of the correct answer in the space given.
4. Section B consists of Descriptive questions carrying 5 marks each. Restrict your answer to 500 words. Additional plain sheets have been attached to the question paper to answer Section B

SECTION – A

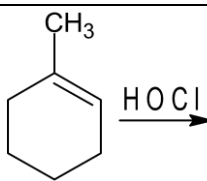
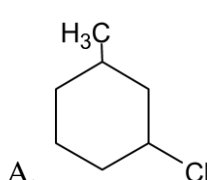
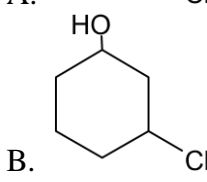
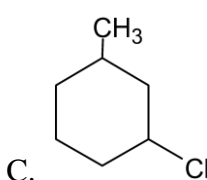
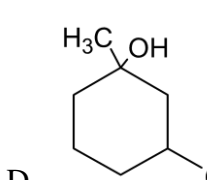
Answer the following questions by writing the Alphabet of the correct answer in the Box given:

30 X 1 = 30

1.	Which of the following cannot be obtained from X-ray diffraction studies A. Bond angle of Si-O-Si in a mineral B. Absolute configuration of a chiral natural product C. Vibration frequency of a carbonyl group D. Spacing between two parallel aromatic rings
2.	Calculate the EMF of the cell $Ag(s) Ag^+(aq, 0.010 M) Ag^+(aq, 1.0 M) Ag(s)$ A. 0.0591 V B. 100 V C. 0.12 V D. Cannot be determined with the data provided
3.	According to the Grotthus Draper Law in photochemistry A. One molecule absorbs one quanta of light B. A radiation should be absorbed by the system to cause a photochemical reaction C. The quantum yield of a photochemical reaction can be more than one D. The energy of one mole of photons is an Einstein
4.	Identify the wrong statement about LCAO A. Linear combination of a minimum of AOs are used to generate the MOs B. The number of MOs generated will be less than the total AOs used C. MOs are arranged from lowest to highest energy for filling

	D. MOs are filled following Hund's rule and Pauli Exclusion
5.	According to Pauling's rules a radius ratio of 0.75 favors a coordination number of A. 8 B. 6 C. 4 D. 12
6.	δ bonds are formed between A. s-s orbitals B. s-p orbitals C. s-d orbitals D. d-d orbitals
7.	The Born Landé equation relates A. Lattice energy to bond distance B. Bond order to valency C. Enthalpy change to number of cycles D. Bond length to structure
8.	Born-Oppenheimer approximation allows the separation of A. Rotational energy from translational energy of molecules B. Energy of the nucleus from that of electrons C. Energy of sigma and pi electrons D. Energy of core electrons and valance electrons
9.	The phenomenon where two expected strong and weak bands are replaced with two strong bands in a vibrational spectrum is called A. Fundamental vibration B. Overtone C. Combination band D. Fermi Resonance
10	The chromatographic analysis for a compound gave a retention time of 8 min and a baseline width of 0.2 in a column 2 m long. What is the height of a theoretical plate in mm? A. 4 B. 1.25 C. 2.5 D. 5
11	The allotrope of carbon that is a 2D nanomaterial is A. Carbon nanotube B. Fullerene C. Graphene D. Graphite
12	Nylon 6 is A. Polyacrylamide

	<p>B. Polycaprolactam C. Polystyrene D. Polyethylene</p>
13	<p>Quantum yield (Φ) is defined as</p> <p>A. the ratio of the number of electrons absorbed to the number of photons emitted B. the ratio of the number of photons emitted to the number of photons absorbed C. the ratio of the number of photons absorbed to the number of photons emitted D. the ratio of the number of photons absorbed to the number of absorbed electrons emitted</p>
14	<p>Addition of hydrogen halides is an example of _____ reactions of alkenes</p> <p>A. nucleophilic addition B. free radical addition C. electrophilic addition D. none of the above</p>
15	<p>Retrosynthesis of acetophenone gives two synthetic equivalents, which are...</p> <p>A. benzene and acetyl chloride B. phenol and acetyl chloride C. toluene and acetyl chloride D. benzene and methyl chloride</p>
16	<p>The most deshielded proton among the options is</p> <p>A. C_6H_5-H B. $C=C-H$ C. $C\equiv C-H$ D. All are shielded</p>
17	<p>For a rotational vibrational transition the true statement is</p> <p>A. Rotational and vibrational quantum numbers should change B. Only rotational quantum number should change C. Only vibrational quantum number should change D. Any one need to change</p>
18	<p>The luminescence phenomenon with the highest lifetime is</p> <p>A. Phosphorescence B. Fluorescence C. Chemiluminescence D. Electroluminescence</p>
19	<p>In a solution, containing KCl and KI precipitation titration was carried out using standard silver nitrate solution. The precipitate formed at the initiation of the titration is K_{sp} of AgI is 8.5×10^{-17} and that of AgCl is 1.7×10^{-10}</p> <p>A. KI B. KCl</p>

	<p>C. Both D. Depend on the concentration of silver nitrate solution</p>
20	<p>      </p>
21	<p>The metal in chlorophyll is A. Fe B. Mn C. Zn D. Mg</p>
22	<p>The Phosphorous isotope with a nuclear spin of $\frac{1}{2}$ is A. ^{30}P B. ^{31}P C. ^{32}P D. ^{34}P</p>
23	<p>The number of distinct protons in the NMR spectrum of ethanol is A. 1 B. 2 C. 3</p>

	D. 4
24	The coordination number of an octahedral void site is A. 2 B. 4 C. 6 D. 8
25	The method that can be used to prepare nanoparticles A. Sol-gel B. CVD C. Laser ablation D. All of the above
26	The colloidal system where a discontinuous solid phase is dispersed in a continuous liquid phase is A. sol B. gel C. aerogel D. aerosol
27	The reaction involving a carbanion is A. Claisen condensation B. Aldol condensation C. Dieckman condensation D. All of the above
28	The element with the highest electronegativity is A. Chlorine B. Oxygen C. Fluorine D. Carbon
29	The spectroscopic technique that can be used for characterizing a nanoparticle is A. ESR B. Absorbance spectroscopy C. Microwave spectroscopy D. None of the above
30	The radiation with the lowest energy in the list is A. Microwave B. Radio Waves C. X-rays D. Infra red

Section - B

1. Explain the SN1 and SN2 mechanism of substitution reaction with an example
2. Discuss the use of X-ray diffraction in material characterization
3. Write a note on an electrochemical cell
4. Write a note on the use of various spectroscopies in the identification of molecules
5. What are nanomaterials? What are their uses?
6. What are the applications of polymers?

KEY

1. C
2. C
3. B
4. B
5. A
6. D
7. A
8. B
9. D
10. B
11. C
12. B
13. B
14. C
15. A
16. A
17. A
18. A
19. B
20. D
21. D
22. C
23. C
24. C
25. D
26. A
27. D
28. C
29. B
30. B