

NEET 2024 S3 Zoology Question Paper with Solutions

1. Given below are two statements:

Statement I: In the nephron, the descending limb of the loop of Henle is impermeable to water and permeable to electrolytes.

Statement II: The proximal convoluted tubule is lined by simple columnar brush border epithelium and increases the surface area for reabsorption.

- (1) Statement I is false but Statement II is true
- (2) Both Statement I and Statement II are true
- (3) Both Statement I and Statement II are false
- (4) Statement I is true but Statement II is false

Correct Answer: (3) Both Statement I and Statement II are false

Solution:

Step 1: Understanding the Descending Limb of the Loop of Henle

- The descending limb of the loop of Henle is actually permeable to water and impermeable to electrolytes.
- Therefore, Statement I is false.

Step 2: Understanding the Proximal Convoluted Tubule (PCT)

- The proximal convoluted tubule (PCT) is lined by simple cuboidal epithelium with a brush border, not simple columnar epithelium.
- This brush border helps in increasing the surface area for reabsorption. - Therefore, Statement II is also false.

Quick Tip

- The descending limb of the loop of Henle is permeable to water but impermeable to salts and solutes.
- The proximal convoluted tubule is lined with simple cuboidal epithelium with microvilli to maximize absorption.

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

Assertion A: FSH acts upon ovarian follicles in females and Leydig cells in males.

Reason R: Growing ovarian follicles secrete estrogen in females while interstitial cells secrete androgen in male human beings.

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

Correct Answer: (1) A is false but R is true

Solution:

Step 1: Understanding the Role of FSH - Follicle Stimulating Hormone (FSH) acts on ovarian follicles in females and Sertoli cells in males, not Leydig cells.

- Leydig cells are stimulated by Luteinizing Hormone (LH) to produce androgens.
- Therefore, Assertion (A) is false.

Step 2: Understanding the Hormonal Secretion

- Growing ovarian follicles secrete estrogen in females.
- Interstitial cells (Leydig cells) secrete androgen in males.
- This statement is factually correct.
- Therefore, Reason (R) is true.

Quick Tip

- FSH stimulates ovarian follicle growth in females and Sertoli cells in males.
- LH stimulates Leydig cells to secrete testosterone in males.
- Estrogen is secreted by growing ovarian follicles in females.

3. Which one of the following factors will not affect the Hardy-Weinberg equilibrium?

- (1) Constant gene pool
- (2) Genetic recombination
- (3) Genetic drift
- (4) Gene migration

Correct Answer: (1) Constant gene pool

Solution:

Step 1: Understanding Hardy-Weinberg Equilibrium

- The Hardy-Weinberg principle states that allele and genotype frequencies in a population remain constant from generation to generation in the absence of evolutionary forces.

Step 2: Factors Affecting Hardy-Weinberg Equilibrium

- Factors that disrupt equilibrium include:
- Genetic drift: Random changes in allele frequency.
- Genetic recombination: Can lead to variation and changes in allele frequency.
- Gene migration: Introduction of new alleles into a population.

Step 3: Why Constant Gene Pool Does Not Affect Equilibrium

- A constant gene pool means that allele frequencies do not change over generations.
- This maintains the Hardy-Weinberg equilibrium, fulfilling the principle's assumptions.

Quick Tip

The Hardy-Weinberg equilibrium remains stable when: - No mutation occurs. - No natural selection acts on the population. - No gene flow (migration) occurs. - No genetic drift occurs. - Random mating happens within the population.

4. Which of the following are Autoimmune disorders?

- A. Myasthenia gravis
- B. Rheumatoid arthritis
- C. Gout
- D. Muscular dystrophy
- E. Systemic Lupus Erythematosus (SLE)

Choose the most appropriate answer from the options given below:

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

Correct Answer: (3) A, B & E only

Solution:

Step 1: Understanding Autoimmune Disorders Autoimmune diseases occur when the body's immune system mistakenly attacks its own cells, tissues, or organs.

Step 2: Evaluating Each Condition - Myasthenia gravis (A): An autoimmune disorder where antibodies attack neuromuscular junctions, causing muscle weakness.

- **Rheumatoid arthritis (B):** An autoimmune disorder leading to joint inflammation and damage.

- **Gout (C):** Not an autoimmune disease; it results from uric acid accumulation.

- **Muscular dystrophy (D):** A genetic disorder, not an autoimmune condition.

- **Systemic Lupus Erythematosus (E):** A severe autoimmune disease affecting multiple organs.

Step 3: Conclusion - The correct autoimmune disorders from the list are Myasthenia gravis (A), Rheumatoid arthritis (B), and SLE (E). - Therefore, the correct answer is (3) A, B & E only.

Quick Tip

Common autoimmune disorders include: - Type 1 Diabetes, where the immune system attacks insulin-producing cells. - Multiple Sclerosis (MS), affecting the nervous system. - Hashimoto's Thyroiditis, where the immune system attacks the thyroid gland.

5. Given below are some stages of human evolution.

Arrange them in correct sequence. (Past to Recent)

- A. *Homo habilis*
- B. *Homo sapiens*
- C. *Homo neanderthalensis*
- D. *Homo erectus*

Choose the correct sequence of human evolution from the options given below:

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

Correct Answer: (1) A-D-C-B

Solution:

Step 1: Understanding Human Evolution The evolution of modern humans occurred in a sequence from primitive hominins to *Homo sapiens*. The correct chronological order follows:

1. *Homo habilis* (A): Earliest member of the genus Homo, known for using primitive tools.
2. *Homo erectus* (D): More advanced than *Homo habilis*, developed better tools and control over fire.
3. *Homo neanderthalensis* (C): A close relative of modern humans, exhibiting advanced social behavior.
4. *Homo sapiens* (B): The most recent species, representing modern humans.

Step 2: Conclusion - The correct chronological order of human evolution is A → D → C → B. - Therefore, the correct answer is (1) A-D-C-B.

Quick Tip

Key evolutionary traits: - *Homo habilis*: First tool users. - *Homo erectus*: First to use fire. - *Homo neanderthalensis*: Adapted to cold climates. - *Homo sapiens*: Modern humans with advanced cognitive abilities.

6. Given below are two statements:

Statement I: The presence or absence of hymen is not a reliable indicator of virginity.

Statement II: The hymen is torn during the first coitus only.

- (1) Statement I is false but Statement II is true
- (2) Both Statement I and Statement II are true
- (3) Both Statement I and Statement II are false
- (4) Statement I is true but Statement II is false

Correct Answer: (4) Statement I is true but Statement II is false

Solution:

Step 1: Understanding the Hymen and Virginity

- The hymen is a thin membrane that partially covers the vaginal opening.
- Its presence or absence is not a reliable indicator of virginity, as it can be stretched or torn due to various physical activities such as sports, cycling, or medical examinations.
- Thus, Statement I is true.

Step 2: Examining Statement II - While the hymen may tear during first coitus, it is not the only reason for its rupture.

- Many women are born with a minimal hymenal membrane, while others may experience its rupture due to non-sexual activities.
- Therefore, Statement II is false.

Step 3: Conclusion - Since Statement I is true and Statement II is false, the correct answer is (4) Statement I is true but Statement II is false.

Quick Tip

The hymen can be stretched or torn due to physical activities such as sports, horse riding, or tampon use. Its presence or absence should not be considered an indicator of virginity.

7. Match List I with List II

List I		List II	
A.	Non-medicated IUD	I.	Multiload 375
B.	Copper releasing IUD	II.	Progestogens
C.	Hormone releasing IUD	III.	Lippes loop
D.	Implants	IV.	LNG-20

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

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

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

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

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

Solution:

Step 1: Understanding the Types of Intrauterine Devices (IUDs) and Implants

- **Non-medicated IUD (A):** The Lippes loop is an example of a non-medicated IUD, which prevents implantation by inducing a local inflammatory response.

