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?
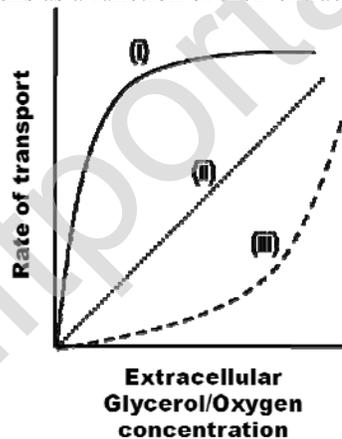
(A) glycerol-(ii) and oxygen-(iii)   (B) glycerol-(ii) and oxygen-(i)

(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 ($\Delta G^{o\prime}$) and the equilibrium constant (K_{eq}) of an exergonic reaction, at pH 7.0, is **TRUE**?

(A) $\Delta G^{o\prime}$ is positive and K_{eq} is less than one

(B) $\Delta G^{o\prime}$ is negative and K_{eq} is less than one

(C) $\Delta G^{o\prime}$ is negative and K_{eq} is greater than one

(D) $\Delta G^{o\prime}$ 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 µg/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)?
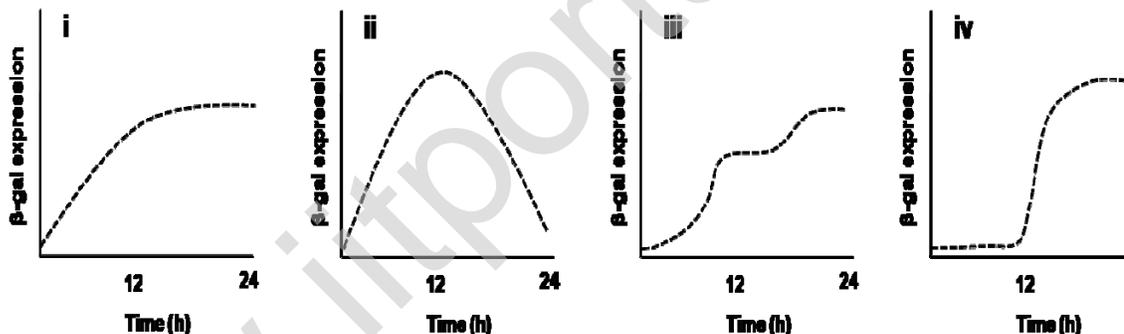
(A) i   (B) iii   (C) ii   (D) iv

END OF THE QUESTION PAPER