

NEET 2025 Botany Question Paper with Solutions

Time Allowed :3 Hours	Maximum Marks :720	Total Questions :180
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General Instructions

Read the following instructions very carefully and strictly follow them:

1. The test is of 3 hours duration.
2. The question paper consists of 180 questions. The maximum marks are 720.
3. There are four parts in the question paper consisting of Biology, Physics, Chemistry, and Mathematics.
4. 4 marks are awarded for each correct answer and 1 mark is deducted for each wrong answer.
5. No marks will be awarded or deducted for unanswered questions.
6. Candidates must use only blue or black ballpoint pens to fill the OMR sheet.
7. The question paper consists entirely of Multiple Choice Questions (MCQs).

101. The protein portion of an enzyme is called:

- (1) Coenzyme
- (2) Apoenzyme
- (3) Prosthetic group
- (4) Cofactor

Correct Answer: (2) Apoenzyme

Solution: Enzymes are biological catalysts. Many enzymes require non-protein components called cofactors for their activity. The protein part of the enzyme, without the cofactor, is called the apoenzyme. When the apoenzyme combines with its cofactor, it becomes a holoenzyme (the complete, active enzyme). Coenzymes are organic cofactors, while prosthetic groups are cofactors tightly bound to the apoenzyme. Cofactors are a broader term encompassing both coenzymes and prosthetic groups. Therefore, only the apoenzyme refers specifically to the protein portion.

Quick Tip

Remember the acronym: **Holoenzyme = Apoenzyme + Cofactor**. The apoenzyme is the protein part.

102. Twins are born to a family that lives next door to you. The twins are a boy and a girl. Which of the following must be true?

- (1) They are fraternal twins.
- (2) They were conceived through in vitro fertilization.
- (3) They have 75% identical genetic content.
- (4) They are monozygotic twins.

Correct Answer: (1) They are fraternal twins.

Solution: Monozygotic (identical) twins develop from a single fertilized egg that splits into two embryos. Since they originate from the same zygote, they are always the same sex. Dizygotic (fraternal) twins develop from two separate eggs fertilized by two different sperm.

Because they are from separate zygotes, they can be different sexes and have different genetic makeup (like any siblings). A boy and a girl twin pair can only be fraternal twins. In vitro fertilization doesn't determine whether twins are monozygotic or dizygotic. 75% genetic similarity is not a standard measure for twins.

Quick Tip

Different sexes = Fraternal twins. Same sex = Could be identical or fraternal.

103. After maturation, in primary lymphoid organs, the lymphocytes migrate for interaction with antigens to secondary lymphoid organ(s)/tissue(s) like:

- A. thymus
 - B. bone marrow
 - C. spleen
 - D. lymph nodes
 - E. Peyer's patches
- (1) A, B, C only
(2) E, A, B only
(3) C, D, E only
(4) B, C, D only

Correct Answer: (3) C, D, E only

Solution: Primary lymphoid organs (bone marrow and thymus) are where lymphocytes mature. Secondary lymphoid organs (spleen, lymph nodes, Peyer's patches, tonsils, and mucosa-associated lymphoid tissue (MALT)) are where mature lymphocytes encounter antigens and initiate immune responses. The thymus and bone marrow are sites of lymphocyte development, not the primary location for antigen interaction.

Quick Tip

Primary lymphoid organs = Maturation. Secondary lymphoid organs = Antigen encounter.

104. In frog, the Renal portal system is a special venous connection that acts to link:

- (1) Liver and kidney
- (2) Kidney and intestine
- (3) Kidney and lower part of body
- (4) Liver and intestine

Correct Answer: (3) Kidney and lower part of body

Solution: The renal portal system in frogs is a unique venous system. Blood from the hind limbs and tail drains into the renal portal veins, which then enter the kidneys before going to the heart. This allows the kidneys to filter blood from the lower body before it reaches the systemic circulation. This is distinct from the hepatic portal system, which connects the intestines to the liver.

Quick Tip

Renal portal system: Lower body → Kidneys → Heart. Hepatic portal system: Intestines → Liver → Heart.

105. Which of the following enzyme(s) are NOT essential for gene cloning?

- A. Restriction enzymes
- B. DNA ligase
- C. DNA mutase
- D. DNA recombinase

E. DNA polymerase

- (1) A and B only
- (2) D and E only
- (3) B and C only
- (4) C and D only

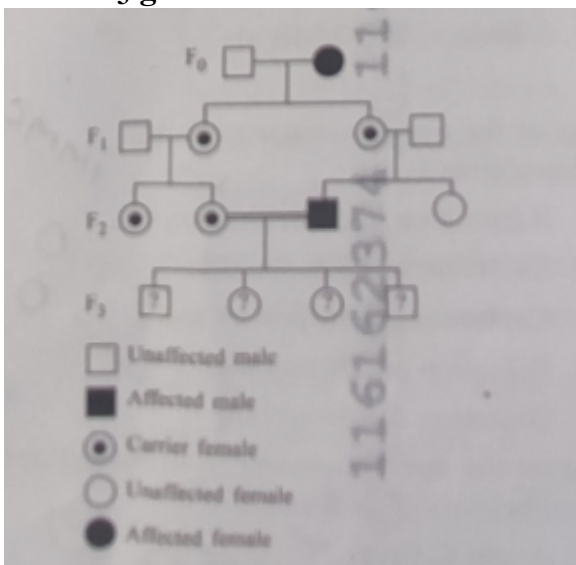
Correct Answer: (4) C and D only

Solution: Gene cloning involves cutting DNA (restriction enzymes), joining DNA fragments (DNA ligase), and copying DNA (DNA polymerase). DNA mutase (which isn't a standard enzyme used in molecular biology) and DNA recombinase (while involved in natural recombination, not typically a required enzyme in standard gene cloning protocols using plasmid vectors) are not essential for this process. DNA polymerase is essential for replicating the cloned DNA within the host organism.