- **Copper releasing IUD (B):** Multiload 375 is a copper-releasing IUD that enhances contraceptive effectiveness by releasing copper ions, which reduce sperm motility.

- **Hormone releasing IUD (C):** LNG-20 (Levonorgestrel-releasing IUD) is a hormone-based IUD that releases progestogen, preventing implantation.

- **Implants (D):** Progestogens are used in contraceptive implants, which release hormones steadily into the bloodstream to prevent ovulation.

Step 2: Conclusion - Based on the correct matching: - A → III (Lippes loop)

- B → I (Multiload 375)

- C → IV (LNG-20)

- D → II (Progestogens)

Thus, the correct answer is (1) A-III, B-I, C-IV, D-II.

Quick Tip

Hormone-releasing IUDs release synthetic progestogens like Levonorgestrel, whereas copper IUDs work by releasing copper ions that reduce sperm viability and mobility.

8. Consider the following statements:

- A. Annelids are true coelomates
- B. Poriferans are pseudocoelomates
- C. Aschelminthes are acoelomates
- D. Platyhelminthes are pseudocoelomates

Choose the correct answer from the options given below : (1) D only

- (2) B only
- (3) A only
- (4) C only

Correct Answer: (3) A only

Solution:

Step 1: Understanding Coelomates, Pseudocoelomates, and Acoelomates

- Coelomates: These animals have a true coelom lined with mesoderm. Example: **Annelids** (Correct Statement A).
- Pseudocoelomates: These animals have a body cavity but it is not lined entirely with mesoderm. Example: **Aschelminthes (Nematodes)**, not Poriferans. (Statement B is incorrect).
- Acoelomates: These animals lack a coelom. Example: Platyhelminthes, not Aschelminthes (Statement C is incorrect).
- Platyhelminthes are acoelomates, not pseudocoelomates (Statement D is incorrect).

Step 2: Conclusion - The only correct statement is A (Annelids are true coelomates).

- Hence, the correct answer is (3) A only.

Quick Tip

Acoelomates (e.g., Platyhelminthes) lack a body cavity, pseudocoelomates (e.g., Nematodes) have a false coelom, and true coelomates (e.g., Annelids) have a coelom lined entirely by mesoderm.

9. Which of the following factors are favourable for the formation of oxyhaemoglobin in alveoli?

- (1) Low $p\text{CO}_2$ and High temperature
- (2) High $p\text{O}_2$ and High $p\text{CO}_2$
- (3) High $p\text{O}_2$ and Lesser H^+ concentration
- (4) Low $p\text{CO}_2$ and High H^+ concentration

Correct Answer: (3) High $p\text{O}_2$ and Lesser H^+ concentration

Solution:

Step 1: Understanding Oxyhaemoglobin Formation

- Oxyhaemoglobin (**HbO_2**) formation occurs when oxygen binds to haemoglobin in the alveoli.
- This process is favoured by high partial pressure of oxygen ($p\text{O}_2$) and low concentration of H^+ ions (less acidity).

Step 2: Evaluating the Given Options

- Option (1): High temperature does not favour oxyhaemoglobin formation, as higher temperatures cause dissociation of **HbO_2** .
- Option (2): High $p\text{CO}_2$ increases acidity, which promotes oxygen dissociation rather than binding.
- Option (3) (Correct): High $p\text{O}_2$ enhances oxygen binding to haemoglobin, and lower H^+ concentration prevents oxygen dissociation.
- Option (4): High H^+ concentration leads to oxyhaemoglobin dissociation rather than formation.

Step 3: Conclusion - The correct answer is (3) High $p\text{O}_2$ and Lesser H^+ concentration.

Quick Tip

In the alveoli, oxygen binding to haemoglobin is favoured by: 1. **High $p\text{O}_2$** , ensuring efficient loading of oxygen. 2. **Low $p\text{CO}_2$** , reducing carbonic acid formation. 3. **Lower H^+ concentration**, maintaining haemoglobin's affinity for oxygen.

10. Match List I with List II:

	List I		List II
A.	Expiratory capacity	I.	Expiratory reserve volume + Tidal volume + Inspiratory reserve volume
B.	Functional residual capacity	II.	Tidal volume + Expiratory reserve volume
C.	Vital capacity	III.	Tidal volume + Inspiratory reserve volume
D.	Inspiratory capacity	IV.	Expiratory reserve volume + Residual volume

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

Solution:

Step 1: Understanding the Respiratory Capacities

1. Expiratory Capacity (A): The sum of Tidal Volume and Expiratory Reserve Volume, which corresponds to (II).
2. Functional Residual Capacity (B): The sum of Expiratory Reserve Volume and Residual Volume, which matches (IV).
3. Vital Capacity (C): The sum of Expiratory Reserve Volume, Tidal Volume, and Inspiratory Reserve Volume, which corresponds to (I).
4. Inspiratory Capacity (D): The sum of Tidal Volume and Inspiratory Reserve Volume, which matches (III).

Step 2: Evaluating the Given Options

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

Step 3: Conclusion - The correct answer is (2) A-II, B-IV, C-I, D-III.

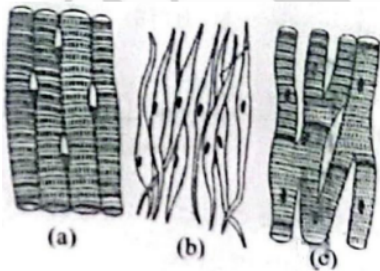
Quick Tip

Respiratory capacities are derived from the combination of different lung volumes: 1.

Vital Capacity (VC) = IRV + TV + ERV 2. **Inspiratory Capacity (IC)** = TV + IRV

3. **Expiratory Capacity (EC)** = TV + ERV 4. **Functional Residual Capacity (FRC)**
= ERV + RV

11. Three types of muscles are given as a, b, and c. Identify the correct matching pair along with their location in the human body:



Name of muscle/location

1. (a) Involuntary - Nose tip
(b) Skeletal - Bone
(c) Cardiac - Heart
2. (a) Smooth - Toes
(b) Skeletal - Legs
(c) Cardiac - Heart
3. (a) Skeletal - Triceps
(b) Smooth - Stomach
(c) Smooth - Heart
4. (a) Skeletal - Biceps
(b) Involuntary - Intestine
(c) Cardiac - Heart

Correct Answer: (3) (a) Skeletal - Triceps, (b) Smooth - Stomach, (c) Smooth - Heart

Solution:**Step 1: Understanding the Muscle Types and Locations**

1. Skeletal Muscle (a): These are voluntary muscles attached to bones and responsible for movement. Example: Triceps.
2. Smooth Muscle (b): These are involuntary muscles found in internal organs like the stomach.
3. Cardiac Muscle (c): Found only in the heart, responsible for pumping blood.

Step 2: Evaluating the Given Options

- Option (1): Incorrect, as nose tip does not contain involuntary muscle.
- Option (2): Incorrect, as toes do not primarily have smooth muscle.
- Option (3) (Correct): Skeletal muscle in triceps, smooth muscle in stomach, and cardiac muscle in heart.
- Option (4): Incorrect, as intestines do not belong in this specific classification.

Step 3: Conclusion - The correct answer is (3) Skeletal - Triceps, Smooth - Stomach, Cardiac - Heart.

Quick Tip

Muscles are classified into three types: 1. Skeletal Muscle: Voluntary, striated, multi-nucleated, attached to bones. 2. Smooth Muscle: Involuntary, non-striated, found in organs like intestines, stomach. 3. Cardiac Muscle: Involuntary, striated, intercalated discs, found only in the heart.

