

K: MICROBIOLOGY

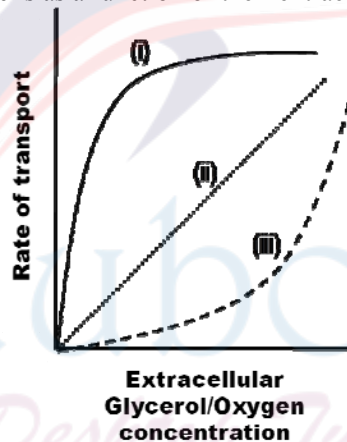
Q. 1 – Q. 10 carry one mark each.

- 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) β -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 NO_3^- (B) anaerobic oxidation of NH_4^+
 (C) aerobic oxidation of NH_4^+ (D) aerobic oxidation of NO_2^-

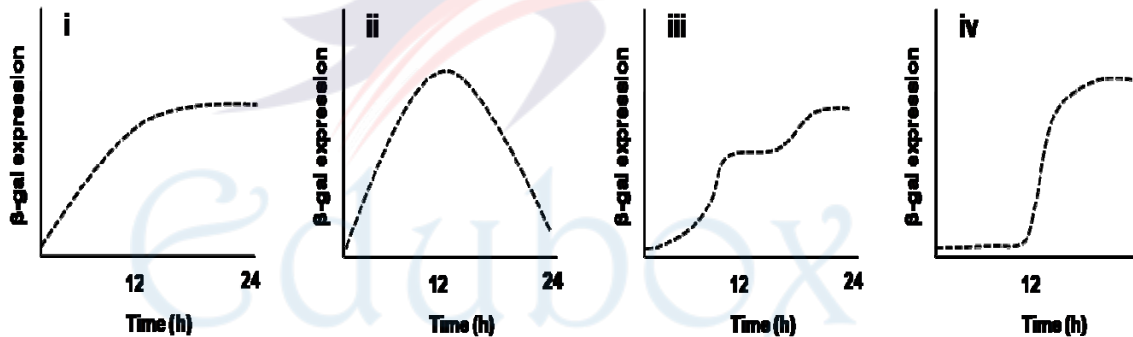
Q. 11 – Q. 20 carry two marks each.

- 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 (λ) 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 (ΔG°) and the equilibrium constant (K_{eq}) of an exergonic reaction, at pH 7.0, is **TRUE**?
 (A) ΔG° is positive and K_{eq} is less than one
 (B) ΔG° is negative and K_{eq} is less than one
 (C) ΔG° is negative and K_{eq} is greater than one
 (D) ΔG° 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 h^{-1} dilution rate and 100 ml/h feed flow rate is _____
- Q.16 If the decimal reduction time for spores of a certain bacterium at 121°C is 12 seconds, the time required (in minutes) to reduce 10^{10} spores to one spore by heating at 121°C is _____
- Q.17 The doubling time (in minutes) of a bacterium with a specific growth rate of 2.3 h^{-1} in 500 ml of growth medium is _____
- Q.18 A bacterial culture is grown using 2.0 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 mg/ml and 0.9 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 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 h of growth, lactose is added as the sole carbon source and the strain is further grown for 12 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 β -galactosidase (β -gal) expression (in arbitrary units)?



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

END OF THE QUESTION PAPER