Quick Tip

Gene cloning essentials: Cut (restriction enzymes), Paste (ligase), Copy (polymerase).

106. With the help of the given pedigree, find out the probability for the birth of a child having no disease and being a carrier (has the disease mutation in one allele of the gene) in the F₃ generation.



- (1) 1/2
- (2) 1/8
- (3) Zero
- (4) 1/4

Correct Answer: (4) 1/4

Solution: The pedigree shows an autosomal recessive trait. In the F₂ generation, the affected male (shaded square) must have the genotype "aa," and the carrier female (half-filled circle)

must have the genotype "Aa." Their children in the F₃ generation can have the following genotypes: Aa (carrier, no disease) or aa (affected). The probability of an F₃ child being a carrier (Aa) is 1/2. Since the question asks for the probability of any of their children being a carrier, and there's only one child being considered in F₃ from this particular couple, the answer is 1/2 1/2 = 1/4 (Note: If the questions asked what is the probability of having a daughter who is a carrier that will become 1/2 1/2 1/2 = 1/8 because girls are also 1/2 probability.)

Quick Tip

Draw a Punnett square for the F₂ parents (Aa x aa) to visualize the probabilities of the F₃ genotypes.

107. Which one of the following is the characteristic feature of gymnosperms?

- (1) Seeds are naked.
- (2) Seeds are absent.
- (3) Gymnosperms have flowers for reproduction.
- (4) Seeds are enclosed in fruits.

Correct Answer: (1) Seeds are naked.

Solution: Gymnosperms are seed-bearing plants, but their seeds are not enclosed within an ovary or fruit. Instead, the seeds are exposed on the surface of cone scales or similar structures. This "naked seed" characteristic is the defining feature of gymnosperms, distinguishing them from angiosperms (flowering plants), whose seeds are enclosed in fruits.

Quick Tip

Gymnosperm = "naked seed." Angiosperm = "vessel seed" (enclosed in a fruit).

108. The first menstruation is called:

- (1) Menarche

- (2) Diapause
- (3) Ovulation
- (4) Menopause

Correct Answer: (1) Menarche

Solution: Menarche is the term specifically used to describe the onset of the first menstrual period in females, marking the beginning of puberty. Menopause refers to the cessation of menstruation. Ovulation is the release of an egg from the ovary. Diapause is a period of suspended development in some organisms.

Quick Tip

Menarche = Start. Menopause = Stop.

109. In bryophytes, the gemmae help in which one of the following:

- (1) Asexual reproduction
- (2) Nutrient absorption
- (3) Gaseous exchange
- (4) Sexual reproduction

Correct Answer: (1) Asexual reproduction

Solution: Gemmae are small, multicellular structures produced by some bryophytes (mosses, liverworts, and hornworts) for asexual reproduction. They are dispersed from the parent plant and can develop into new individuals, allowing for rapid colonization and propagation without the need for fertilization.

Quick Tip

Gemmae = Clones.

110. How many meiotic and mitotic divisions need to occur for the development of a mature female gametophyte from the megaspore mother cell in an angiosperm plant?

- (1) 1 Meiosis and 2 Mitosis
- (2) 1 Meiosis and 3 Mitosis
- (3) No Meiosis and 2 Mitosis
- (4) 2 Meiosis and 3 Mitosis

Correct Answer: (2) 1 Meiosis and 3 Mitosis

Solution: The megaspore mother cell undergoes one meiotic division to produce four megaspores. Typically, three of these megaspores degenerate, and the remaining functional megaspore undergoes three rounds of mitosis to form the eight-nucleate, seven-celled embryo sac (the mature female gametophyte).

Quick Tip

Megaspore mother cell → 1 Meiosis → 1 surviving megaspore → 3 Mitoses → Embryo sac.

111. Role of the water vascular system in Echinoderms is:

- A. Respiration and Locomotion
 - B. Excretion and Locomotion
 - C. Capture and transport of food
 - D. Digestion and Respiration
 - E. Digestion and Excretion
- (1) A and C Only
 - (2) B and C Only
 - (3) B, D and E Only
 - (4) A and B Only

Correct Answer: (1) A and C Only

Solution: The water vascular system is a unique hydraulic system found in echinoderms (starfish, sea urchins, etc.). Its primary functions are locomotion (via tube feet), food capture (also using tube feet), and respiration (gas exchange through tube feet and other structures). It plays a minor role in excretion, but its main roles are locomotion, feeding, and respiration.

Quick Tip

Water vascular system: Locomotion, Feeding, Respiration.

