L: Microbiology

Q. 1 – Q. 6 carry one mark each.

Q.1 Which of the following scientists developed the modern concept of chemotherapy and chemotherapeutic agents?

(A) Robert Koch
(B) Paul Ehrlich
(C) Joseph Lister
(D) Louis Pasteur

Q.2 The refractive index of the immersion oil used in microscopy to achieve higher resolution is

(A) Same as glass
(B) Less than air
(C) Less than glass
(D) Same as air

Q.3 Which of the following synthetic antibacterial compound inhibit supercoiling of bacterial DNA?

(A) Sulfonamide
(B) p-Fluorophenyl alanine
(C) Puromycin
(D) Rifampin

Q.4 Which one of the following is not a lymphocyte?

(A) B-cell
(B) T-cell
(C) NK-cell
(D) Mast-cell

Q.5 Which of the following organism has a single stranded positive sense RNA genome?

(A) Influenza virus
(B) Poliovirus
(C) Hepatitis B virus
(D) Pox virus

Q.6 Cyanobacteria comprises a large and morphologically heterogenous group of

(A) Chemoautotrophs
(B) Photoheterotrophs
(C) Photoautotrophs
(D) Chemoheterotrophs

Q. 7 – Q. 24 carry two marks each.

Q.7 In the peptidoglycan layer of bacterial cell wall, which of the following pair of aminoacids are usually found in D-configuration?

(A) Alanine and glutamic acid
(B) Alanine and lysine
(C) Alanine and arginine
(D) Glutamic acid and lysine

Q.8 Which of the following inclusion bodies contains the enzymes responsible for carbon dioxide fixation in bacteria?

(A) Lysosomes
(B) Peroxisomes
(C) Metachromatic granules
(D) Carboxysomes

Q.9 When bacterial cells are placed in a 2 M NaCl solution, the plasmamembrane will

(A) Burst
(B) Undergo plasmolysis
(C) Remain unchanged
(D) Swell

Q.10 Which of the following couple will have the maximum tendency to donate electrons? (Redox potentials are given in the parenthesis)

(A) $2H^+ / H_2$ (–0.42V)
(B) $NAD^+ / NADH$ (–0.32V)
(C) NO_3^- / NO_2^- (+0.42V)
(D) $½ O_2 / H_2O$ (+0.82V)

Q.11 Match the following group of microorganism with their oxygen requirements.

Group of microorganisms	Oxygen requirement
P. Obligate aerobe	1. Grows equally well in presence or absence of oxygen
Q. Microaerophile	2. Grows only in presence of oxygen
R. Obligate anaerobe	3. Cannot tolerate oxygen
S. Aerotolerant anaerobe	4. Can grow only at reduced oxygen levels

(A) P-3; Q-1; R-2; S-4
(B) P-4; Q-3; R-2; S-1
(C) P-2; Q-4; R-3; S-1
(D) P-1; Q-4; R-3; S-2

Q.12 In which of the following cases of microbial growth, lag phase usually does not occur?

(A) If inoculum is taken from old (stationary phase) culture and inoculated into same medium
(B) Inoculum consists of damaged cells (but not killed), inoculated into the same medium
(C) Inoculum is transferred from a rich culture medium to a poorer one
(D) If an exponentially growing culture is inoculated into the same medium under the same conditions of growth

Q.13 Which one of the following statements is INCORRECT about bacterial endospore?

(A) Core pH is about 5.5 to 6.0
(B) Resistant to lysozyme
(C) Dipicolinic acid is present
(D) Small acid soluble protein is absent

Q.14 The following reaction of glyoxylate cycle requires two enzymes P and Q

$$\text{Isocitrate} \xrightarrow{P} \text{succinate} + \text{glyoxylate}$$

$$\text{Glyoxylate} + \text{acetyl CoA} \xrightarrow{Q} \text{malate} + \text{CoA}$$

Which of the following combinations is the true representative of P and Q?

(A) Isocitrate lyase and malate synthase
(B) Isocitrate lyase and malate dehydrogenase
(C) Isocitrate dehydroxygenase and malate dehydrogenase
(D) Isocitrate dehydrogenase and malate synthase

Q.15 Which of the following statements is NOT included in Koch's postulate?

(A) A specific organism can always be found in association with a given disease
(B) The organism can be isolated and grown in pure cultures in the laboratory
(C) The pure culture will produce the disease when inoculated into susceptible animal
(D) It is possible to clone the genome of the organism from the experimentally infected animal

Q.16 The commercially used technique for pasteurization of milk involves low temperature holding (LTH) and high temperature short time (HTST) methods. Which of the following methods is INCORRECT?

