

Roll No.

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.

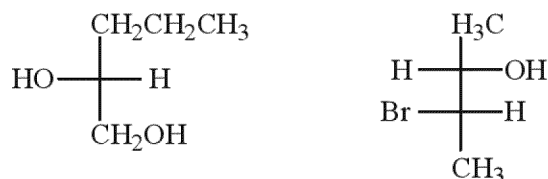
**SECTION-A**

**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 :  
 $(CH_3)_3N + (CH_3)_3S^+ \rightarrow (CH_3)_4N^+ + (CH_3)_2S$
- 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.

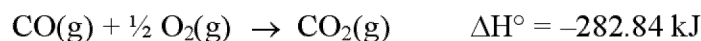


### SECTION-B

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 ( $\Delta G^\circ$ ) of the reaction :



The standard entropy of  $\text{CO}_2(\text{g})$ ,  $\text{CO}(\text{g})$  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 :
- $\text{BCl}_3$
  - $\text{PCl}_5$
- (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 :
- Oxidation reactions
  - 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.**