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

CLASS: BTECH
BRANCH: CSE/IT/ECE/EEE

SEMESTER : I
SESSION : MO/19

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. Before attempting the question paper, be sure that you have got the correct question paper.
5. Tables/Data hand book/Graph paper etc. to be supplied to the candidates in the examination hall.

Q.1(a) The radius of Cs^+ is 169 pm and that of Cl^- is 181 pm, predict the structure of CsCl and coordination number of Cs^+. Crystal field splitting in tetrahedral complexes $\Delta_t = \frac{4}{9}\Delta_o$. Explain. [5]

Q.1(b) Give the IUPAC nomenclature of the following: $[Co(en)_3]Cl_3$ and $K_4[Fe(CN)_6]$. Explain briefly the concept of *Jahn-Teller* effect. [5]

Q.2(a) Which of the following canonical forms would contribute most towards resonance? Why? [5]
(a) $CH_2=CH-CH=CH_2$ (b) $\bar{C}H_2-CH=CH-\vec{C}H_2$ (c) $\bar{C}H_2-\vec{C}H-CH=CH_2$
$CH_2=CH-\bar{C}H-\vec{C}H_2 \rightarrow \bar{C}H_2-CH=\vec{C}H-\bar{C}H_2 \rightarrow \bar{C}H_2-\vec{C}H-CH=CH_2$
On the basis of resonance, how would you explain low reactivity of vinyl bromide as compared to ethyl bromide?

Q.2(b) What do you understand by equatorial and axial bonds? Show them in the chair form of cyclohexane. Draw the ball and stick model of chair and boat conform of cyclohexane. [5]

Q.3(a) Does activation energy vary with temperature? What would happen to the collision frequency, if the pressure of a gas is lowered? What is meant by the term *relaxation* used in the study of fast reactions in solution? [5]

Q.3(b) What is autocatalysis? Give suitable example. Describe the theory behind *heterogeneous* catalysis. [5]

Q.4(a) If atomic masses of *A* and *B* of molecule *AB* are m_A and m_B respectively and *I* is the moment of inertia of the same molecule. How are the two related to the internuclear distance *r*? State the difference between exocyclic and endocyclic conjugated double bonds. [5]

Q.4(b) ^{13}C is NMR active while ^{12}C is not. Explain. Why TMS is used as a reference standard in NMR spectroscopy? [5]

Q.5(a) Draw a neat labelled phase diagram of *water* system and explain areas, curves and triple point in it. [5]

Q.5(b) Using *Le-Chatelier's* principle, suggest the conditions under which high yield of ammonia may be obtained using *Haber's* process. Explain the construction and working of the hydrogen-oxygen fuel cell. [5]

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