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Undergraduate Admission Test: Microbiology Honours

Full Marks: 75 **Time: 1 hour**

1. Evolution of a eukaryotic cell pass through a great modification of its organelles. The data represents such specific point of its organelles packaging into a cells by chronological evolution, find out the right combination of evolutionary pathway.
   a) Prokaryotes → mitochondria → ribosome → RER → nucleus → plant cell.
   b) Early protozoa → RER → mitochondria → chloroplast → Golgi apparatus → plant cell.
   c) Prokaryotes → ribosome → mitochondria → RER → nucleus → animal cell.
   d) Archaea → bacteria → mitochondria → nucleus → RER → animal cell.

2. Which of the following statements is correct?
   A. Catalytic activity is lost when the co-factor is removed from the enzyme.
   B. Coenzyme nicotinamide adenine dinucleotide (NAD) and NADP contains the vitamin niacin.
   C. Bio-macromolecules have a hierarchy of structures such as primary, secondary, tertiary and quaternary.
   D. Enzymes lower the activation energy of reactions and enhance greatly the rate of the reactions.
   E. Nucleic acids carry hereditary information and are passed on from parental generation to progeny.

   a) A & E only
   b) B & C only
   c) B & D only
   d) All of these

3. Centrioles, cilia, flagella, and basal bodies have remarkably similar structural elements and arrangements. This leads us to which of the following as a probable hypothesis?
   a) Disruption of one of these types of structure should necessarily disrupt each of the others as well.
   b) Loss of basal bodies should lead to loss of all cilia, flagella, and centrioles.
   c) Motor proteins such as dynein must have evolved before any of these four kinds of structure
   d) Natural selection for motility must select for microtubular arrays in circular patterns.

4. Adult human RBCs are enucleated. Which of the following statement(s) is/are most appropriate explanation for this feature?
   A. They do not need to produce
   B. They are somatic cells
   C. They do not metabolize
   D. All their internal space is available for oxygen transport

   a) A Only
   b) D Only
   c) B & C Only
   d) A, B & D Only

5. Which one of the following statements in regard to the excretion by the human kidneys is correct?
   a) Ascending limb of loop of Henle is impermeable to electrolytes
   b) Descending limb of loop of Henle is impermeable to water
   c) Distal convoluted tubule is incapable of reabsorbing HCO_3^-
   d) Nearly 99% of the glomerular filtrate is reabsorbed by the renal tubules

6. Among the statement which one is right?
   a) The nucleosome model proposed by R.D. Kornberg in 1974 is the most significant one that explains the structure of nucleolus. Where histone proteins and DNA are associates to form the core particle.
   b) Satellite or SAT chromosomes are chromosomes that contain secondary constructs that serve as nucleolar organizing regions to produce 16S, and 28S ribosomal RNA.
   c) The nucleolus disappear during the cell division start to form spindle apparatus. And again reappear after telophase
   d) The nucleolus is the largest nuclear organelle and is the primary site of ribosome subunit biogenesis in eukaryotic cells. It is assembled around arrays of ribosomal DNA genes, forming specific chromosomal features known as nucleolar organizer regions (NORs) which are the sites of ribosomal DNA transcription.

7. Identify the incorrect statement regarding the role of skin and mucous membrane in innate immunity
   a) These physically inhibit the entry of microbes.
   b) Their secretions contain antimicrobial proteins like lysozyme.
   c) Secretions from sebaceous glands and sweat glands give the skin an alkaline pH.
   d) Mucus produced by mucous membrane traps the microbes.

8. Many microorganisms fix nitrogen symbiotically by partnering with a host plant. The plant provides sugars from photosynthesis that are utilized by the nitrogen-fixing microorganism for the energy it needs for nitrogen fixation. In exchange for these carbon sources, the microbe provides fixed nitrogen to the host plant for its growth. In respect of this statement arrange the under points in most commensurate order for nitrogen fixation.
   A. The nitrogen molecule is composed of two nitrogen atoms joined by a triple covalent bond, thus making the molecule highly inert and nonreactive. Nitrogenase catalyzes the breaking of this bond and the addition of three hydrogen atoms to each nitrogen atom.
   B. Plant provides a suitable environment by producing leghemoglobin.
   C. The bacteria colonize the host plant's root system and cause the roots to form nodules to house the bacteria, where they can fix the reaction.
   D. Plants can readily assimilate NH_3 to produce the aforementioned nitrogenous biomolecules.