112. Read the following statements on plant growth and development:

A. Parthenocarpy can be induced by auxins. B. Plant growth regulators can be involved in promotion as well as inhibition of growth. C. Dedifferentiation is a pre-requisite for re-differentiation. D. Abscisic acid is a plant growth promoter. E. Apical dominance promotes the growth of lateral buds. (1) A, C, E only

(2) A, D, E only

(3) B, D, E only

(4) A, B, C only

Correct Answer: (4) A, B, C only

Solution: A. True: Auxins can induce parthenocarpy (fruit development without fertilization).

B. True: Plant growth regulators (hormones) can stimulate or inhibit growth depending on the hormone and concentration.

C. True: Dedifferentiation (loss of specialized structure and function) is necessary before cells can re-differentiate into new cell types.

D. False: Abscisic acid is a growth inhibitor, involved in stress responses like drought tolerance.

E. False: Apical dominance suppresses lateral bud growth, favoring growth of the main stem.

Quick Tip

Auxins = Parthenocarpy. Abscisic acid = Inhibitor. Apical dominance = Suppresses lateral buds.

113. Which of the following type of immunity is present at the time of birth and is a non-specific type of defence in the human body?

- (1) Innate Immunity
- (2) Cell-mediated Immunity
- (3) Humoral Immunity
- (4) Acquired Immunity

Correct Answer: (1) Innate Immunity

Solution: Innate immunity is the body's first line of defense, present from birth. It's non-specific, meaning it doesn't target particular pathogens but provides a general defense against a wide range of threats. Acquired immunity (including cell-mediated and humoral immunity) develops after exposure to specific antigens.

Quick Tip

Innate = Born with it. Acquired = Develops after exposure.

114. Why can't insulin be given orally to diabetic patients?

- (1) It will be digested in Gastro-Intestinal (GI) tract.
- (2) Because of structural variation.
- (3) Its bioavailability will be increased.
- (4) Human body will elicit strong immune response.

Correct Answer: (1) It will be digested in Gastro-Intestinal (GI) tract.

Solution: Insulin is a protein hormone. If taken orally, it would be broken down by digestive enzymes in the stomach and small intestine, rendering it ineffective. This is why insulin is typically administered by injection, allowing it to enter the bloodstream directly.

Quick Tip

Insulin = Protein. Proteins get digested.

115. Which one of the following equations represents the Verhulst-Pearl Logistic Growth of population?

- (1) $dN/dt = rN(K-N)/K$
- (2) $dN/dt = rN(N-K)/K$
- (3) $dN/dt = rN(K+N)/K$
- (4) $dN/dt = rN(K-N)/N$

Correct Answer: (1) $dN/dt = rN(K-N)/K$

Solution: The Verhulst-Pearl Logistic Growth equation describes population growth that is initially exponential but levels off as the population approaches carrying capacity (K). The correct equation incorporates the term $(K-N)/K$, which represents the proportion of the carrying capacity still available for population growth.

Quick Tip

Logistic growth: Starts fast, then slows down as it approaches K.

116. Silencing of specific mRNA is possible via RNAi because of:

- (1) Inhibitory ssRNA
- (2) Complementary dsRNA
- (3) Non-complementary ssRNA
- (4) Complementary dsRNA

Correct Answer: (2/4) Complementary dsRNA

Solution: RNA interference (RNAi) is a mechanism for gene silencing. It's triggered by double-stranded RNA (dsRNA) that is complementary to the target mRNA. This dsRNA is processed into small interfering RNAs (siRNAs), which guide the degradation or translational repression of the target mRNA.

Quick Tip

RNAi = dsRNA = Silencing.

117. Match List I with List II.

List I	List II
A. Adenosine	I. Nitrogen base
B. Adenylic acid	II. Nucleotide
C. Adenine	III. Nucleoside
D. Alanine	IV. Amino acid

(1) A-III, B-II, C-IV, D-I

(2) A-III, B-II, C-I, D-IV

(3) A-II, B-III, C-I, D-IV

(4) A-III, B-IV, C-II, D-I

Correct Answer: (2) A-III, B-II, C-I, D-IV

Solution: Adenosine is a nucleoside (nitrogenous base + sugar).

Adenylic acid is a nucleotide (nitrogenous base + sugar + phosphate).

Adenine is a nitrogenous base (purine).

Alanine is an amino acid.

Quick Tip

Nucleoside = Base + Sugar. Nucleotide = Base + Sugar + Phosphate.

118. Frogs respire in water by skin and buccal cavity and on land by skin, buccal cavity and lungs.

(1) The statement is true for both the environment.

(2) The statement is false for water but true for land.

(3) The statement is false for both the environment.

(4) The statement is true for water but false for land.

Correct Answer: (1) The statement is true for both environments.

Solution: Frogs utilize multiple respiratory surfaces. In water, they primarily rely on cutaneous respiration (skin) and buccal pumping (buccal cavity). On land, they continue to use skin and buccal pumping but also utilize their lungs for more efficient gas exchange in air.

Quick Tip

Frogs: Skin and buccal cavity always, lungs on land.

119. All living members of the class Cyclostomata are:

- (1) Endoparasite
- (2) Symbiotic
- (3) Ectoparasite
- (4) Free living

Correct Answer: (3) Ectoparasite

Solution: Cyclostomata (lampreys and hagfish) are jawless fish. While some are free-living scavengers (hagfish), all extant lampreys are ectoparasites, attaching to other fish and feeding on their blood and tissues.