12. The flippers of the Penguins and Dolphins are the example of the

Divergent evolution Adaptive radiation Natural selection Convergent evolution

Correct Answer: (4) Convergent evolution

Solution:**Step 1: Understanding Convergent Evolution**

Convergent evolution refers to the process where organisms that are not closely related independently evolve similar traits as a result of adapting to similar environments or

ecological niches. This occurs despite having different ancestral lineages.

Step 2: Why Flippers of Penguins and Dolphins Exhibit Convergent Evolution?

- **Penguins (Birds)** and **Dolphins (Mammals)** belong to different taxonomic groups but have evolved **flippers** as a common adaptive feature.
- These flippers aid in **swimming** and survival in an aquatic environment.
- Despite their distinct evolutionary backgrounds, both species developed **similar morphological structures** due to **similar environmental pressures**.

Step 3: Eliminating Incorrect Options

- **Divergent Evolution (Option 1)**: Occurs when related species evolve different traits due to adaptation to different environments. Example: Darwin's finches.
- **Adaptive Radiation (Option 2)**: Rapid diversification of a species into multiple forms, adapting to different ecological niches. Example: Galápagos finches.
- **Natural Selection (Option 3)**: A process that favors the survival of organisms best suited to their environment but does not necessarily lead to the independent evolution of similar traits in unrelated species.

Conclusion: Since penguins and dolphins independently evolved flippers due to similar aquatic environments, they exhibit **Convergent Evolution**. Thus, the correct answer is **(4) Convergent evolution**.

13. Match List I with List II:

Choose the correct answer from the options given below:

A-II, B-IV, C-III, D-I A-I, B-III, C-II, D-IV A-IV, B-III, C-I, D-II A-III, B-I, C-IV, D-II

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

Solution:

Step 1: Understanding the Diseases and Their Classification

List I		List II	
A.	Typhoid	I.	Fungus
B.	Leishmaniasis	II.	Nematode
C.	Ringworm	III.	Protozoa
D.	Filariasis	IV.	Bacteria

- **Typhoid** is caused by the bacterium *Salmonella typhi*, so it belongs to the **Bacteria** category. (A-IV)
- **Leishmaniasis** is caused by the protozoan parasite *Leishmania*, so it belongs to the **Protozoa** category. (B-III)
- **Ringworm** is a fungal infection caused by *Trichophyton* species, so it belongs to the **Fungus** category. (C-I)
- **Filariasis** is caused by parasitic nematodes such as *Wuchereria bancrofti*, so it belongs to the **Nematode** category. (D-II)

Step 2: Verifying the Options

- Option (1): Incorrect, as Typhoid is not related to Nematodes.
- Option (2): Incorrect, as Ringworm is not caused by Nematodes.
- Option (3): Correct, as it matches all diseases with their correct classification.
- Option (4): Incorrect, as it mismatches diseases and causative organisms.

Conclusion: The correct matching is **A-IV, B-III, C-I, D-II**, thus the correct answer is **(3)**.

14. Following are the stages of pathway for conduction of an action potential through the heart:

- A. AV bundle
- B. Purkinje fibres
- C. AV node
- D. Bundle branches
- E. SA node

Choose the correct sequence of pathway from the options given below:

E-A-D-B-C E-C-A-D-B A-E-C-B-D B-D-E-C-A

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

Solution:

Step 1: Understanding the Electrical Conduction Pathway in the Heart

The sequence of electrical conduction in the heart is:

- **Sinoatrial (SA) Node (E):** The natural pacemaker of the heart where the electrical impulse originates.
- **Atrioventricular (AV) Node (C):** Delays the impulse before passing it to the ventricles.
- **AV Bundle (A) (Bundle of His):** Conducts the impulse from the AV node to the ventricles.
- **Bundle Branches (D):** Conducts the impulse down the interventricular septum.
- **Purkinje Fibers (B):** Distribute the impulse throughout the ventricular myocardium for contraction.

Step 2: Matching the Sequence with the Given Options

The correct sequence of conduction is:

SA node (E) → AV node (C) → AV bundle (A) → Bundle branches (D) → Purkinje fibers (B)

Now, checking the options:

- Option (1): Incorrect order.
- Option (2): Correct order (**E-C-A-D-B**).

- Option (3): Incorrect order.
- Option (4): Incorrect order.

Conclusion: The correct pathway is **E-C-A-D-B**, thus the correct answer is **(2)**.

15. Match List I with List II:

List-I	Enzyme	List-II	Bond Broken
A.	Lipase	I.	Peptide bond
B.	Nuclease	II.	Ester bond
C.	Protease	III.	Glycosidic bond
D.	Amylase	IV.	Phosphodiester bond

Choose the correct answer from the options given below: (1) A-IV, B-I, C-III, D-II (2) A-IV, B-II, C-III, D-I (3) A-III, B-II, C-I, D-IV (4) A-II, B-IV, C-I, D-III

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

Solution:

Step 1: Understanding the functions of the given enzymes:

- **Lipase:** Breaks ester bonds in lipids → **II. Ester bond.**
- **Nuclease:** Breaks phosphodiester bonds in nucleic acids → **IV. Phosphodiester bond.**
- **Protease:** Breaks peptide bonds in proteins → **I. Peptide bond.**
- **Amylase:** Breaks glycosidic bonds in polysaccharides → **III. Glycosidic bond.**

Thus, the correct matching is:

A-II, B-IV, C-I, D-III

Quick Tip

Understanding enzyme specificity and the bonds they act upon is crucial for solving biochemical matching problems efficiently.

16. Which of the following statements is incorrect?

Bio-reactors have an agitator system, an oxygen delivery system, and a foam control system. A bio-reactor provides optimal growth conditions for achieving the desired product. Most commonly used bio-reactors are of stirring type. Bio-reactors are used to produce small-scale bacterial cultures.

Correct Answer: (4) Bio-reactors are used to produce small-scale bacterial cultures.

Solution:

Step 1: Understanding Bio-reactors

A bio-reactor is a controlled system designed for the large-scale production of microorganisms, cells, or enzymes. It provides:

- Agitation for uniform mixing.
- Oxygen delivery for aerobic cultures.
- Foam control systems to prevent excessive foam formation.

Step 2: Analyzing the Statements

- **Statement 1:** Correct. Bio-reactors are equipped with an agitator system, an oxygen delivery mechanism, and a foam control system.
- **Statement 2:** Correct. Bio-reactors maintain optimal growth conditions to maximize product yield.
- **Statement 3:** Correct. Stirred tank bio-reactors are the most commonly used type.
- **Statement 4:** Incorrect. Bio-reactors are typically used for large-scale production, not small-scale bacterial cultures.

Conclusion: The incorrect statement is **Statement 4**, making option (4) the correct answer.

Quick Tip

Bio-reactors are mainly used in industrial and pharmaceutical applications for large-scale fermentation and cell culture processes.

17. The "Ti plasmid" of *Agrobacterium tumefaciens* stands for:

Temperature independent plasmid

Tumour inhibiting plasmid

Tumor independent plasmid

Tumor inducing plasmid

Correct Answer: (4) Tumor inducing plasmid.

Solution:

Step 1: Understanding the Ti Plasmid

The **Ti plasmid** (Tumor-inducing plasmid) is found in *Agrobacterium tumefaciens*, a soil bacterium known for causing crown gall disease in plants. The plasmid carries *T-DNA*, which integrates into the plant genome and leads to tumor formation.

