BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI
(END SEMESTER EXAMINATION)

CLASS: BTECH/IMSC **SEMESTER : II**
BRANCH: BT/CHEMICAL/CIVIL/MECH/PROD/FT **SESSION : SP/2022**

SUBJECT: CH101 CHEMISTRY

TIME: 3 Hours **FULL MARKS: 50**

INSTRUCTIONS:
1. The question paper contains 5 questions each of 10 marks and total 50 marks.
2. Attempt all questions.
3. The missing data, if any, may be assumed suitably.
***4*. Tables/Data hand book/Graph paper etc. to be supplied to the candidates in the examination hall.**

Q.1(a) Use the following information to calculate the heat of sublimation for potassium: [5]
Heat of formation for KCl(s) = -437 kJ/mol; Electron affinity for Cl = -349 kJ/mol; Ionization energy for K = 418 kJ/mol; Lattice energy for KCl = 717 kJ/mol; Heat of formation for Cl(g) = 122 kJ/mol; Bond dissociation energy for $Cl_2(g)$ = 243 kJ/mol

Q.1(b) Draw and explain the splitting pattern of d-orbitals in octahedral and tetrahedral crystal field. [5]

Q.2(a) What are the essential criteria for effective combination of atomic orbitals to form stable molecular orbitals? Discuss the formation of bonding and antibonding molecular orbitals with the applications of linear combination of atomic orbitals (LCAO) method. [5]

Q.2(b) Why in general melting point of cis-isomers are lower compared to trans-isomers? Predict whether cyclopentadiene anion is aromatic or not? [5]

Q.3(a) Draw and explain the concentrations vs time plot for reactant and products of parallel reactions. [5]

Q.3(b) What is the Michaelis-Menten equation? What is the behavior in the limit of low and high substrate concentration? [5]

Q.4(a) With the help of a neat diagram, compare the electronic transitions possible for C-C, C=C & C=O bonds. [5]

Q.4(b) What do you mean by the term 'chemical shift'? Discuss the proton NMR signals for the following: (i) $CH_3CH_2CH_2$ Br (ii) C_2H_5OH. [5]

Q.5(a) Determine the numer of components, Number of phases and degrees of freedom for the following system: [5]
(i) $CaCO_3(s) \rightleftharpoons CaO(s) + CO_2(g)$
(ii) KCl-NaBr-H_2O

Q.5(b) How change in enthalpy, change in entropy and equilibrium constant of a chemical reaction can be determined from Van't-Hoff equation? [5]

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