Quick Tip

Cyclostomata = Mostly ectoparasites (lampreys).

120. Identify the statement that is NOT correct.

- (1) The heavy and light chains are held together by disulfide bonds.
- (2) Antigen binding site is located at C-terminal region of antibody molecules.
- (3) Constant regions of heavy and light chains are located at C-terminus of antibody molecules.
- (4) Each antibody has two light and two heavy chains.

Correct Answer: (2) Antigen binding site is located at C-terminal region of antibody molecules.

Solution: The antigen-binding site of an antibody is located at the *N-terminal* region (variable region), not the C-terminal region. The other statements are correct: Heavy and light chains are linked by disulfide bonds, constant regions are at the C-terminus, and each antibody has two heavy and two light chains.

Quick Tip

Antigen-binding = N-terminal (Variable region).

121. Given below are two statements: one is labelled as Assertion (A) and the other is labelled as Reason (R).

Assertion (A): The primary function of the Golgi apparatus is to package the materials made by the endoplasmic reticulum and deliver it to intracellular targets and outside the cell.

Reason (R): Vesicles containing materials made by the endoplasmic reticulum fuse with the cis face of the Golgi apparatus, and they are modified and released from the trans face of the Golgi apparatus.

- (1) Both A and R are true but R is not the correct explanation of A.
- (2) A is true but R is false.
- (3) A is false but R is true.
- (4) Both A and R are true and R is the correct explanation of A.

Correct Answer: (4) Both A and R are true and R is the correct explanation of A.

Solution: Both the assertion and reason are accurate and directly related. The Golgi apparatus receives proteins and lipids from the ER, processes and modifies them (e.g., glycosylation, sorting), and then packages them into vesicles for delivery to various destinations within the cell or for secretion outside the cell. The cis face is the receiving side, and the trans face is the shipping side of the Golgi.

Quick Tip

Golgi = Post office of the cell (receives, processes, ships).

122. Consider the following:

A. The reductive division for human female gametogenesis starts earlier than that of male gametogenesis.

B. The gap between the first meiotic division and the second meiotic division is much shorter for males compared to females.

C. The first polar body is associated with the formation of the primary oocyte.

D. Luteinizing Hormone (LH) surge leads to disintegration of the endometrium and onset of menstrual bleeding.

(1) A and C are true

(2) B and D are true

(3) B and C are true

(4) A and B are true

Correct Answer: (4) A and B are true

Solution: A. True: Meiosis I in females begins during fetal development and is arrested until puberty. In males, meiosis I begins at puberty.

B. True: In males, meiosis I and II proceed relatively continuously. In females, there's a long delay between meiosis I (completed at ovulation) and meiosis II (completed only upon fertilization).

C. False: The first polar body is formed during meiosis I, which results in a secondary oocyte, not a primary oocyte.

D. False: The LH surge triggers ovulation. Menstrual bleeding is caused by a drop in progesterone and estrogen levels if fertilization doesn't occur.

Quick Tip

Female meiosis: Starts early, long pause. Male meiosis: Starts later, continuous.

123. Match List I with List II:

List I

List II

A. Scutellum

I. Persistent nucellus

B. Non-albuminous seed

II. Cotyledon of Monocot seed

C. Epiblast

III. Groundnut

D. Perisperm

IV. Rudimentary cotyledon

- (1) A-IV, B-III, C-II, D-I
- (2) A-IV, B-III, C-I, D-II
- (3) A-II, B-IV, C-III, D-I
- (4) A-II, B-III, C-IV, D-I

Correct Answer: (4) A-II, B-III, C-IV, D-I

Solution: Scutellum is the single cotyledon in monocot seeds. Non-albuminous seeds (like groundnut) have no endosperm at maturity. Epiblast is a rudimentary cotyledon in some monocots. Perisperm is persistent nucellus tissue in some seeds.

Quick Tip

Scutellum = Monocot cotyledon. Perisperm = Persistent nucellus.

124. What is the main function of the spindle fibers during mitosis? (1) To synthesize new DNA

- (2) To repair damaged DNA
- (3) To regulate cell growth
- (4) To separate the chromosomes

Correct Answer: (4) To separate the chromosomes

Solution: Spindle fibers are microtubule structures that attach to chromosomes during mitosis. Their primary function is to pull the sister chromatids apart and move them to opposite poles of the cell, ensuring that each daughter cell receives a complete set of chromosomes.

Quick Tip

Spindle fibers = Chromosome separation.

125. Which of the following statements about RuBisCO is true? (1) It has higher affinity for oxygen than carbon dioxide.

- (2) It is an enzyme involved in the photolysis of water.
- (3) It catalyzes the carboxylation of RuBP.
- (4) It is active only in the dark.

Correct Answer: (3) It catalyzes the carboxylation of RuBP.

Solution: RuBisCO (Ribulose-1,5-bisphosphate carboxylase/oxygenase) is the key enzyme in the Calvin cycle (dark reactions of photosynthesis). It catalyzes the fixation of CO₂ by adding it to RuBP (ribulose-1,5-bisphosphate). While it can also react with oxygen (photorespiration), its affinity for CO₂ is higher under normal conditions. It is not involved in the photolysis of water, which occurs in the light-dependent reactions.