Step 2: Analyzing the Statements

- **Statement 1:** Incorrect. The Ti plasmid is not related to temperature independence.
- **Statement 2:** Incorrect. The plasmid does not inhibit tumors; rather, it induces them.
- **Statement 3:** Incorrect. It is not tumor-independent; it actively promotes tumor formation.
- **Statement 4:** Correct. The Ti plasmid is responsible for inducing tumors in plants.

Conclusion: The correct answer is **option (4)**.

Quick Tip

The Ti plasmid is widely used in genetic engineering to transfer desirable genes into plant cells.

18. Match List I with List II:

List I	List II
A.Common cold	I.Plasmodium
B.Hemozoin	II.Typhoid
C.Widal test	III.Rhinoviruses
D.Allergy	IV.Dust mites

Choose the correct answer from the options given below:

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

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

Solution: Step 1: Analyze the options by identifying the correct matching between the terms in List I and List II.

- Common cold is caused by Rhinoviruses, which matches with III.
- Hemozoin is produced by Plasmodium, matching with I.
- Widal test is used to diagnose Typhoid, which matches with II.
- Allergy is related to Dust mites, matching with IV.

Thus, the correct matching is:

$A - III, B - I, C - II, D - IV.$

Quick Tip

Understanding the causes of diseases and the tests used for diagnosis can help match the right terms effectively.

19. Following are the stages of cell division:

- A. Gap 2 phase
- B. Cytokinesis
- C. Synthesis phase
- D. Karyokinesis
- E. Gap 1 phase

Choose the correct sequence of stages from the options given below:

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

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

Solution: Step 1: Analyze the stages of cell division:

- Gap 1 phase (E) occurs first, as it is the stage before synthesis.
- Synthesis phase (C) comes after Gap 1 phase, where DNA replication occurs.
- Gap 2 phase (A) follows synthesis phase, where the cell prepares for mitosis.
- Karyokinesis (D) is the division of the nucleus during mitosis.
- Cytokinesis (B) occurs last, where the cytoplasm divides, resulting in two daughter cells.

Thus, the correct sequence is:

$$E - C - A - D - B.$$

Quick Tip

Remember the order of the stages in cell division: Gap 1 phase (E), Synthesis phase (C), Gap 2 phase (A), Karyokinesis (D), and Cytokinesis (B).

20. Which of the following is not a natural/traditional contraceptive method?

- (1) Vaults
- (2) Coitus interruptus
- (3) Periodic abstinence
- (4) Lactational amenorrhea

Correct Answer: (1) Vaults

Solution:

Step 1: Understand the natural/traditional contraceptive methods:

- Coitus interruptus (2), also known as withdrawal method, is a natural contraceptive method where the male partner withdraws before ejaculation.
- Periodic abstinence (3) involves avoiding sexual intercourse during the fertile period of the woman's menstrual cycle.
- Lactational amenorrhea (4) is the temporary natural infertility that occurs after childbirth when a woman is breastfeeding, which can act as a contraceptive.

Vaults (1), however, is not a traditional contraceptive method; it is not recognized as a natural or traditional way to prevent pregnancy.

Thus, the correct answer is:

Vaults (1).

Quick Tip

Traditional contraceptive methods often rely on natural cycles or physical withdrawal, whereas Vaults are not a recognized method.

21. Match List I with List II:

List I	List II
<i>A. Pleurobrachia</i>	<i>I. Mollusca</i>
<i>B. Radula</i>	<i>II. Ctenophora</i>
<i>C. Stomochord</i>	<i>III. Osteichthyes</i>
<i>D. Air bladder</i>	<i>IV. Hemichordata</i>

Choose the correct answer from the options given below:

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

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

Solution:

Step 1: Match the items from List I with the corresponding items in List II:

- Pleurobrachia (A) is a member of the phylum Ctenophora, so it matches with II.
- Radula (B) is an organ found in Mollusca, so it matches with I.
- Stomochord (C) is a characteristic of Hemichordata, so it matches with IV.
- Air bladder (D) is found in Osteichthyes (bony fish), so it matches with III.

Thus, the correct matching is:

$$A - II, B - I, C - IV, D - III.$$

Quick Tip

Understand the classification and key characteristics of various phyla to help match terms correctly.

22. Which one is the correct product of DNA dependent RNA polymerase to the given template?

3' TACATGGCAAATATCCATTCA5'

Choose the correct answer from the options given below:

- (1) 5' ATGACCgttTTAAGT3'
- (2) 5' AUGACCGUUUAGGUG3'
- (3) 5' AUGUAAAGUUUAGGAAGU3'
- (4) 5' AUGUACCGUUUAGGGAAGU3'

Correct Answer: (2) 5' AUGACCGUUUAGGUG3'

Solution:

Step 1: The DNA template strand is given, and we need to transcribe it to RNA. During transcription, RNA polymerase synthesizes the RNA strand in the 5' to 3' direction, using the DNA template strand in the 3' to 5' direction.

The RNA sequence is complementary to the template strand, where:

- A (Adenine) pairs with U (Uracil) in RNA.
- T (Thymine) pairs with A (Adenine) in RNA.
- C (Cytosine) pairs with G (Guanine) in RNA.
- G (Guanine) pairs with C (Cytosine) in RNA.

By applying these rules, we transcribe the given DNA template strand (3' TACATGGCAAATATCCATTCA 5') to the RNA sequence:

5' AUGACCGUUUAGGUG3'

Thus, the correct RNA sequence is:

5' AUGACCGUUUAGGUG3'.

Quick Tip

Remember the base pairing rules during transcription: - A (DNA) pairs with U (RNA), - T (DNA) pairs with A (RNA), - C (DNA) pairs with G (RNA), - G (DNA) pairs with C (RNA).

23. Match List I with List II:

List I	List II
<i>A.</i> α – I antitrypsin	<i>I.</i> Cotton bollworm
<i>B.</i> Cry IAb	<i>II.</i> ADA deficiency
<i>C.</i> Cry IAc	<i>III.</i> Emphysema
<i>D.</i> Enzyme replacement therapy	<i>IV.</i> Corn borer

Choose the correct answer from the options given below:

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

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

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

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

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

Solution: Step 1: Analyze each term in List I and match it with the correct term from List II:

- α – I antitrypsin (A) is related to Emphysema (III). α – I antitrypsin deficiency leads to emphysema, a lung condition.
- Cry IAb (B) is related to Cotton bollworm (I). Cry proteins are used in genetically modified crops like cotton to control pests like the bollworm.
- Cry IAc (C) is related to Corn borer (IV). Cry proteins also provide protection against pests like the corn borer.
- Enzyme replacement therapy (D) is related to ADA deficiency (II). Enzyme replacement therapy is used to treat ADA (Adenosine deaminase) deficiency, a genetic disorder.

Thus, the correct matching is:

$$A - III, B - IV, C - I, D - II.$$

Quick Tip

Understanding the relationship between genetic disorders, enzyme deficiencies, and their treatments, along with the use of Cry proteins in pest control, is essential for matching the terms correctly.

24. Match List I with List II:

List I	List II
<i>A.Pterophyllum</i>	<i>I.Hag fish</i>
<i>B.Myxine</i>	<i>II.Saw fish</i>
<i>C.Pristis</i>	<i>III.Angel fish</i>
<i>D.Exocoetus</i>	<i>IV.Flying fish</i>

Choose the correct answer from the options given below:

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

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

Solution:

Step 1: Match the terms from List I with the correct terms from List II:

- Pterophyllum (A) is the scientific name for the Angel fish (III).
- Myxine (B) is the scientific name for the Hag fish (I).
- Pristis (C) is the scientific name for the Saw fish (II).
- Exocoetus (D) is the scientific name for the Flying fish (IV).