   a) A → C → D → B
   b) C → B → A → D
   c) B → C → A → D
   d) A → D → B → C

9. There are 666 bases in an mRNA molecule and it codes for a 221 amino-acid protein. If the codon at position 622 is converted to a stop codon, find the number of amino-acids the resultant protein will be shortened of -

a) 13
b) 14
c) 15
d) 207

10. An inbred strain of snapdragons with violet flowers and dull leaves was crossed to another inbred strain with white flowers and shiny leaves. The F1 plants, which all had violet flowers and dull leaves, were backcrossed to the strain with white flowers and shiny leaves, and the following F2 plants were obtained: 50 violet, dull; 46 white, shiny; 12 violet, shiny; and 10 white, dull. Which of the following comment/(s) is/are true?

A. The genes for flower color and leaf texture are independently assorted because more than 50% of them are of recombinant types
B. The genes for flower color and leaf texture are linked because the frequency of recombination between them is quite higher than what would be expected if they were independently assorted.
C. The genes for flower color and leaf texture are linked because the frequency of recombination between them is quite lower than what would be expected if they were independently assorted.
D. The genes for flower color and leaf texture are independently assorted because less than 50% of them are of recombinant types.

a) Only A & B
b) Only B
c) Only C
d) All of these.

11. Below some statements are given related to the thalassemia disease. Study them carefully and choose the right option /(s).

A. Jaundice is not a clinical manifestation of thalassemia major.
B. It is most commonly found in European population.
C. The most reliable method for diagnosis of the disease can be done by high-performance liquid chromatography (HPLC)
D. Iron supplements are needed by the thalassemia patients during blood transfusion

a) Only A
b) Only B
c) Only C
d) All of these.

12. Anaphase Promoting Complex (APC) is a protein degradation machinery necessary for proper mitosis of animal cells. If APC is defective in a human cell, which of the following is expected to occur?

a) Recombination of chromosome arms will occur
b) Chromosomes will not condense
c) Chromosomes will not segregate
d) Chromosomes will be fragmented

13. A decapeptide (Mol. wt. 796) on complete hydrolysis gives glycine (Mol. wt. 75), alanine and phenylalanine. Glycine contributes 47.0% to the total weight of the hydrolyzed products. Calculate the number of glycine units present in the decapeptide.

a) 3.
b) 4.
c) 6.
d) 8.

14. A mixture of rRNA, relaxed plasmid DNA, nicked Plasmid DNA and supercoiled Plasmid DNA is run in agarose gel electrophoresis. Which sequence in correct -

a) cathode > relaxed > rRNA > supercoiled > nicked > anode
b) cathode > relaxed > supercoiled > nicked > rRNA > anode
c) cathode > nicked > relaxed > supercoiled > rRNA > anode
d) anode > rRNA > supercoiled > relaxed > nicked > cathode

15. Which respiratory disorder is most commonly characterized by the inflammation and narrowing of the airways, leading to wheezing and difficulty breathing?

a) Asthma
b) Chronic obstructive pulmonary disease (COPD)
c) Pneumonia
d) Tuberculosis

16. Which of the following statement/(s) is/are true regarding the 'major environmental issues'?

Statements:

A. Global warming is caused primarily by the increase in greenhouse gases like CO_2 and methane.
B. Ozone depletion is mainly due to the release of chlorofluorocarbons (CFCs).
C. Eutrophication is the enrichment of water bodies with nutrients, leading to excessive growth of algae.

a) Only A
b) Only A and B
c) Only B & C
d) All of these

17. Study the following statements regarding the 'translocation of solutes' in plants and choose the wrong option/(s)

Statements:

A. Translocation of solutes in the xylem is bidirectional.
B. Phloem loading can be a passive process in some plants.
C. Source-to-sink translocation is dependent on the pressure flow hypothesis.
D. Sucrose is actively transported into the phloem sieve tubes at the source.