(A) expose milk to 145° F for 30 min
(B) expose milk to 161° F for 15 sec
(C) expose milk to 143° F for 30 min
(D) expose milk to 71.7° C for 15 sec

Q.17 The phenomenon in which a prophage is able to make changes in the properties of a host bacterium in lysogeny is termed as

(A) Immunity repression
(B) Lysogenic induction
(C) Lysogenic conversion
(D) Lytic infection

Q.18 Phage typing is frequently used in medical diagnosis for the identification of certain strains of pathogens, such as

(A) *Staphylococci*
(B) Enteroviruses
(C) *Plasmodium falciparum*
(D) *Leishmania donovani*

Q.19 Which of the following virus needs a helper virus for their genome replication?

(A) Hepatitis A
(B) Hepatitis D
(C) Hepatitis C
(D) Hepatitis E

Q.20 Which of the following viruses usually causes 'latent infection' in the human neuronal cells?

(A) Poliovirus
(B) Japanese Encephalitis virus
(C) Herpes simplex virus type I
(D) Rabies virus

Q.21 Match the correct combination of toxin and the mode of action

Toxin	Mode of action
P. Pertussis toxin	1. Prevents release of glycine by nerve end
Q. Diptheria toxin	2. Blocks G-protein signal transduction
R. Botulinum toxin	3. Induces fluid loss from intestinal cells
S. Tetanus toxin	4. Inhibits protein synthesis in eukaryotes
	5. Causes haemolysis
	6. Blocks release of acetylcholin by nerve end

(A) P-3, Q-2, R-5, S-4
(B) P-2, Q-4, R-6, S-1
(C) P-5, Q-6, R-3, S-2
(D) P-1, Q-3, R-2, S-5

Q.22 The following antibiotics affect the bacterial protein synthesis with their site of action. Which of the following combinations is correct?

Antibiotic	Site of action
P. Streptomycin	1. Aminoacyl tRNA association with ribosome
Q. Tetracyclin	2. Transpeptidation
R. Erythromycin	3. Translocation
S. Chloramphenicol	4. Initiation of protein synthesis

(A) P-2; Q-3; R-4; S-1
(B) P-4; Q-1; R-3; S-2
(C) P-1;Q-4; R-3;S-2
(D) P-4; Q-1;R-2; S-3

Common Data Questions

Common Data for Questions 23, 24:
Besides the repression / derepression control of tryptophan operon the second level of regulation is known as attenuation. The presence of two tryptophan codons within the *trpL* controls this phenomenon. The presence of tryptophan-charged $tRNA_{trp}$ causes the premature termination of transcription, yields a 140 nucleotide long leader sequence transcript. By site-directed mutagenesis the two UGG Trp codons of the *trpL* sequence were modified to CGG, arginine codon (arg).

Q.23 Which of the following amino acid(s) would be able to restore the attenuation control of *trp* operon?

(A) Tryptophan alone
(B) Arginine alone
(C) Tryptophan or arginine
(D) Neither arginine nor tryptophan

Q.24 Deletion of part of the *trpL* region will result in

(A) Increase in the rate of expression of '*trp*' structural genes
(B) Decrease in the rate of expression of '*trp*' structural genes
(C) No change in the rate of expression of '*trp*' structural genes
(D) Inhibition of the expression of all the genes in the operon

Linked Answer Questions: Q. 25 to Q. 28 carry two marks each.

Statement for Linked Answer Questions 25 & 26:
The nucleic acid from a microorganism was isolated and the base composition was determined to be as follows:

A=35%, T=15%, G=35%, C=15%

Q.25 What could be the physical nature of the nucleic acid?

(A) Double stranded circular DNA
(B) Double stranded linear DNA
(C) Single stranded linear DNA
(D) Single stranded RNA

Q.26 The optical density of the above nucleic acid was measured at 260 nm wavelength at 37 °C and 95 °C. What possible changes could you expect in the optical density with the increase in temperature?

(A) Significant increase
(B) Only two fold increase
(C) Significant decrease
(D) No significant change

Statement for Linked Answer Questions 27 & 28:
In a bacterial culture initial cell population is 1×10^3 cells. The generation time of the bacterial cell is 20 minutes and the lag phase is 1 hour.

Q.27 If the culture is allowed to grow for 4 hours, how many generations would take place?

(A) 8
(B) 12
(C) 10
(D) 9

Q.28 What will be the cell population after 3 hours?

(A) 6.4×10^6 (B) 3.2×10^4 (C) 3.2×10^6 (D) 6.4×10^4

END OF THE SECTION