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Total No. of Pages : 03

Total No. of Questions : 09

B.Tech. (Chemistry Groups) (2018 Batch) (Sem.-1,2)

CHEMISTRY-I

Subject Code : BTCH-101-18

M.Code : 75343

Time : 3 Hrs.

Max. Marks : 60

INSTRUCTIONS TO CANDIDATES :

1. SECTION-A is COMPULSORY consisting of TEN questions carrying TWO marks each.
2. SECTION - B & C. have FOUR questions each.
3. Attempt any FIVE questions from SECTION B & C carrying EIGHT marks each.
4. Select atleast TWO questions from SECTION - B & C.

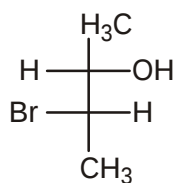
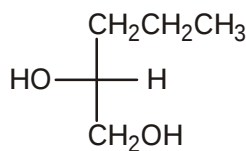
SECTION-A

1. Answer briefly :

- a) What are the important features of crystal field theory?
- b) Can oxidation state be negative? Discuss.
- c) What is the difference between conduction band and valence band?
- d) Why is fluorescence so sensitive?
- e) Give one main point of difference between wet and dry corrosion.
- f) Write the transition state for the following S_N2 reaction :
$$(\text{CH}_3)_3\text{N} + (\text{CH}_3)_3\text{S}^+ \rightarrow (\text{CH}_3)_4\text{N}^+ + (\text{CH}_3)_2\text{S}$$
- g) Why d and f orbitals show poor shielding effect?
- h) How do vander Waals interactions occur?
- i) The following compounds show only one signal in ^1H NMR. Write their structural formula.



j) Indicate R or S configuration at stereogenic center(s). Assign priorities to each group.

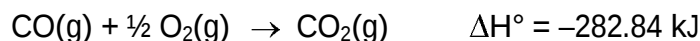


SECTION-B

2. a) Obtain the time-dependent Schrodinger wave equation for a particle. (6)
b) Give the physical meaning of wave function. (2)
3. a) What is crystal field theory? How does this theory account for the fact that $[\text{CoF}_6]^{3-}$ is paramagnetic but $[\text{Co}(\text{NH}_3)_6]^{3+}$ is diamagnetic though both are octahedral. (6)
b) Discuss the role of doping on the band structure of solids. (2)
4. a) Why is UV-Visible spectroscopy called electronic spectroscopy? Explain various types of transitions for organic molecules that take place in UV-Visible range. (5)
b) How is fluorescence used in medicine? What is the unit of fluorescence intensity? (3)
5. a) Derive the van der Waals equation for describing P-V-T relationship in real gases. (5)
b) The van der Waals constants of a gas are: $a = 0.751 \text{ dm}^6 \text{ atm mol}^{-2}$ and $b = 0.0226 \text{ dm}^3 \text{ mol}^{-1}$. Calculate critical constants. (3)

SECTION-C

6. a) Calculate the standard free energy change (ΔG°) of the reaction :



The standard entropy of $\text{CO}_2\text{(g)}$, CO(g) and $\text{O}_2\text{(g)}$ are 213.80, 197.90 and 205.01 $\text{J K}^{-1} \text{ mol}^{-1}$, respectively. Is this reaction feasible at standard state? (4)

- b) What advantages does the use of "ion-exchange resin" provide over "zeolite process" for softening of hard water? (4)

7. a) Discuss the molecular geometries of the following :
 i) BCl_3
 ii) PCl_5
 (Atomic number: B = 5, P = 15) (4)
- b) What is effective nuclear charge? Which element has the highest effective nuclear charge? (2)
- c) What is ionization energy? Which elements have the highest ionization energy? (2)
8. a) Discuss isomerism in transitional metal complexes. (5)
- b) The following compound has only one stereogenic center. Why then does it have four stereoisomers? Explain. (3)
- $$\begin{array}{c} \text{CH}_3\text{CH}_2\text{CHCH}_2\text{CH}=\text{CHCH}_3 \\ | \\ \text{Br} \end{array}$$
9. a) Explain $\text{S}_{\text{N}}2$ mechanism by taking an example of alkyl halide as a substrate. (4)
- b) Write short notes on the following organic reactions :
 i) Oxidation reactions
 ii) Ring opening reactions (4)

NOTE : Disclosure of Identity by writing Mobile No. or Making of passing request on any page of Answer Sheet will lead to UMC against the Student.