Quick Tip

RuBisCO = Calvin cycle = CO₂ fixation.

126. Given below are two statements:

Statement I: The DNA fragments extracted from gel electrophoresis can be used in the construction of recombinant DNA.

Statement II: Smaller size DNA fragments are observed near the anode while larger fragments are found near the wells in an agarose gel.

- (1) Both statement I and statement II are incorrect.
- (2) Statement I is correct but statement II is incorrect.
- (3) Statement I is incorrect but statement II is correct.
- (4) Both statement I and statement II are correct.

Correct Answer: (4) Both statement I and statement II are correct.

Solution: Both statements are correct. DNA fragments separated by gel electrophoresis can be extracted and used for various molecular biology applications, including constructing recombinant DNA molecules. In gel electrophoresis, DNA migrates towards the positive electrode (anode) because DNA is negatively charged. Smaller fragments move faster and farther than larger fragments, which remain closer to the wells where the DNA was initially loaded.

Quick Tip

Gel electrophoresis: Small fragments travel farther. Recombinant DNA uses these fragments.

127. Which factor is important for termination of transcription?

- (1) σ (sigma)
- (2) ρ (rho)
- (3) γ (gamma)
- (4) α (alpha)

Correct Answer: (2) ρ (rho)

Solution:

The rho (ρ) factor is a protein involved in the termination of transcription in prokaryotes. It binds to specific sequences in the newly synthesized RNA and acts as a helicase to unwind the DNA-RNA hybrid, leading to the release of the RNA polymerase and termination of transcription. Sigma factor is involved in initiation, not termination.

Quick Tip

Rho (ρ) = Termination. Sigma (σ) = Initiation.

128. Consider the following statements regarding the function of adrenal medullary hormones:

- A. It causes pupillary constriction.
 - B. It is a hyperglycemic hormone.
 - C. It causes piloerection.
 - D. It increases the strength of heart contraction.
- (1) B, C and D Only
 - (2) A, C and D Only
 - (3) D Only

(4) C and D Only

Correct Answer: (1) B, C and D Only

Solution: The adrenal medulla releases epinephrine and norepinephrine (adrenaline and noradrenaline). These hormones prepare the body for "fight or flight" responses. They increase heart rate and contraction strength (D), stimulate glucose release from the liver (hyperglycemic effect - B), and cause piloerection (hair standing on end - C). They cause pupillary dilation, not constriction (A).

Quick Tip

Adrenal medulla = Fight or flight = Increased heart rate, glucose, piloerection.

129. Histones are enriched with:

- (1) Leucine & Lysine
- (2) Phenylalanine & Leucine
- (3) Phenylalanine & Arginine
- (4) Lysine & Arginine

Correct Answer: (4) Lysine & Arginine

Solution: Histones are proteins that package DNA into nucleosomes. They are positively charged due to a high content of basic amino acids, primarily lysine and arginine. This positive charge allows them to interact strongly with the negatively charged DNA.

Quick Tip

Histones = Positive charge = Lysine & Arginine.

130. Genes R and Y follow independent assortment. If RRYY produce round yellow seeds and rryy produce wrinkled green seeds, what will be the phenotypic ratio of the F2 generation?

- (1) Phenotypic ratio – 3:1
- (2) Phenotypic ratio – 9:3:3:1
- (3) Phenotypic ratio – 9:7
- (4) Phenotypic ratio – 1:2:1

Correct Answer: (2) Phenotypic ratio – 9:3:3:1

Solution: This is a classic dihybrid cross. Independent assortment of two genes with dominant/recessive alleles (R/r and Y/y) results in a 9:3:3:1 phenotypic ratio in the F₂ generation:

9: Round, Yellow (R₋Y₋)

3: Round, Green (R₋yy)

3: Wrinkled, Yellow (rrY₋)

1: Wrinkled, Green (rryy)

Quick Tip

Dihybrid cross = 9:3:3:1.

131. Which of the following hormones released from the pituitary is actually synthesized in the hypothalamus?

- (1) Anti-diuretic hormone (ADH)
- (2) Follicle-stimulating hormone (FSH)
- (3) Adrenocorticotrophic hormone (ACTH)
- (4) Luteinizing hormone (LH)

Correct Answer: (1) Anti-diuretic hormone (ADH)

Solution: Anti-diuretic hormone (ADH), also known as vasopressin, is synthesized in the hypothalamus and stored in the posterior pituitary gland. FSH, LH, and ACTH are synthesized and released by the anterior pituitary.

Quick Tip

ADH = Made in hypothalamus, stored in posterior pituitary.

132. Given below are two statements: one is labelled as Assertion (A) and the other is labelled as Reason (R).

Assertion (A): All vertebrates are chordates but all chordates are not vertebrates.

Reason (R): The members of subphylum Vertebrata possess a notochord during the embryonic period; the notochord is replaced by a cartilaginous or bony vertebral column in adults.

- (1) Both A and R are true but R is not the correct explanation of A.
- (2) A is true but R is false.
- (3) A is false but R is true.
- (4) Both A and R are true and R is the correct explanation of A.

Correct Answer: (1) Both A and R are true but R is not the correct explanation of A.