Thus, the correct matching is:

$$A - III, B - I, C - II, D - IV.$$

Quick Tip

Remember the unique characteristics of different fish species, such as the flying ability of Exocoetus and the distinct appearance of Pristis, to help identify the correct matches.

25. Which of the following is not a component of Fallopian tube?

- (1) Ampulla
- (2) Uterine fundus
- (3) Isthmus
- (4) Infundibulum

Correct Answer: (2) Uterine fundus

Solution:

Step 1: The Fallopian tube consists of the following parts:

- Ampulla: The part of the Fallopian tube where fertilization usually occurs.
- Isthmus: The narrow part of the Fallopian tube that connects to the uterus.
- Infundibulum: The funnel-shaped opening of the Fallopian tube near the ovary, which catches the egg.

Uterine fundus, however, is a part of the uterus, not the Fallopian tube. Therefore, it is not a component of the Fallopian tube.

Thus, the correct answer is:

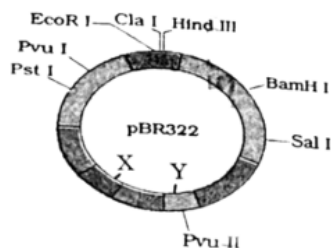
Uterine fundus (2).

Quick Tip

The Fallopian tube includes the ampulla, isthmus, and infundibulum, but the uterine fundus is part of the uterus.

26. The following diagram showing restriction sites in E. coli cloning vector pBR322.

Find the role of 'X' and 'Y' genes:



Choose the correct answer from the options given below:

- (1) Gene 'X' is responsible for recognition sites and 'Y' is responsible for antibiotic resistance.
- (2) The gene 'X' is responsible for resistance to antibiotics and 'Y' for protein involved in the replication of Plasmid.
- (3) The gene 'X' is responsible for controlling the copy number of the linked DNA and 'Y' for protein involved in the replication of Plasmid.
- (4) The gene 'X' is for protein involved in replication of Plasmid and 'Y' for resistance to antibiotics.

Correct Answer: (3) The gene 'X' is responsible for controlling the copy number of the linked DNA and 'Y' for protein involved in the replication of Plasmid.

Solution:

Step 1: In the pBR322 cloning vector:

- Gene X: It is responsible for controlling the copy number of the linked plasmid DNA. It ensures that the plasmid is replicated at the proper rate to maintain a suitable number of plasmids within the host cell.
 - Gene Y: This gene codes for a protein that is involved in the replication of the plasmid. It plays a critical role in the DNA replication machinery, ensuring the plasmid DNA is copied.
- Thus, the correct answer is:

Gene 'X' controls copy number of linked DNA and gene 'Y' is involved in replication of plasmid.

Quick Tip

In plasmid vectors like pBR322, the replication control gene (X) and replication initiation proteins (Y) work together to maintain plasmid stability and replication within the host.

27. Match List I with List II:

List I	List II
<i>A</i> .Fibrous joints	<i>I</i> .Adjacent vertebrae, limited movement
<i>B</i> .Cartilaginous joints	<i>II</i> .Humerus and Pectoral girdle, rotational movement
<i>C</i> .Hinge joints	<i>III</i> .Skull, don't allow any movement
<i>D</i> .Ball and socket joints	<i>IV</i> .Knee, help in locomotion

Choose the correct answer from the options given below:

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

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

Solution:

Step 1: Match the terms from List I with the correct terms from List II:

- Fibrous joints (A): These joints are immovable and found between adjacent vertebrae, allowing limited movement. Therefore, they match with I.
- Cartilaginous joints (B): These joints are semi-movable and are found in areas like the humerus and pectoral girdle, allowing rotational movement. Thus, they match with II.
- Hinge joints (C): These joints, like the knee, help in movement and are located in places where bending occurs. Hence, they match with IV.
- Ball and socket joints (D): These joints, like the skull, allow no movement and provide stability. Therefore, they match with III.

Thus, the correct matching is:

$$A - I, B - II, C - IV, D - III.$$

Quick Tip

Fibrous joints allow limited movement, cartilaginous joints allow rotational movement, hinge joints enable bending, and ball-and-socket joints offer a wide range of motion.

28. Which of the following is not a steroid hormone?

- (1) Glucagon
- (2) Cortisol
- (3) Testosterone
- (4) Progesterone

Correct Answer: (1) Glucagon

Solution: Step 1: Understand the classification of hormones:

- Steroid hormones are derived from cholesterol and include hormones like Cortisol, Testosterone, and Progesterone. These hormones are lipid-soluble and can pass through cell membranes to bind with intracellular receptors.
- Glucagon (1) is a peptide hormone, not a steroid hormone. It is produced by the pancreas and plays a key role in regulating blood sugar levels.

Thus, the correct answer is:

Glucagon (1).

Quick Tip

Steroid hormones are derived from cholesterol, while peptide hormones like glucagon are made of amino acids and are water-soluble.

29. Match List I with List II:

List I	List II
A.Axoneme	I.Centrioles
B.Cartwheel pattern	II.Cilia and flagella
C.Crista	III.Chromosome
D.Satellite	IV.Mitochondria

Choose the correct answer from the options given below:

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

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

Solution:

Step 1: Match the terms from List I with the correct terms from List II:

- Axoneme (A) is the central structure of cilia and flagella, so it matches with II (Cilia and flagella).
- Cartwheel pattern (B) is seen in centrioles, so it matches with I (Centrioles).
- Crista (C) is the inner membrane structure found in mitochondria, so it matches with IV (Mitochondria).
- Satellite (D) is related to chromosomes, so it matches with III (Chromosome).

Thus, the correct matching is:

$$A - II, B - I, C - IV, D - III.$$

Quick Tip

The structure and patterns in cellular organelles are unique. For instance, the axoneme is crucial for cilia and flagella, while cartwheel patterns are characteristic of centrioles.

30. Match List I with List II:

List I	List II
A.Cocaine	I.Effective sedative in surgery
B.Heroin	II.Cannabis sativa
C.Morphine	III.Erythroxylum
D.Marijuana	IV.Papaver somniferum

Choose the correct answer from the options given below:

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

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

Solution:

Step 1: Match the terms from List I with the correct terms from List II:

- Cocaine (A) is derived from Erythroxylum (III), a plant that produces the stimulant.
- Heroin (B) is derived from Papaver somniferum (IV), also known as the opium poppy.
- Morphine (C) is derived from Papaver somniferum (IV), and it is often used as an effective sedative in surgery.
- Marijuana (D) is derived from Cannabis sativa (II), a plant that produces the drug.

Thus, the correct matching is:

$$A - III, B - IV, C - I, D - II.$$

Quick Tip

Understanding the sources of various drugs can help match them with their respective plants or derivatives, such as cocaine from Erythroxylum and marijuana from Cannabis sativa.

31. In both sexes of cockroach, a pair of jointed filamentous structures called anal cerci are present on

- (1) 11th segment
- (2) 5th segment
- (3) 10th segment
- (4) 8th and 9th segment

Correct Answer: (3) 10th segment

Solution:

Step 1: The anal cerci are sensory structures found in cockroaches. These paired jointed filamentous structures are present on the 10th segment of both male and female cockroaches. Thus, the correct answer is:

10th segment (3).

Quick Tip

In cockroaches, anal cerci play an important role in detecting air currents and other environmental signals. They are located on the 10th segment.

32. Match List I with List II:

List I (Sub Phases of Prophase I)	List II (Specific Characters)
A. Diakinesis	I. Synaptonemal complex formation
B. Pachytene	II. Completion of terminalisation of chiasmata
C. Zygotene	III. Chromosomes look like thin threads
D. Leptotene	IV. Appearance of recombination nodules

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

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

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

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

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

Solution:

Step 1: The correct matching between the sub-phases of prophase I and their specific characters is as follows:

- **A. Diakinesis** corresponds to **II. Completion of terminalisation of chiasmata**. In this stage, the chromosomes are fully condensed, and the chiasmata (points where homologous chromosomes cross over) are completed.

