# B.Tech- 2nd (Sec-D,E,F,G,H,I & J)

## Chemistry

*Full Marks* : 50

*Time* : $2\frac{1}{2}$ hours

Answer **all** questions

*The figures in the right-hand margin indicate marks*

Symbols carry usual meaning

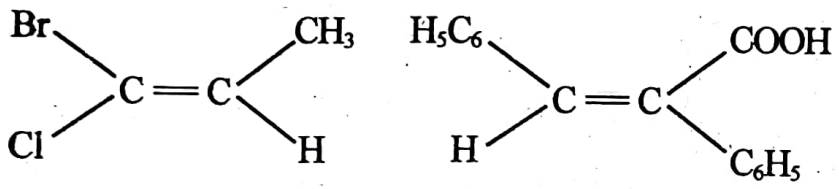
**1.** Answer *all* questions : $2 \times 5$

(*a*) The noble gases have very high values of ionization energy but their electron affinity values are almost zero. Why ?

(*b*) 2g of $H_2$ and 16g of He are mixed at 298K and 1 atm pressure. Calculate the entropy of mixing per mole of the mixture formed, assuming the ideal behaviour.

(*c*) Which of the following molecule will show rotational spectra and why ?
$CO_2$, HF, $N_2$, CO.

(*d*) Assign E and Z to the following compounds




(*e*) Discuss the stability order of alkyl carbocations with the help of inductive effect.

**2.** Explain the following : 2 × 4

(*i*) With increase of shielding effect, the magnitude of ionization energy decreases.

(*ii*) Electron affinity values of Chlorine is more than fluorine.

(*iii*) Alkali metals do not form $M^{2+}$ ion.

(*iv*) EA values of the halogens are the highest in each period.





*Or*

What is electronegativity ? Give the Milliken's equation for electronegativity. Name the factors affecting the magnitude of electronegativity. Write two applications of electronegativity. 1 + 2 + 3 + 2

**3.** (*a*) What are factors affecting the entropy of a system ? 4

(*b*) Explain how the free energy varies with temperature and pressure. 2 + 2

*Or*

(*a*) Derive Vant Hoff Isotherm. 4

(*b*) The equilibrium constant for the reaction $H_2(g) + S(s) \rightleftharpoons H_2S(g)$ is 18.5 at 925 K and 9.25 at 1000 K. Calculate standard enthalpy of the reaction. Also calculate $\Delta G^\circ$ and $\Delta S^\circ$ at 925 K. 2 + 2

4. (*a*) Show that for a rigid diatomic rotor the moment of inertia is given by $I = \mu r^2$ 4

(*b*) The pure rotational spectrum of CN molecule in gaseous phase shows series of equally spaced lines with interspacing 3.8 $cm^{-1}$. Calculate the inter-nuclear distance of CN molecule. Given molar masses : $^{12}C$=12 and $^{14}N$ = 14 g/mol. 4

*Or*

(*a*) Calculate the vibrational absorption frequency of the carbonyl, > C = O group if force constant of the double bond is $1.0 \times 10^6$ dyne/$cm^2$. 4

(*b*) Discuss different types of electronic transition in uv-vis spectroscopy. 4

5. (*a*) What do you mean by cis and trans isomers ? Which is stable ? Write the cis and trans structure of but-2-endioic acid. 1 + 1 + 2





(*b*) What are staggered and eclipsed conformations of butane ? 4

*Or*

(*a*) What is chirality ? Draw the optical isomers of 2-butanol. 2 + 2

(*b*) What do you mean by diastereomers ? Write the properties of diastereomers. 2 + 2

6. (*a*) What is a carbene ? How it is generated ? How it is different from carbanion ? 1 + 1 + 2

(*b*) What is elimination reaction ? Discuss the mechanism of β-elimination reaction with giving an example of Setzev's rule. 1 + 3

*Or*

What are nucleophilic substitution reactions ? Explain the mechanism of $S_N^1$ and $S_N^2$ reactions with example and stereochemistry. 2 + 3 + 3

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