B.Sc. 3rd Semester (Honours) Examination, 2020 (CBCS)

Subject: Biotechnology

Paper: CC-7

Time: 2 Hours **Full Marks: 40**

The figures in the margin indicate full marks.

Candidates must give their answer legibly in their own words as far as practicable.

Answer any *eight* questions from the following: **8 × 5 = 40**

1. What do you mean by 'Donnan equilibrium'?
   Explain the condition of spontaneity of a chemical reaction and equilibrium state in terms of entropy (S) and Gibbs free energy (G). **5**

2. Show that heat change at constant pressure (q_p) is equal to change in enthalpy (ΔH) of a given system.
   The volume of an ideal gas kept in a closed cylinder is 21 L and it is reduced to one-third of its initial volume when compressed by constant external pressure of 3 atm under isothermal condition. Find the values of heat change (q), work done (w) on the gas and the change in internal energy (ΔU). **5**

3. What do you mean by 'artificial radioactivity'? Give example.
   Make a comparative statement on the common properties of α, β and γ-rays emitted by radioactive sources. **5**

4. The half-life of a radioactive element ($t_{1/2}$) is independent of its initial concentration – justify the statement.
   1 g of a radioactive element is reduced to 0.0625 g due to radioactive decay for 20 years. Find the decay constant (λ) and half-life ($t_{1/2}$) of the concerned element. **5**

5. The *p*H of an aqueous solution of a carboxylic acid (R-COOH) depends on its dissociation constant (K_a) or degree of dissociation (α).– Justify the statement.
   The dissociation constant (K_a) of a weak monobasic acid is 1.6×10^{-4} at 25 ºC. Calculate the degree of dissociation (α) in 0.1 M aqueous solution of the weak electrolyte at the given temperature. **5**

6. The specific conductance (k) of 0.1 M solution of a weak electrolyte is 0.009 $ohm^{-1}.cm^{-1}$. Find the degree of dissociation of the given electrolyte if its molar conductance (Λ^o) at infinite dilution is 260 $ohm^{-1}.cm^2.\ mol^{-1}$.
   Establish the relation between the specific conductance (k) and equivalent conductance (Λ) of an aqueous solution of an electrolyte. **5**

7. Compare the dipole moments of *cis*-1,2-dichloroethene and *trans*-1,2-dichloroethene.
The dipole moment of HF molecule is 1.91 D. The length of H−F bond is 0.92 Å. Calculate the percentage ionic character of the bond. **5**

8. The acidic salt KHF_2 does exist while the salt $KHCl_2$ does not real existence – Justify.
Arrange the following three isomeric dichlorobenzenes in the descending order of dipole moments and also explain the order. **5**

9. Distinguish between the order and molecularity of a chemical reaction.
In the reaction, $3X \rightarrow 2Y + Z$, the rate of disappearance of 'X' at any particular moment is found to be 0.072 $mol.L^{-1}.s^{-1}$. Find the rate of formation of 'Y' and 'Z' at the same point of time. **5**

10. In a first order chemical reaction, 75% of reaction is completed in 1 hour. Calculate the half-life ($t_{1/2}$) of the given reaction.
What do you mean by 'energy of activation' of a chemical reaction? Explain the parameter using energy-profile diagram for an exothermic as well as an endothermic reaction. **5**
