

## K: MICROBIOLOGY

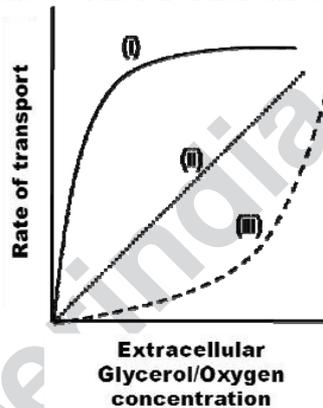
**Q. 1 – Q. 10 carry one mark each.**

- Q.1 Lophotrichous bacteria have  
 (A) one flagellum  
 (B) a cluster of flagella at one or both ends  
 (C) flagella that are spread evenly over the whole surface  
 (D) a single flagellum at each pole
- Q.2 In aerobic respiration, the final electron acceptor is  
 (A) hydrogen (B) nitrogen (C) sulfur (D) oxygen
- Q.3 A process in which fatty acids are shortened by two carbons at a time resulting in release of acetyl-CoA is known as  
 (A) photophosphorylation (B) carboxylation  
 (C)  $\beta$ -oxidation (D) oxidative phosphorylation
- Q.4 Limulus Amoebocyte Lysate (LAL) assay is used to identify the presence of  
 (A) endotoxin (B) exotoxin (C) anthrax toxin (D) tetanus toxin
- Q.5 Match scientists in **Group I** with terms related to their major scientific contributions in **Group II**
- | Group I                    | Group II                       |
|----------------------------|--------------------------------|
| (P) Sanger                 | (i) DNA double helix structure |
| (Q) Watson and Crick       | (ii) DNA sequencing            |
| (R) Waksman                | (iii) Complement               |
| (S) Bordet                 | (iv) Streptomycin              |
|                            | (v) Immune tolerance           |
| (A) P-iii, Q-iv, R-ii, S-i | (B) P-ii, Q-iii, R-iv, S-v     |
| (C) P-iv, Q-i, R-ii, S-v   | (D) P-ii, Q-i, R-iv, S-iii     |
- Q.6 Base-pair substitutions caused by the chemical mutagen ethyl methane sulfonate are a result of  
 (A) hydroxylation (B) alkylation (C) deamination (D) intercalation
- Q.7 The classical way of representing taxonomic hierarchy of living organisms in **ASCENDING ORDER** is  
 (A) genus, species, class, order, family (B) species, genus, order, family, class  
 (C) species, genus, family, order, class (D) genus, species, order, class, family
- Q.8 Of the following, the most effective method to kill bacterial endospores is  
 (A) moist heat sterilization (B) UV irradiation  
 (C) filtration (D) pasteurization

- Q.9 The class of enzymes, which catalyze addition of groups to double bonds and non-hydrolytic removal of chemical groups, is  
 (A) oxidoreductase (B) transferase (C) hydrolase (D) lyase
- Q.10 Anammox organisms carry out  
 (A) anaerobic reduction of  $\text{NO}_3^-$  (B) anaerobic oxidation of  $\text{NH}_4^+$   
 (C) aerobic oxidation of  $\text{NH}_4^+$  (D) aerobic oxidation of  $\text{NO}_2^-$

