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B.Tech. DEGREE EXAMINATION, DECEMBER 2023
First and Second Semester

18CYB101J - CHEMISTRY

(For the candidates admitted from the academic year 2018-2019 to 2021-2022)

Note:

- (i) **Part - A** should be answered in OMR sheet within first 40 minutes and OMR sheet should be handed over to hall invigilator at the end of 40th minute.
- (ii) **Part - B & Part - C** should be answered in answer booklet.

Time: 3 hours

Max. Marks: 100

PART – A (20 × 1 = 20 Marks)

Answer ALL Questions

Marks BL CO PO

- | | | | | |
|--|---|---|---|---|
| 1. The wave function ψ describes | 1 | 1 | 6 | 1 |
| (A) Intensity | | | | |
| (B) Energy density | | | | |
| (C) State of the system | | | | |
| (D) Probability | | | | |
| 2. Points inside the box where $\psi = 0$ are called | 1 | 1 | 1 | 3 |
| (A) Anti nodes | | | | |
| (B) Nodes | | | | |
| (C) Radial points | | | | |
| (D) Angular points | | | | |
| 3. Bond order for O_2^- and O_2^{2-} are _____ and _____ respectively | 1 | 3 | 1 | 3 |
| (A) 1, 2.5 | | | | |
| (B) 1.5, 1 | | | | |
| (C) 2.5, 3 | | | | |
| (D) 1.5, 2 | | | | |
| 4. Identify the incorrect statement regarding aromaticity | 1 | 3 | 1 | 1 |
| (A) It is the extra stability possessed by a molecule | | | | |
| (B) p – orbital must be planar and overlap | | | | |
| (C) Cyclic delocalization take place | | | | |
| (D) It does not follow Huckel's rule | | | | |
| 5. The magnetic moment (spin only) of $[NiCl_4]^{2-}$ is | 1 | 1 | 2 | 1 |
| (A) 1.82 BM | | | | |
| (B) 5.46 BM | | | | |
| (C) 2.82 BM | | | | |
| (D) 1.41 BM | | | | |
| 6. The vibrational rotational spectrum is observed in the _____ region | 1 | 3 | 2 | 4 |
| (A) Near IR | | | | |
| (B) Microwave | | | | |
| (C) Visible | | | | |
| (D) Radio frequency | | | | |
| 7. An atom has two unpaired electrons. The total spin of this atom will be | 1 | 4 | 2 | 5 |
| (A) 0 | | | | |
| (B) 1 | | | | |
| (C) 1.5 | | | | |
| (D) 2 | | | | |
| 8. Which of the following is not a type of bending molecular vibration? | 1 | 4 | 3 | 5 |
| (A) Scissoring | | | | |
| (B) Symmetric stretching | | | | |
| (C) Wagging | | | | |
| (D) Rocking | | | | |

9. Which of the following is also known as X ray photo electron spectroscopy? 1 2 3 1
 (A) Auger electron spectroscopy (B) Electron impact spectroscopy
 (C) Electron spectroscopy for Chemical analysis (D) Secondary ion mass spectroscopy
10. Compute the miller indices for the intercepts $x = \frac{1}{4}$, $y = 1$ and $z = \frac{1}{2}$. 1 3 2 4
 (A) (412) (B) (632)
 (C) (101) (D) (110)
11. In XPS, the photon ejects electrons from which orbital? 1 2 2 1
 (A) 1s electron (B) 3s electron
 (C) 2s electron (D) All of the above
12. Choose the correct order of ionization energy 1 2 3 1
 (A) $N > O > F$ (B) $F > O > N$
 (C) $N > O < F$ (D) $O > F > N$
13. In a reversible process $\Delta_{\text{system}} + \Delta_{\text{surrounding}}$ is ____ 1 4 2 5
 (A) Infinity (B) Zero
 (C) Greater than zero (D) Less than zero
14. If the enthalpy change for a reaction is zero, ΔG° is equal to 1 4 2 5
 (A) $T \Delta S^\circ$ (B) $-T \Delta S^\circ$
 (C) $-\Delta H^\circ$ (D) $\ln k_{\text{eq}}$
15. The energy related when an electron is added to gaseous neutral atoms is called as ____ 1 1 4 1
 (A) Ionisation energy (B) Electro negativity
 (C) Electron affinity (D) Electropositivity
16. In pourbaix diagram the following equation $Fe^{3+} + e^- \rightarrow Fe^{2+}$ is
 (A) pH dependent (B) pH independent
 (C) solvent dependent (D) Solvent independent
17. The potential energy of n-butane is maximum for 1 3 5 4
 (A) Skew conformation (B) Staggered conformation
 (C) Eclipsed conformation (D) Gauche conformation
18. The rate of nucleophilic substitution reactions are higher in the presence of ____ 1 4 4 5
 (A) Electron withdrawing groups (B) Electron releasing groups
 (C) Both electron withdrawing and releasing groups (D) Initiators
19. Which of the following substances can act as reducing agent? 1 1 4 1
 (A) $KMnO_4$ (B) $NaBH_4$
 (C) HNO_3 (D) H_2O_2
20. Analgesics are used to 1 3 4 1
 (A) Reduce pain (B) Reduce nausea
 (C) Increase ache (D) Increase pain

PART – B (5 × 4 = 20 Marks)Answer **ANY FIVE** Questions

	Marks	BL	CO	PO
21. Explain Heisenberg uncertainty principle.	4	2	1	3
22. Sketch the molecular orbital energy level diagram for H_2^+ ion and calculate its bond order.	4	3	1	3
23. What are allowed and for-bidden transitions in spectroscopy? Explain with an example.	4	4	2	3
24. What is Inter-plane spacing in lattices? Give the expression taking an example.	4	2	3	1
25. Write note on hard and soft bases with example for each.	4	2	6	1
26. Explain briefly Newmann projection with an example.	4	2	6	3
27. Discuss Dieckmann condensation with an example.	4	2	5	3

PART – C (5 × 12 = 60 Marks)Answer **ALL** Questions

	Marks	BL	CO	PO
28. a. Derive Schrodinger equation for one-dimensional box and obtain the eigen value and eigen function by solving the equation.	12	2	6	1
(OR)				
b.i. Explain in detail π molecular orbital of butadiene.	6	4	6	4
ii. Discuss the energy level diagram for splitting of d orbital in a octahedral ligand field taking an example.	6	3	4	4
29. a.i. What is electromagnetic spectrum? Explain the different regions in it.	4	2	6	1
ii. Discuss in detail about the selection rule for rotational spectrum of a rigid diatomic molecule.	8	4	6	1
(OR)				
b.i. What is spectrochemical series? Mention its importance.	4	2	2	1
ii. Explain in detail the influence of electronic environment on the position of signals taking an example in NMR spectroscopy.	8	1	6	1
30. a. Discuss the principle, instrumentation and applications of XPS.	12	3	6	4

(OR)

b.i. Define the terms	6	3	3	4
a) Critical temperature				
b) Critical volume				
c) Critical pressure				
ii. What is electron affinity? Arrange Br, F, I and Cl in the order of increasing affinity.	6	3	3	4
31. a. Derive Nernst equation and give its applications.	12	2	4	1
(OR)				
b. Write a neat sketch explaining Pourbaix diagram of Iron.	12	1	4	1
32. a. Explain in detail the conformational analysis of n-butane with potential energy diagram.	12	3	5	4
(OR)				
b. Explain in detail in case of co-ordination compounds.	12	4	6	4
i. Structural isomerism				
ii. Stereoisomerism in coordination compounds				

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