Solution: The assertion is true. Vertebrates are a subphylum within the phylum Chordata. However, other chordate subphyla (Urochordata and Cephalochordata) are not vertebrates. The reason is also true – vertebrates develop a vertebral column that replaces the notochord. However, the reason doesn't fully explain why all chordates aren't vertebrates. The key difference lies in the development of a vertebral column, which is unique to vertebrates. Other chordates retain the notochord throughout their lives.

Quick Tip

Vertebrates have backbones (vertebral column). Some chordates don't.

133. Given below are two statements:

Statement I: Fig fruit is a non-vegetarian fruit as it has enclosed fig wasps in it.

Statement II: Fig wasp and fig tree exhibit a mutual relationship as the fig wasp completes its life cycle in the fig fruit and the fig fruit gets pollinated by the fig wasp.

- (1) Both statement I and statement II are incorrect.
- (2) Statement I is correct but statement II is incorrect.
- (3) Statement I is incorrect but statement II is correct.
- (4) Both statement I and statement II are correct.

Correct Answer: (4) Both statement I and statement II are correct.

Solution: Both statements are correct. Fig wasps and fig trees have a highly specialized mutualistic relationship. Female fig wasps enter the fig inflorescence (which develops into the fig fruit) to lay eggs. In the process, they pollinate the fig flowers. Some wasps become trapped and die inside, becoming part of the fruit. While technically the fig might contain remnants of insects, it's generally not considered truly "non-vegetarian" in the dietary sense.

Quick Tip

Figs and fig wasps = Mutualism (but some wasps get trapped).

134. Sweet potato and potato represent a certain type of evolution. Select the correct combination of terms to explain the evolution.

- (1) Homology, divergent
- (2) Homology, convergent
- (3) Analogy, divergent
- (4) Analogy, convergent

Correct Answer: (4) Analogy, convergent

Solution: Sweet potato (modified root) and potato (modified stem) have similar functions (food storage) but evolved from different plant parts. This is an example of analogous structures arising through convergent evolution. Convergent evolution occurs when unrelated organisms develop similar traits due to similar environmental pressures.

Quick Tip

Analogous structures = Convergent evolution.

135. Which of the following microbes is NOT involved in the preparation of household products?

A. *Aspergillus niger*

B. *Lactobacillus*

C. *Trichoderma polysporum*

D. *Saccharomyces cerevisiae*

E. *Propionibacterium sharmanii*

(1) A and C only

(2) C and D only

(3) C and E only

(4) A and B only

Correct Answer: (3) C and E only

Solution: *Aspergillus niger* is used in citric acid production.

Lactobacillus is used in yogurt and cheese making.

Trichoderma polysporum is a source of cyclosporin A (immunosuppressant).

Saccharomyces cerevisiae is used in baking and brewing.

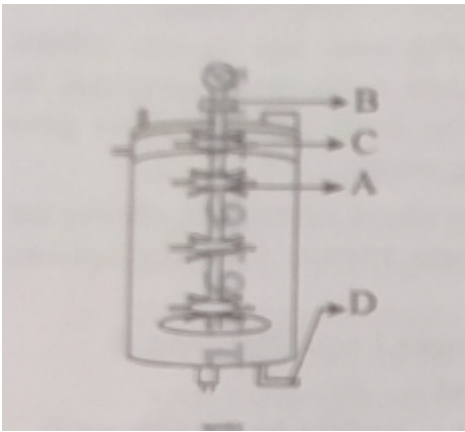
Propionibacterium sharmanii is used in Swiss cheese production for its characteristic flavor.

Trichoderma polysporum is used pharmaceutically, not typically in household products.

Quick Tip

Lactobacillus = Yogurt. *Saccharomyces* = Yeast.

136. Identify the part of a bioreactor which is used as a foam breaker from the given figure.



- (1) B
- (2) D
- (3) C
- (4) A

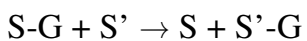
Correct Answer: (3) C

Solution: Part 'C' in the diagram represents the impeller. While the impeller's primary function is mixing and oxygen transfer, it also helps break down foam that can form during fermentation, preventing blockage of filters and other parts of the bioreactor. 'A' is the sparger, 'B' is the acid/base inlet, and 'D' is the harvest outlet/sampling port.

Quick Tip

Impeller = Mixing + Foam breaker.

137. Name the class of enzyme that usually catalyzes the following reaction:



Where:

G → a group other than hydrogen

S → a substrate

S' → another substrate

- (1) Lyase
- (2) Transferase

- (3) Ligase
- (4) Hydrolase

Correct Answer: (2) Transferase

Solution: Transferases are enzymes that catalyze the transfer of a functional group (in this case, "-G") from one molecule (S-G) to another (S'). Lyases break bonds without water, ligases join molecules, and hydrolases use water to break bonds.

Quick Tip

Transferases = Transfer functional groups.

138. Match List I with List II:

List I

List II

- | | |
|------------------|-----------------------------|
| A. Chlorophyll a | I. Yellow-green |
| B. Chlorophyll b | II. Yellow |
| C. Xanthophylls | III. Blue-green |
| D. Carotenoids | IV. Yellow to Yellow-orange |

- (1) A-III, B-II, C-IV, D-I
- (2) A-I, B-II, C-IV, D-III
- (3) A-III, B-IV, C-II, D-I
- (4) A-III, B-IV, C-III, D-I

Correct Answer: A-III, B-I, C-IV, D-II (None of the provided options are correct)

Solution: Chlorophyll a is blue-green.