- **B. Pachytene** corresponds to **IV. Appearance of recombination nodules**. During pachytene, the homologous chromosomes are fully paired, and recombination nodules (sites of crossover) appear.
 - **C. Zygotene** corresponds to **I. Synaptonemal complex formation**. In this stage, the synaptonemal complex is formed between homologous chromosomes, facilitating their pairing.
 - **D. Leptotene** corresponds to **III. Chromosomes look like thin threads**. During leptotene, chromosomes begin to condense but still appear as thin threads under a microscope.
- Thus, the correct matching is:

A-II, B-IV, C-I, D-III.

Quick Tip

In meiosis, the prophase I stages are characterized by the pairing and recombination of homologous chromosomes. Each stage has specific morphological characteristics that help in identifying the process.

33. Given below are two statements: One is labelled as Assertion A and the other is labelled as Reason R:

Assertion A: Breast-feeding during initial period of infant growth is recommended by doctors for bringing a healthy baby.

Reason R: Colostrum contains several antibodies absolutely essential to develop resistance for the new born baby.

In the light of the above statements, choose the most appropriate answer from the options given below:

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

Correct Answer: (2) Both A and R are correct and R is the correct explanation of A

Solution:

Step 1: Assertion A is correct. Breastfeeding is recommended by doctors during the initial period of infant growth because it provides essential nutrients and immunity to the baby.

Step 2: Reason R is also correct. Colostrum, the first milk produced by the mother after childbirth, is rich in antibodies that are crucial for the newborn's immune system to resist infections.

Step 3: Reason R provides the correct explanation for Assertion A because the antibodies in colostrum contribute to the newborn's immunity, supporting the recommendation for breastfeeding during the initial period.

Thus, both Assertion A and Reason R are correct, and Reason R correctly explains Assertion A.

Quick Tip

Breastfeeding in the initial stages not only provides nutrients but also helps in building the infant's immune system through the antibodies present in colostrum.

34. Match List I with List II:

List I	List II
A. Down's syndrome	I. 11th chromosome
B. α -Thalassemia	II. 'X' chromosome
C. β -Thalassemia	III. 21st chromosome
D. Klinefelter's syndrome	IV. 16th chromosome

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

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

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

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

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

Solution:

Step 1: Down's syndrome is caused by an extra copy of the 21st chromosome. Hence, **A.**

Down's syndrome corresponds to **III. 21st chromosome**.

Step 2: α -Thalassemia is associated with a deletion or mutation on chromosome 16. Hence,

B. α -Thalassemia corresponds to **IV. 16th chromosome**.

Step 3: β -Thalassemia is associated with mutations on chromosome 11. Hence, **C.**

β -Thalassemia corresponds to **I. 11th chromosome**.

Step 4: Klinefelter's syndrome is caused by the presence of an extra X chromosome, making males XXY. Hence, **D. Klinefelter's syndrome** corresponds to **II. 'X' chromosome**.

Thus, the correct matching is:

A-III, B-IV, C-I, D-II.

Quick Tip

Genetic disorders are often linked to mutations or anomalies in specific chromosomes. Understanding the chromosomal basis of these disorders helps in their diagnosis and study.

35. Match List I with List II:

List I	List II
A. Pons	I. Provides additional space for Neurons, regulates posture and balance.
B. Hypothalamus	II. Controls respiration and gastric secretions.
C. Medulla	III. Connects different regions of the brain.
D. Cerebellum	IV. Neurosecretory cells

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

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

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

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

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

Solution:

Step 1: A. Pons connects different regions of the brain, particularly involved in communication between the cerebellum and cerebrum. Hence, **A** corresponds to **III**.

Connects different regions of the brain.

Step 2: B. Hypothalamus controls important functions such as respiration and gastric secretions. Hence, **B** corresponds to **II. Controls respiration and gastric secretions**.

Step 3: C. Medulla contains centers that regulate vital autonomic functions like heartbeat, blood pressure, and respiration. Hence, **C** corresponds to **I. Provides additional space for neurons, regulates posture and balance**.

Step 4: D. Cerebellum plays a key role in motor control, balance, and posture regulation. Hence, **D** corresponds to **IV. Neurosecretory cells**.

Thus, the correct matching is:

A-III, B-IV, C-II, D-I.

Quick Tip

The brain is divided into various regions, each responsible for specific functions like coordination, balance, respiration, and communication between other parts of the brain.

36. As per ABO blood grouping system, the blood group of father is B⁺, mother is A⁺ and child is O⁺. Their respective genotype can be:

- (A) $|B^i|/|A^i|$
- (B) $|B^i|/|A^i|/ii$
- (C) $|A^B|/ii|A^B|$
- (D) $|A^i|/|B^i|/A^i$
- (E) $|ii|/|A^i|/B^i$

Correct Answer: (2) A only

Solution:

Step 1: The father has blood group B, which means his genotype could either be $|B^i|/|B^i|$ or $|B^i|/|A^i|$. Since the child is of blood group O, the father must have a genotype $|B^i|/|A^i|$, with the possibility of carrying the O allele.

Step 2: The mother has blood group A, which means her genotype could either be $|A^i|/|A^i|$ or $|A^i|/|B^i|$. Since the child has blood group O, the mother must also carry an O allele, so her genotype must be $|A^i|/ii$.

Step 3: The child has blood group O, which means the child must inherit an O allele from both parents. This matches the genotypes given in option A, $|B^i|/|A^i|$ for the father and $|A^i|/ii$ for the mother.

Thus, the correct answer is **A only**.

Quick Tip

In ABO blood grouping, a person with blood group O must have two O alleles (ii), whereas a person with blood group A or B may carry one O allele and one A or B allele.

37. Match List I with List II:

List I	List II
A. Unicellular glandular epithelium	I. Salivary glands
B. Compound epithelium	II. Pancreas
C. Multicellular glandular epithelium	III. Goblet cells of alimentary canal
D. Endocrine glandular epithelium	IV. Moist surface of buccal cavity

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

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

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

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

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

Solution:

Step 1: A. Unicellular glandular epithelium consists of a single cell type that secretes mucus, and it is present in the **III. Goblet cells of the alimentary canal**.

Step 2: B. Compound epithelium consists of multiple layers and is found in areas requiring protection and covering, such as **IV. Moist surface of the buccal cavity**.

Step 3: C. Multicellular glandular epithelium is composed of multiple cells and includes structures like **I. Salivary glands**.

Step 4: D. Endocrine glandular epithelium releases hormones directly into the bloodstream and is present in organs such as the **II. Pancreas**.

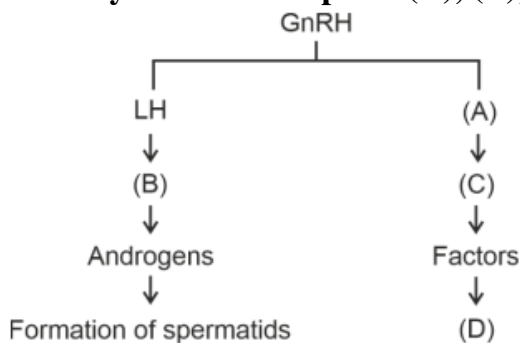
Thus, the correct matching is:

A-III, B-IV, C-I, D-II.

Quick Tip

Glandular epithelium can be unicellular (e.g., goblet cells), multicellular (e.g., salivary glands), or endocrine (e.g., pancreas), each serving distinct functions such as secretion and hormone release.