a) Only A
b) Only C
c) Only D
d) Only A & B

18. The three domains of life help to explain cellular evolution and LUCA (Last Universal Common Ancestor). Carl Woese and colleagues proposed the three-domain system in 1990; the concept of Three Domain of Life represents any one of the following as truth.
   a) The name "archaea" comes from an ancient Greek word that means "ancient things," and it refers to the earliest species of life on Earth.
   b) Fungi are in a separate kingdom with plants within the domain Eukarya.
   c) Eukaryotes are directly originate from the bacterial lineage.
   d) The ribosomal RNA (rRNA) sequence of Eukarya is distinct from that of Archaea and Bacteria

19. In animal tissue system choose the wrong statement/(s)?
   A. In neurons, action potentials play a central role in cell–cell communication by providing for, or with regard to saltatory conduction, assisting the propagation of signals along the neuron's axon toward synaptic boutons situated at the ends of an axon.
   B. Lactic acid causes fatigue in muscles due to binding of muscle calcium, Ca is stored in sarcoplasmic reticulum. These are released in to the sarcoplasm during muscle contraction.
   C. Epithelial tissues form the protective covering and inner lining of the body and organs. These are held together by gap junctions, tight junctions, zonula adheren, desmosomes, or interdigitation.
   D. Connective tissues develop from the mesodermal cells of the embryo. They support and bind other tissues in the body.
   a) A only
   b) B & C only
   c) B only
   d) C & D only

20. Which of the following statement is incorrect regarding RNA interference?
   a) It is a method of cellular defense.
   b) The introduction of DNA into the host cell produces both sense and anti-sense RNA.
   c) It involves silencing of a specific mRNA.
   d) Dicer is a DNase enzyme that cuts the dsRNA molecules into siRNAs.

21. Hydrogen bond between two atoms is formed due to –
   a) displacement of electrons towards hydrogen atom resulting in a polar molecule
   b) formation of a bond between hydrogen atoms of one molecule and the other
   c) displacement of electrons towards a more electronegative atom resulting in a fractional positive charge on hydrogen
   d) existence of an attractive force which binds hydrogen atoms together.

22. Match List I with List II

List I		List II	
A.	Diamond	(i)	Used as a dry lubricant
B.	Fullerene	(ii)	Used as a reducing agent
C.	Graphite	(iii)	Carbon atoms are sp^3 hybridized
D.	Coke	(iv)	Cage like molecules

a) A- (iv), B- (ii), C- (i), D- (iii)
b) A- (iii), B- (i), C- (iv), D- (ii)
c) A- (iii), B- (iv), C- (i), D- (ii)
d) A- (iv), B- (i), C- (ii), D- (iii)

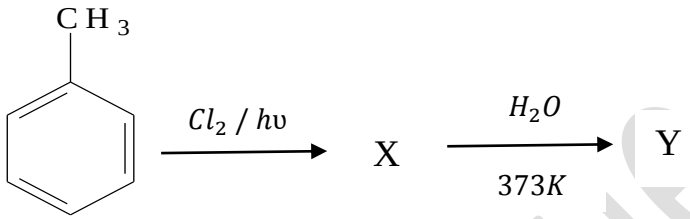
23. The ratio of mass percent of C and H of an organic compound ($C_XH_YO_Z$) is 6:1. If one molecule of the above compound ($C_XH_YO_Z$) contains half as much oxygen as required to burn one molecule of compound C_XH_Y completely to CO_2 and H_2O, the empirical formula of compound $C_XH_YO_Z$ is

a) $C_3H_6O_3$
b) $C_2H_4O_3$
c) C_2H_4O
d) $C_3H_4O_2$

24. Which of the following configurations represents the most electronegative element?

a) $1s^2\ 2s^2\ 2p^6\ 3s^1$
b) $1s^2\ 2s^2\ 2p^5$
c) $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^5$
d) $1s^2\ 2s^2\ 2p^4$

25. Study the following sequence of reaction and identify the compounds X and Y



a) X = Benzaldehyde & Y = Benzoic acid
b) X = 2-Chlorotoluene & Y = 2-Chlorobenzoic acid
c) X = 2,4-Dichlorobenzene & Y = Benzoic acid
d) X = Benzal chloride & Y = Benzaldehyde