Chlorophyll b is yellow-green.

Xanthophylls are yellow to yellow-orange.

Carotenoids are yellow to red-orange (although in this option, yellow has been provided).

Quick Tip

Chlorophyll a = Blue-green.

Chlorophyll b = Yellow-green.

Carotenoids = Yellow-orange/red-orange.

Xanthophylls = Yellow.

139. The correct sequence of events in the life cycle of bryophytes is:

- A. Fusion of antherozoid with egg.
- B. Attachment of gametophyte to substratum.
- C. Reduction division to produce haploid spores.
- D. Formation of sporophyte.
- E. Release of antherozoids into water.

- (1) D, B, E, A, C, D
- (2) B, E, A, D, C
- (3) B, E, A, D, C
- (4) D, E, A, C, B

Correct Answer: (2) B, E, A, D, C

- Solution:**
1. The gametophyte attaches to the substratum (B).
 2. Antherozoids are released into the water (E).
 3. Fertilization occurs (A).
 4. The sporophyte develops (D).
 5. Meiosis occurs in the sporophyte, producing spores (C).

Quick Tip

Bryophytes: Gametophyte dominant, sporophyte dependent.

140. Match List - I with List - II:

List - I

List - II

- A. Centromere I. Mitochondrion
B. Cilium II. Cell division
C. Cristae III. Cell movement
D. Cell membrane IV. Phospholipid Bilayer

(1) A-II, B-III, C-IV, D-I

(2) A-IV, B-III, C-I, D-II

(3) A-II, B-II, C-III, D-IV

(4) A-I, B-III, C-III, D-IV

Correct Answer: A-II, B-III, C-I, D-IV (None of the provided options is entirely correct)

Solution: Centromere plays a crucial role in cell division.

Cilia are involved in cell movement.

Cristae are folds in the inner mitochondrial membrane.

The cell membrane is primarily composed of a phospholipid bilayer.

Quick Tip

Centromere = Cell division.

Cilia = Movement.

Cristae = Mitochondria.

Cell membrane = Phospholipid bilayer.

141. Find the correct statements:

A. In human pregnancy, the major organ systems are formed at the end of 12 weeks.

B. In human pregnancy, the major organ systems are formed at the end of 8 weeks.

C. In human pregnancy, the heart is formed after one month of gestation.

D. In human pregnancy, limbs and digits develop by the end of the second month.

E. In human pregnancy, the appearance of hair is usually observed in the fifth month.

(1) B and C Only

(2) B, C, D, and E Only

(3) A, C, D, and E Only

(4) A and E Only

Correct Answer: (2) B, C, D, and E Only

Solution: B. True: By the end of 8 weeks (end of the embryonic period), the major organ systems have formed.

C. True: The heart begins to form very early, within the first month.

D. True: Limbs and digits develop during the second month.

E. True: Fetal hair (lanugo) appears around the fifth month.

A. False: While organ systems continue to develop and refine after 12 weeks, the basic structures are in place by 8 weeks.

Quick Tip

8 weeks = Major organ systems formed.

142. Each of the following characteristics represents a Kingdom proposed by Whittaker. Arrange the following in increasing order of complexity of body organization.

- A. Multicellular heterotrophs with a cell wall made of chitin. (Fungi)
- B. Heterotrophs with tissue/organ/organ system level of body organization. (Animalia)
- C. Prokaryotes with a cell wall made of polysaccharides and amino acids. (Monera)
- D. Eukaryotic autotrophs with tissue/organ level of body organization. (Plantae)
- E. Eukaryotes with cellular body organization. (Protista)

(1) C, E, A, D, B

(2) A, C, E, D, B

(3) C, E, A, B, D

(4) A, C, E, B, D

Correct Answer: (1) C, E, A, D, B

Solution: The correct order of increasing complexity is:

1. **Monera (C):** Prokaryotic, unicellular.

2. **Protista (E):** Eukaryotic, mostly unicellular.
3. **Fungi (A):** Eukaryotic, multicellular (but simpler organization than plants or animals).
4. **Plantae (D):** Eukaryotic, multicellular, tissues and organs.
5. **Animalia (B):** Eukaryotic, multicellular, tissues, organs, and organ systems.

Quick Tip

Increasing complexity: Monera → Protista → Fungi → Plantae → Animalia.

143. Which are correct:

- A. Computed tomography and magnetic resonance imaging detect cancers of internal organs.
 - B. Chemotherapeutic drugs are used to kill non-cancerous cells.
 - C. α -interferon activates the cancer patients' immune system and helps in destroying the tumor.
 - D. Chemotherapeutic drugs are biological response modifiers.
 - E. In the case of leukemia, blood cell counts are decreased.
- (1) D and E only
(2) C and D only
(3) A and C only
(4) B and D only

Correct Answer: (3) A and C only

Solution: A. True: CT scans and MRI are used to detect internal cancers.

B. False: Chemotherapy targets rapidly dividing cells, including cancer cells, but also affects some healthy cells, leading to side effects.

