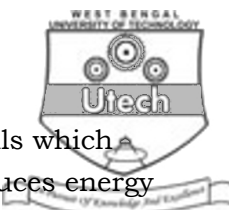


Invigilator's Signature :



- v) Glycolysis is a metabolic process of cells which
- a) consumes energy b) produces energy
 - c) produces new cells d) none of these.
- vi) NADH through electron transport chain produces
- a) 3 ADP b) 2 ADP
 - c) 3 ATP d) 2 ATP.
- vii) The plot of rate versus substrate concentration of an enzymatic reaction gives a section of rectangular hyperbola. The system represents a
- a) shifting order reaction b) first order reaction
 - c) zero order reaction d) none of these.
- viii) An example of a macronutrient is
- a) sodium b) potassium
 - c) manganese d) copper.
- ix) The maximum velocity (V_m) in Michaelis-Menten equation
- a) is an intrinsic kinetic parameter
 - b) is not an intrinsic kinetic parameter
 - c) depends strongly on temperature
 - d) none of these.
- x) Glycogen is a
- a) polysaccharide b) disaccharide
 - c) monosaccharide d) protein.
- xi) In glycolysis, number of ATP molecules formed per mole of glucose is
- a) 34 b) 6
 - c) 2 d) 4.
- xii) Thermoacidophilic bacteria grow at
- a) high temperature and low pH
 - b) low temperature and high pH
 - c) high temperature and high pH
 - d) low temperature and low pH.



GROUP – B

(Short Answer Type Questions)

Answer any *three* of the following. $3 \times 5 = 15$

2. What are amino acids ? Describe their zwitterionic structure and explain the term iso-electric point. $1 + 2 + 2$
3. Derive the rate equation of a substrate uninhibited enzymatic reaction using steady state assumption of Briggs-Halden theory.
4. Define catabolism and anabolism. Using a schematic diagram describe the glycolysis process. $2 + 3$
5. How the concentration of substrate can be evaluated at the surface of the matrix for an immobilized enzyme reaction when external diffusion controls the process ?
6. Find the concentration of substrate at the maximum rate of cell growth when the system follows the Monods equation.

GROUP – C

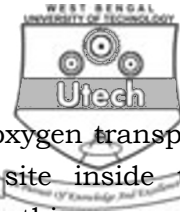
(Long Answer Type Questions)

Answer any *three* of the following. $3 \times 15 = 45$

7. a) Discuss in detail the different methods used for evaluating the kinetic parameters of Michaelis Menten equation. Why is direct data fit method superior to other methods ? $5 + 2$
- b) The following data have been obtained for two different initial enzyme concentrations for an enzyme-catalyzed reaction :

Substrate concentration, (gm/litre)	20.0	10.0	6.7	5.0	4.0	3.3	2.9	2.5
Rate (g/l-min) with $C_{E0} = 0.015$ gm/litre	1.14	0.87	0.70	0.59	0.50	0.44	0.39	0.35
Rate (g/l-min) with $C_{E0} = 0.00875$ gm/litre	0.67	0.51	0.41	0.34	0.29	×	×	×

Find the intrinsic kinetic parameters of Michaelis and Menten equation by Hanes-Woolfs method. 8



8. a) Show schematically the mechanism of oxygen transport from a gas bubble to the reaction site inside the individual cells and describe each step in this process. 6
- b) Derive the relationship between the overall mass transfer coefficient based on liquid phase (K_L) and the gas (k_g) and liquid film (k_l) coefficients for the case of oxygen transfer from gas bubble to cells. Under what condition K_L and k_l are identical ? 4 + 1
- c) Write a short note on Bubble Column Reactor. 4
9. Discuss briefly different models used to characterize non ideal flow in bioreactor and briefly describe any one of them. What is the significance of vessel dispersion number ? Sketch the response curves for random input, cyclic input, step input and pulse input perturbations. 4 + 5 + 2 + 4
10. Derive an equation for internal mass-transfer resistance for immobilized enzyme. What is Damköhler Number and what is its significance ? What is effectiveness factor ? Describe the process of intraparticle diffusive mass-transfer of immobilized enzyme and hence define the first order rate kinetics for immobilized enzymes. Name a few natural and synthetic supports for immobilized enzymes. 4 + 2 + 2 + 5 + 2
11. Write short notes on any *three* of the following : 3 × 5
 - a) Reverse osmosis
 - b) Gas Chromatography
 - c) Fed-batch bioreactor
 - d) Monod equation
 - e) Logarithmic growth of microbes.

=====