38. Identify the correct option (A), (B), (C), (D) with respect to spermatogenesis.



- (1) ICSH, Leydig cells, Sertoli cells, spermatogenesis
- (2) FSH, Leydig cells, Sertoli cells, spermiogenesis
- (3) ICSH, Interstitial cells, Leydig cells, spermiogenesis
- (4) FSH, Sertoli cells, Leydig cells, spermatogenesis

Correct Answer: (2) FSH, Leydig cells, Sertoli cells, spermiogenesis

Solution:

Step 1: The question describes the hormonal regulation of spermatogenesis, beginning with GnRH (Gonadotropin-releasing hormone). GnRH stimulates the release of **LH** (Luteinizing hormone), which acts on **Leydig cells** to stimulate the production of **androgens** (testosterone).

Step 2: Androgens then promote the function of **Sertoli cells**, which are responsible for the nourishment and development of sperm cells.

Step 3: **FSH** (Follicle-stimulating hormone) also plays a role in regulating Sertoli cells and aiding in the process of **spermiogenesis**, which is the final stage of sperm cell maturation, forming mature sperm from spermatids.

Thus, the correct sequence is:

FSH, Leydig cells, Sertoli cells, spermiogenesis.

Quick Tip

Spermatogenesis involves the process where spermatogonia develop into mature sperm cells. Spermiogenesis is the final maturation of spermatids into spermatozoa, which involves the action of hormones such as FSH and LH.

39. Given below are two statements:

Statement I: Gause's competitive exclusion principle states that two closely related species competing for different resources cannot exist indefinitely.

Statement II: According to Gause's principle, during competition, the inferior will be eliminated. This may be true if resources are limiting.

In the light of the above statements, choose the correct answer from the options given below:

- (1) Statement I is false but Statement II is true.
- (2) Both Statement I and Statement II are true.
- (3) Both Statement I and Statement II are false.
- (4) Statement I is true but Statement II is false.

Correct Answer: (1) Statement I is false but Statement II is true.

Solution:

Step 1: Statement I is incorrect. Gause's competitive exclusion principle states that two closely related species that compete for the same resources cannot coexist indefinitely in the same ecological niche. It does not specifically state that they cannot compete for different resources.

Step 2: Statement II is correct. According to Gause's principle, in competitive situations, one species may be more efficient at utilizing the resources, and the inferior species may be eliminated if the resources are limited. This is consistent with the idea that competition can lead to the elimination of one species when resources are scarce.

Thus, the correct answer is **Statement I is false but Statement II is true**.

Quick Tip

The competitive exclusion principle suggests that when two species compete for identical resources in an ecological niche, one species will outcompete the other. This highlights the importance of niche differentiation in maintaining biodiversity.

40. Match List I with List II related to digestive system of cockroach.

	List I		List II
A.	The structures used for storing of food	I.	Gizzard
B.	Ring of 6-8 blind tubules at junction of foregut and midgut.	II.	Gastric Caeca
C.	Ring of 100-150 yellow coloured thin filaments at junction of midgut and hindgut.	III.	Malpighian tubules
D.	The structures used for grinding the food.	IV.	Crop

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

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

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

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

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

Solution:

Step 1: A. The structures used for storing food refers to the **IV. Crop**. The crop stores food temporarily before digestion.

Step 2: B. Ring of 6-8 blind tubules at junction of foregut and midgut refers to **II.**

Gastric Caeca. These structures are involved in digestion and absorption in cockroaches.

Step 3: C. Ring of 100-150 yellow coloured thin filaments at junction of midgut and hindgut refers to the **III. Malpighian tubules.** These tubules are involved in excretion and osmoregulation.

Step 4: D. The structures used for grinding the food refers to the **I. Gizzard,** which grinds food in the digestive system of the cockroach.

Thus, the correct matching is:

A-IV, B-II, C-III, D-I.

Quick Tip

The digestive system of the cockroach is efficient in storing, digesting, and excreting food through specialized structures like the crop, gastric caeca, malpighian tubules, and gizzard.

41. Match List I with List II:

List I	List II
A. Mesozoic Era	I. Lower invertebrates
B. Proterozoic Era	II. Fish & Amphibia
C. Cenozoic Era	III. Birds & Reptiles
D. Paleozoic Era	IV. Mammals

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

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

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

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

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

Solution:

Step 1: The **Mesozoic Era** is known for the rise of birds and reptiles, making it correspond to **III. Birds & Reptiles**.

Step 2: The **Proterozoic Era** is characterized by the development of lower invertebrates, hence it corresponds to **I. Lower invertebrates**.

Step 3: The **Cenozoic Era** saw the rise of mammals, so it corresponds to **IV. Mammals**.

Step 4: The **Paleozoic Era** is known for the development of fish and amphibians, thus it corresponds to **II. Fish & Amphibia**.

Thus, the correct matching is:

A-III, B-I, C-IV, D-II.

Quick Tip

The geological time scale is divided into different eras based on the predominant life forms and evolutionary stages, with each era contributing to the rise of distinct groups of organisms.

42. Match List I with List II:

List I	List II
A. P wave	I. Heart muscles are electrically silent
B. QRS complex	II. Depolarisation of ventricles
C. T wave	III. Depolarisation of atria
D. T-P gap	IV. Repolarisation of ventricles

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

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

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

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

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

Solution:

Step 1: The **P wave** represents the depolarisation of atria, so it corresponds to **III**.

Depolarisation of atria.

Step 2: The **QRS complex** represents the depolarisation of ventricles, so it corresponds to

II. Depolarisation of ventricles.

Step 3: The **T wave** represents the repolarisation of ventricles, so it corresponds to **IV**.

Repolarisation of ventricles.

Step 4: The **T-P gap** represents the period when heart muscles are electrically silent, so it corresponds to **I. Heart muscles are electrically silent.**

Thus, the correct matching is:

A-III, B-I, C-IV, D-I.

Quick Tip

In an electrocardiogram (ECG), the P wave, QRS complex, and T wave represent different phases of electrical activity in the heart: depolarisation of the atria, depolarisation of the ventricles, and repolarisation of the ventricles, respectively.

43. The following are the statements about non-chordates:

- A. Pharynx is perforated by gill slits.
- B. Notochord is absent.
- C. Central nervous system is dorsal.
- D. Heart is dorsal if present.
- E. Post anal tail is absent.

Choose the most appropriate answer from the options given below:

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

Correct Answer: (4) B, D & E only

Solution:

Step 1: Statement A: Pharynx is perforated by gill slits. This is true for non-chordates, such as invertebrates like amphioxus.

Step 2: Statement B: Notochord is absent in non-chordates, as they do not possess this structure, which is a characteristic of chordates.

Step 3: Statement C: Central nervous system is dorsal. This is characteristic of chordates, but non-chordates do not have a dorsal central nervous system.

Step 4: Statement D: The heart, if present, is dorsal. This is a feature of non-chordates, where the heart is located on the dorsal side in certain species.

Step 5: Statement E: Post anal tail is absent in non-chordates, as this feature is typically found in chordates.

Thus, the correct matching is:

B, D & E only.

Quick Tip

Non-chordates are a diverse group that lack a notochord, and their anatomy can differ greatly from chordates, such as having a ventral heart and absence of post-anal tails.

44. Regarding catalytic cycle of an enzyme action, select the correct sequential steps:

- A. Substrate enzyme complex formation.
- B. Free enzyme ready to bind with another substrate.
- C. Release of products.
- D. Chemical bonds of the substrate broken.
- E. Substrate binding to active site.