C. True: α -interferon can boost the immune response against tumors.

D. False: While some chemotherapeutic drugs can be considered biological response modifiers, not all are. The term "biological response modifiers" encompasses a broader range of therapies.

E. False: Leukemia often involves an increase in abnormal white blood cells. Other blood cell counts can decrease as a side effect.

Quick Tip

Cancer detection: CT & MRI. α -interferon = Immune booster.

144. Which of the following genetically engineered organisms was used by Eli Lilly to prepare human insulin?

- (1) Yeast
- (2) Virus
- (3) Phage
- (4) Bacterium

Correct Answer: (4) Bacterium

Solution: Eli Lilly used *Escherichia coli* bacteria to produce human insulin through recombinant DNA technology. The human insulin gene was inserted into the bacterial genome, allowing the bacteria to produce large quantities of human insulin.

Quick Tip

Human insulin = *E. coli* bacteria.

145. What is the pattern of inheritance for a polygenic trait?

- (1) Non-Mendelian inheritance pattern
- (2) Autosomal dominant pattern
- (3) X-linked recessive inheritance pattern
- (4) Mendelian inheritance pattern

Correct Answer: (1) Non-Mendelian inheritance pattern

Solution: Polygenic traits are influenced by multiple genes, resulting in a continuous range of phenotypes (e.g., height, skin color). This inheritance pattern is non-Mendelian, as Mendelian inheritance involves traits controlled by single genes with distinct categories.

Quick Tip

Polygenic = Multiple genes = Non-Mendelian.

146. Which of the following are the post-transcriptional events in a eukaryotic cell?

- A. Transport of pre-mRNA to the cytoplasm prior to splicing.
- B. Removal of introns and joining of exons.
- C. Addition of a methyl group at the 5' end of hnRNA.
- D. Addition of adenine residues at the 3' end of hnRNA.
- E. Base pairing of two complementary RNAs.

- (1) B, C, D only
- (2) B, C, E only
- (3) C, D, E only
- (4) A, B, C only

Correct Answer: (1) B, C, D only

Solution: Post-transcriptional modifications occur after transcription. These include:

B. Splicing: Removal of introns and joining of exons.

C. Capping: Addition of a 7-methylguanosine cap to the 5' end.

D. Polyadenylation: Addition of a poly(A) tail to the 3' end.

Transport to the cytoplasm (A) can occur before or after splicing, but is not itself considered a post-transcriptional modification. Base pairing of RNAs (E) refers to interactions like RNAi.

Quick Tip

Post-transcriptional: Capping, Splicing, Polyadenylation.

147. Which one of the following phytohormones promotes nutrient mobilization which helps in the delay of leaf senescence in plants?

- (1) Abscisic acid

- (2) Gibberellin
- (3) Cytokinin
- (4) Ethylene

Correct Answer: (3) Cytokinin

Solution: Cytokinins are plant hormones that promote cell division and delay senescence (aging) by mobilizing nutrients and preventing their degradation. They are often used commercially to keep cut flowers fresh.

Quick Tip

Cytokinin = Keeps things young.

148. Which one of the following statements refers to Reductionist Biology? (1)

Physiological approach to study and understand living organisms.

(2) Chemical approach to study and understand living organisms.

(3) Behavioural approach to study and understand living organisms.

(4) Physico-chemical approach to study and understand living organisms.

Correct Answer: (2) Chemical approach to study and understand living organisms.

Solution: Reductionist biology attempts to explain complex biological phenomena by breaking them down into their simpler components and studying them at the chemical level. While physiological and physico-chemical approaches are related, the core of reductionism is understanding the chemical basis of life. Behavioral approaches are less reductionist as they focus on higher-level interactions.

Quick Tip

Reductionist biology = Focus on chemical components.

149. Match List - I with List - II:

List - I**List - II**

- A. Emphysema I. Rapid spasms in muscle due to low Ca^{++} in body fluid
B. Angina Pectoris II. Damaged alveolar walls and decreased respiratory surface
C. Glomerulonephritis III. Acute chest pain when not enough oxygen is reaching heart muscle
D. Tetany IV. Inflammation of glomeruli of kidney

- (1) A-III, B-I, C-II, D-IV
(2) A-II, B-IV, C-III, D-I
(3) A-II, B-III, C-IV, D-I
(4) A-III, B-I, C-IV, D-II

Correct Answer: (3) A-II, B-III, C-IV, D-I

Solution: Emphysema is characterized by damaged alveoli (II).

Angina pectoris is chest pain due to insufficient oxygen supply to the heart (III).

Glomerulonephritis is inflammation of the kidney glomeruli (IV).

Tetany involves muscle spasms due to low calcium (I).

Quick Tip

Emphysema = Lungs. Angina = Heart. Glomerulonephritis = Kidneys. Tetany = Calcium.

150. Epiphytes that are growing on a mango branch are an example of which of the following?

- (1) Mutualism
(2) Predation
(3) Amensalism
(4) Commensalism

Correct Answer: (4) Commensalism

Solution: Epiphytes grow on other plants for support but don't harm or benefit the host

plant. This is a commensal relationship (+/0), where one organism benefits and the other is unaffected.

Quick Tip

Epiphytes = Commensalism (+/0).
