# 2020

## BIOCHEMISTRY — HONOURS

### Paper : CC-2

### Full Marks : 50

*The figures in the margin indicate full marks.*

*Candidates are required to give their answers in their own words as far as practicable.*

**1.** Answer ***any five*** questions : 2×5

(a) Calculate ground state term symbol for $Mn^{2+}$ ion.

(b) What do you mean by solvation energy? How can we predict whether an ionic crystal will be soluble in a particular solvent?

(c) Calculate formal charge on each atom of $NO_3^-$ ion.

(d) What is ionic potential? How does it affect polarising power?

(e) What is the unit of radioactive decay constant? How is it related to the half-life of the element?

(f) Write down Saytzeff and Hofmann product of the E2-reaction of $CH_3 - \underset{\underset{Br}{|}}{CH} - CH_2CH_3$.

(g) Give an example of neighbouring group participation.

(h) Draw gauche and anti-form of $CH_3CH_2CH_2CH_3$.

(i) Indicate the suitable solvents for $S_N2$ reaction with reason : DMSO, Acetone, $H_2O$, EtOH.

(j) Which compound is the most reactive for nucleophilic addition and why : HCHO, $CH_3CHO$, PhCHO, $CH_3COCH_3$?

**2.** Answer ***any two*** questions :

(a) (i) How does lattice energy of an ionic solid depend on charge of the constituent ions and their size?

(ii) How many radial and angular nodes are there for a s-orbital of *n*th principal level? 3+2

(b) (i) On the basis of Pauli's exclusion principle work out the maximum number of electrons that might be accommodated in a set of orbitals designated by orbital angular quantum number, *l*.

(ii) State major limitations of VSEPR theory with necessary illustrations. 2+3

(c) Draw all stereoisomers of Tartaric acid. Explain their optical activity. 3+2

(d) Describe the chirotopicity and stereogenicity of $C_3$-atom of all stereoisomers of 2, 3, 4-trihydroxy glutaric acid. 5

**Please Turn Over**

**3.** Answer ***any three*** questions :

(a) (i) The radioactive isotope Indium-111 is often used for diagnosis and imaging in nuclear medicine. Its half-life is 2.8 days. What was the initial mass of the isotope before decay, if the mass in 2 weeks was 5g?

(ii) What do you mean by mass defect and nuclear binding energy?

(iii) Lead is common in radioactive mines.— Explain.

(iv) What is average life for radioactive elements? Work out its relation with radioactive disintegration constant. 3+2+2+3

(b) (i) Give the IUPAC name of the following compounds :

(A) $[Cr(NO_2)_2(en)_2]Cl$ (B) $K_2[NiCl_4]$ (C) $Ni(CO)_4$

(ii) Determine the configuration of *cis*- and *trans*- isomers by chemical method.

(iii) Draw the qualitative molecular orbital energy level diagram with proper label of $O_2$ molecule and hence comment on its bond order and magnetic properties. 3+3+4

(c) (i) Draw pictorially the formation of $\sigma$ and $\pi$ bonds formed by p-orbitals.

(ii) On the basis of VSEPR theory workout the structure of (***any two***) :

$SF_4$, $POCl_3$, $SOF_4$

(iii) State Hund's rule of maximum multiplicity, hence explain why configuration with half filled and completely filled have greater stability.

(iv) Dipole moment of $NH_3$ is greater than that of $NF_3$ though dipole moment of N-H bond is less than that of N-F bond.— Explain. 2+2+4+2

(d) Draw the structure of the following molecules :

(i) 2R, 3R – 2, 3-dihydroxybutanoic acid in Fischer Projection formula.

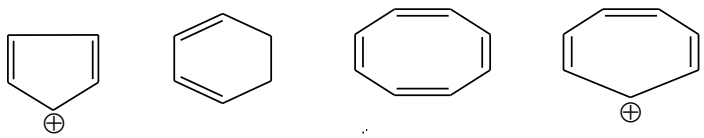
(ii) Erythro – 2, 3-dichloropentane in Newman Projection formula.

(iii) Threo – 2, 3-dibromobutanoic acid in sawhorse projection formula.

(iv) Syn and Anti PhCH = NOH.

(v) E and Z $(CH_3)(Cl)C = C(Br)(Et)$. 2+2+2+2+2

(e) (i) Indicate the following molecule as aromatic, anti-aromatic and non-aromatic.



(ii) Explain the stability order of the following carbocation :

$CH_3\overset{+}{C}H_2$, $(CH_3)_3\overset{\oplus}{C}$, $ClCH_2-\overset{\oplus}{C}H_2$, $(CH_3)_2\overset{\oplus}{C}H$

(iii) Describe the structure of $(CH_3)_3\overset{\ominus}{C}$. 4+4+2

(f) Give the mechanism of the following reactions :

(i) $CH_3–CH_2Br + NaOEt \xrightarrow{DMSO}$

(ii) $(CH_3)_3C–Br + NaOH(dil) \longrightarrow$

(iii) $\underset{(excess)}{HCHO} + CH_3CHO + NaOH \longrightarrow$

(iv)  $+ CH_3Cl + AlCl_3(anhyd) \longrightarrow$

(v) $CH_3CH = CH_2 + O_3 \longrightarrow$ 2×5