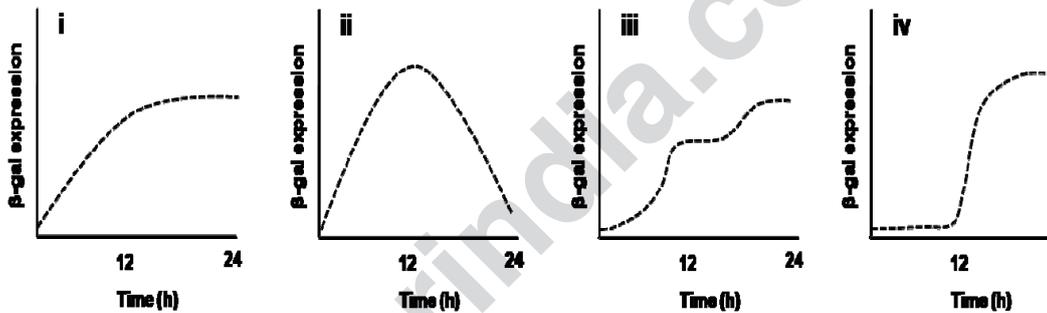
**Q. 11 – Q. 20 carry two marks each.**

- Q.11 Which combination of the following statements about specialized transduction is **TRUE**?  
 (P) Specialized transducing phages can transport only certain genes between bacteria  
 (Q) Specialized transducing phages can transport any gene between bacteria  
 (R) Phage P22 is a specialized transducing phage  
 (S) Phage lambda ( $\lambda$ ) is a specialized transducing phage  
 (A) P and S only (B) Q and R only  
 (C) P and R only (D) Q and S only
- Q.12 Which combination of profiles in the following figure accurately represents the transport rate of glycerol and oxygen into *E. coli* cells as a function of their extracellular concentration?



- (A) glycerol-(ii) and oxygen-(iii) (B) glycerol-(ii) and oxygen-(i)  
 (C) glycerol-(iii) and oxygen-(i) (D) glycerol-(i) and oxygen-(ii)
- Q.13 Which one of the following about the standard free energy change ( $\Delta G^{\circ'}$ ) and the equilibrium constant ( $K_{eq}$ ) of an exergonic reaction, at pH 7.0, is **TRUE**?  
 (A)  $\Delta G^{\circ'}$  is positive and  $K_{eq}$  is less than one  
 (B)  $\Delta G^{\circ'}$  is negative and  $K_{eq}$  is less than one  
 (C)  $\Delta G^{\circ'}$  is negative and  $K_{eq}$  is greater than one  
 (D)  $\Delta G^{\circ'}$  is positive and  $K_{eq}$  is greater than one
- Q.14 An oil immersion objective of a light microscope has a numerical aperture of 1.25. Using the Abbé equation, the maximum theoretical resolving power (in nm) of the microscope with this objective and blue light (wavelength = 450 nm) is \_\_\_\_\_

- Q.15 The working volume (in liter) of a chemostat with  $0.1 \text{ h}^{-1}$  dilution rate and  $100 \text{ ml/h}$  feed flow rate is \_\_\_\_\_
- Q.16 If the decimal reduction time for spores of a certain bacterium at  $121^\circ\text{C}$  is 12 seconds, the time required (in minutes) to reduce  $10^{10}$  spores to one spore by heating at  $121^\circ\text{C}$  is \_\_\_\_\_
- Q.17 The doubling time (in minutes) of a bacterium with a specific growth rate of  $2.3 \text{ h}^{-1}$  in  $500 \text{ ml}$  of growth medium is \_\_\_\_\_
- Q.18 A bacterial culture is grown using  $2.0 \text{ mg/ml}$  fructose as the sole source of carbon and energy. The bacterial biomass concentrations immediately after inoculation and at the end of the growth phase are  $0.1 \text{ mg/ml}$  and  $0.9 \text{ mg/ml}$ , respectively. Assuming complete utilization of the substrate, the bacterial growth yield ( $Y$ ) on fructose is \_\_\_\_\_
- Q.19 The volume (in ml) of a  $1.0 \text{ mg/ml}$  stock solution of ampicillin to be added to  $0.1$  liter of growth medium for achieving a final ampicillin concentration of  $50 \mu\text{g/ml}$  is \_\_\_\_\_
- Q.20 An *E. coli* strain is grown initially on glucose as the sole carbon source. Upon complete consumption of glucose following  $12 \text{ h}$  of growth, lactose is added as the sole carbon source and the strain is further grown for  $12 \text{ h}$ . Assuming that the *E. coli* strain has a functional wild type *lac* operon, which one of the following profiles is the most **ACCURATE** representation of  $\beta$ -galactosidase ( $\beta$ -gal) expression (in arbitrary units)?



- (A) i                      (B) iii                      (C) ii                      (D) iv

**END OF THE QUESTION PAPER**