Choose the correct answer from the options given below:

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

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

Solution:

Step 1: The correct sequence for the catalytic cycle of an enzyme is as follows:

- **E.** Substrate binding to the active site.
- **A.** Substrate enzyme complex formation.
- **D.** Chemical bonds of the substrate broken.
- **C.** Release of products.
- **B.** Free enzyme ready to bind with another substrate.

Thus, the correct sequential order is:

E, A, D, C, B.

Quick Tip

The catalytic cycle of an enzyme follows a series of steps: first, the substrate binds to the enzyme's active site, then the enzyme catalyzes the reaction, breaking bonds, releasing products, and returning to its free form to bind to another substrate.

45. Given below are two statements:

Statement I: Bone marrow is the main lymphoid organ where all blood cells including lymphocytes are produced.

Statement II: Both bone marrow and thymus provide microenvironments for the development and maturation of T-lymphocytes.

In the light of above statements, choose the most appropriate answer from the options given below:

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

Correct Answer: (2) Both Statement I and Statement II are correct.

Solution:

Step 1: Statement I: Bone marrow is indeed the main lymphoid organ where all blood cells, including lymphocytes, are produced. This statement is correct.

Step 2: Statement II: Both bone marrow and thymus play crucial roles in the development and maturation of T-lymphocytes. Bone marrow is the site of origin for T-lymphocytes, and the thymus provides the necessary environment for their maturation. This statement is also correct.

Thus, both statements are correct.

Quick Tip

The bone marrow is responsible for the production of all blood cells, including lymphocytes, while the thymus is involved in the maturation of T-lymphocytes. These two organs are key components of the immune system.

46. Match List I with List II:

List I	List II
A. RNA polymerase III	I. snRNPs
B. Termination of transcription	II. Promotor
C. Splicing of Exons	III. Rho factor
D. TATA box	IV. SnRNAs, tRNA

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

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

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

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

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

Solution:

Step 1: A. RNA polymerase III is responsible for the transcription of small RNA molecules, including tRNA and snRNAs, so it corresponds to **IV. SnRNAs, tRNA**.

Step 2: B. Termination of transcription often involves the Rho factor, which helps terminate transcription in prokaryotes, so it corresponds to **III. Rho factor**.

Step 3: C. Splicing of Exons involves snRNPs (small nuclear ribonucleoproteins), which are crucial for splicing, so it corresponds to **I. snRNPs**.

Step 4: D. TATA box is a promoter element found in eukaryotic genes that is involved in initiating transcription, so it corresponds to **II. Promotor**.

Thus, the correct matching is:

A-IV, B-III, C-I, D-II.

Quick Tip

RNA polymerase III transcribes tRNA and small RNA molecules, while splicing is carried out by snRNPs. The Rho factor plays a key role in termination of transcription in prokaryotes, and the TATA box is a promoter element for gene expression.

47. Match List I with List II:

List I	List II
A. Exophthalmic goiter	I. Excess secretion of cortisol, moon face & hyperglycemia.
B. Acromegaly	II. Hypo-secretion of thyroid hormone and stunted growth.
C. Cushing's syndrome	III. Hyper secretion of thyroid hormone & protruding eye balls.
D. Cretinism	IV. Excessive secretion of growth hormone.

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

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

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

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

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

Solution:

Step 1: A. Exophthalmic goiter is a condition caused by hyper secretion of thyroid hormone, leading to protruding eye balls, so it corresponds to **III. Hyper secretion of thyroid hormone & protruding eye balls.**

Step 2: B. Acromegaly is caused by the excessive secretion of growth hormone, leading to abnormal growth, so it corresponds to **IV. Excessive secretion of growth hormone.**

Step 3: C. Cushing's syndrome is caused by excess secretion of cortisol, resulting in symptoms such as moon face and hyperglycemia, so it corresponds to **I. Excess secretion of cortisol, moon face & hyperglycemia.**

Step 4: D. Cretinism is caused by the hypo-secretion of thyroid hormone, leading to stunted growth, so it corresponds to **II. Hypo-secretion of thyroid hormone and stunted growth.**

Thus, the correct matching is:

A-III, B-IV, C-I, D-II.

Quick Tip

The conditions related to hormone secretion often have distinct symptoms based on whether there is hyper-secretion or hypo-secretion, such as acromegaly (excessive growth hormone) and cretinism (lack of thyroid hormone).

48. Choose the correct statement given below regarding juxta medullary nephron.

- (1) Juxta medullary nephrons outnumber the cortical nephrons.
- (2) Juxta medullary nephrons are located in the columns of Bertini.
- (3) Renal corpuscle of juxta medullary nephron lies in the outer portion of the renal medulla.
- (4) Loop of Henle of juxta medullary nephron runs deep into medulla.

Correct Answer: (4) Loop of Henle of juxta medullary nephron runs deep into medulla.

Solution:

Step 1: Statement 1: Juxta medullary nephrons do not outnumber cortical nephrons. In fact, cortical nephrons are more numerous than juxta medullary nephrons. Hence, this statement is incorrect.

Step 2: Statement 2: Juxta medullary nephrons are not located in the columns of Bertini. They are located at the boundary of the renal cortex and medulla. Therefore, this statement is also incorrect.

Step 3: Statement 3: The renal corpuscle of juxta medullary nephron lies in the outer cortex, not in the outer portion of the renal medulla. Hence, this statement is incorrect.

Step 4: Statement 4: The Loop of Henle of juxta medullary nephrons indeed runs deep into the renal medulla. This is the characteristic feature of juxta medullary nephrons that help in the concentration of urine.

Thus, the correct statement is:

(4) Loop of Henle of juxta medullary nephron runs deep into medulla.

Quick Tip

Juxta medullary nephrons are responsible for concentrating urine and have long loops of Henle that extend deep into the medulla, enabling the kidney to conserve water.

49. Given below are two statements:

Statement I: The cerebral hemispheres are connected by nerve tract known as corpus callosum.

Statement II: The brain stem consists of the medulla oblongata, pons, and cerebrum.

In the light of the above statements, choose the most appropriate answer from the options given below:

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

Correct Answer: (4) Statement I is correct but Statement II is incorrect.

Solution:

Step 1: Statement I: The cerebral hemispheres are indeed connected by the corpus callosum, which is a large bundle of nerve fibers. Therefore, Statement I is correct.

Step 2: Statement II: The brain stem does not include the cerebrum. The brain stem consists of the medulla oblongata, pons, and midbrain, not the cerebrum. Therefore, Statement II is incorrect.

Thus, the correct answer is:

(4) Statement I is correct but Statement II is incorrect.

Quick Tip

The brain stem consists of the medulla oblongata, pons, and midbrain. The corpus callosum connects the two cerebral hemispheres, facilitating communication between them.

50. Given below are two statements:

Statement I: Mitochondria and chloroplasts both are double membrane-bound organelles.

Statement II: Inner membrane of mitochondria is relatively less permeable, as compared to chloroplast.

In the light of the above statements, choose the most appropriate answer from the options given below:

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

Correct Answer: (4) Statement I is correct but Statement II is incorrect.

Solution:

Step 1: Statement I: Both mitochondria and chloroplasts are indeed double membrane-bound organelles. The outer membrane is permeable to small molecules, and the inner membrane is selective. Hence, Statement I is correct.

Step 2: Statement II: The inner membrane of mitochondria is relatively more impermeable than that of chloroplasts. However, it is more permeable compared to the outer membrane. The chloroplast inner membrane, in contrast, is selectively permeable but allows more movement of metabolites. Hence, Statement II is incorrect.

Thus, the correct answer is:

(4) Statement I is correct but Statement II is incorrect.

Quick Tip

Both mitochondria and chloroplasts play vital roles in energy conversion in cells, and their structure includes double membranes with specific permeability properties to regulate transport.