151. Match List I with List II:

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

Choose the correct answer from the options given below:

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

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

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

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

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

Solution: Correct Matching:

A. Typhoid: Typhoid fever is caused by **Salmonella typhi**, which is a bacterium. Therefore, A matches with **IV. Bacteria**.

B. Leishmaniasis: This disease is caused by protozoan parasites of the genus **Leishmania**, transmitted by the bite of certain types of sandflies. Hence, B matches with **III. Protozoa**.

C. Ringworm: Contrary to its name, ringworm is not caused by a worm. It's a fungal infection affecting the skin, hair, or nails, caused by fungi known as dermatophytes. Thus, C matches with **I. Fungus**.

D. Filariasis: This disease is caused by infection with nematodes (roundworms) of the family **Filariidae**. These worms are transmitted to humans through the bite of an infected mosquito. D therefore matches with **II. Nematode**.

Quick Tip

Identifying the causative organisms of diseases is crucial in understanding their treatment and prevention.

---

152. 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

Choose the correct answer from the option given below:

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

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

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

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

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

Solution: Correct Matching:

A. Non-medicated IUD: Non-medicated IUDs, such as the **Lippes Loop**, do not contain hormones or copper. They are inert devices primarily used to create a physical barrier within the uterus. Hence, A matches with **III. Lippes loop**.

B. Copper releasing IUD: Copper IUDs, like the **Multiload 375**, release a small amount of copper into the uterus, which enhances the contraceptive effect by increasing copper ions in the uterine environment that are toxic to sperm. B matches with **I. Multiload 375**.

C. Hormone releasing IUD: These IUDs release hormones to prevent pregnancy. The **LNG-20** is an example of a levonorgestrel-releasing IUD, which makes C correctly matched with **IV. LNG-20**.

D. Implants: Contraceptive implants, such as those releasing **Progestogens**, are small rods inserted under the skin which release hormones to prevent ovulation. D matches with **II. Progestogens**.

Quick Tip

Understanding the different types of IUDs and implants helps in family planning and contraception methods.

---

153. 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.

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

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

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

Solution: Step 1: Analyzing the statements.

Statement I is true: The presence or absence of the hymen cannot conclusively determine virginity.

Statement II is false: The hymen can be torn by various activities, not just during the first coitus.

Quick Tip

Virginity is not a reliable concept based solely on physical characteristics, as it varies among individuals.

---

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

1. 8th and 9th segment
2. 11th segment
3. 5th segment
4. 10th segment

Correct Answer: 4. 10th segment

Solution: Understanding Anal Cerci:

Anal cerci are paired appendages located at the posterior end of many insects, including cockroaches. These structures serve as sensory organs and are highly sensitive to air movements, helping the insect detect predators and other threats from behind.

Cockroach Anatomy:

Cockroaches, like other insects, have segmented bodies comprising three main parts: the head, thorax, and abdomen. The abdomen itself is segmented, typically consisting of ten segments in cockroaches.

Location of Anal Cerci:

The anal cerci are located on the last segment of the cockroach's abdomen. In terms of numerical designation, this is the 10th segment. These cerci extend outward from the tip of the abdomen, giving them a strategic position to detect changes in the environment from a defensive standpoint.

Function and Importance:

Besides serving a sensory function, anal cerci are involved in mating behaviors and can also aid in locomotion to some extent. Their primary role, however, is to enhance the cockroach's ability to react to threats, contributing to their survival and evolutionary success.

Quick Tip

Anal cerci in cockroaches are sensory organs involved in detecting air currents and vibrations.

---

155. 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. Neuro secretory cells

Choose the correct answer from the options given below:

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

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

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

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

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

Solution: Correct Matching:

A. Pons: The pons primarily functions as a major pathway for communication between different parts of the brain, and also between the brain and the spinal cord. It plays a critical role in the control of breathing and other functions. Hence, A matches with **III. Connects different regions of the brain**.

B. Hypothalamus: The hypothalamus contains neurosecretory cells that produce hormones regulating essential functions such as temperature control, thirst, hunger, sleep, mood, and the release of other hormones within the body. This makes B correctly matched with **IV. Neurosecretory cells**.

C. Medulla: Located in the brainstem, the medulla controls autonomic functions such as respiration, heart rate, and gastric secretions. This is why C is matched with **II. Controls respiration and gastric secretions**.

D. Cerebellum: Known for its role in motor control, the cerebellum also contributes to coordination, precision, and accurate timing of movements. It plays a pivotal role in regulating posture and balance, making D correctly paired with **I. Provides additional space for Neurons, regulates posture and balance**.

Quick Tip

Each part of the brain has specific roles, with different regions dedicated to regulating vital functions like balance, respiration, and coordination.

---

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

1. Progesterone
2. Glucagon
3. Cortisol
4. Testosterone

Correct Answer: 2. Glucagon

Solution: Analysis of Each Option: Progesterone: A steroid hormone involved in the menstrual cycle, pregnancy, and embryogenesis of humans and other species. It is synthesized from cholesterol, characteristic of steroid hormones, which means it is not the correct answer.

Glucagon: Unlike the other options, glucagon is a peptide hormone, not a steroid hormone. It is produced by the pancreas and plays a crucial role in glucose metabolism by stimulating the conversion of stored glycogen in the liver into glucose, which is then released into the bloodstream. This makes it the correct answer.

Cortisol: Also known as the stress hormone, cortisol is a steroid hormone produced by the adrenal cortex. It is involved in the regulation of metabolism, immune response, and stress response.

Testosterone: A primary male sex hormone and an anabolic steroid, testosterone is crucial for the development of male reproductive tissues as well as promoting secondary sexual characteristics such as muscle and bone mass, and the growth of body hair.

Quick Tip

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

---

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

3'TACATGGCAAATATCCATTCA5'

1. 5'AUGUACCGUUAAUGGGAAGU3'
2. 5'AUGUACCGUUAAAGGGAGU3'
3. 5'AUGUACCGUUAAUAGGUAGU3'
4. 5'AUGUAAAGUUAAUGGAUGU3'

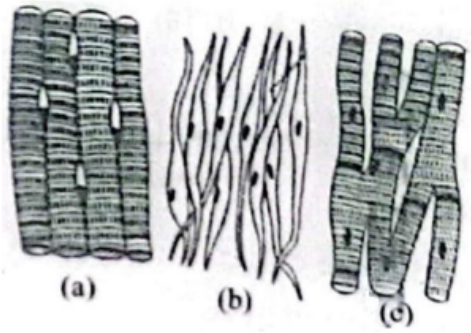
Correct Answer: 3. 5'AUGUACCGUUAAUAGGUAGU3'

Solution: The correct product of DNA dependent RNA polymerase is the RNA sequence that is complementary to the DNA template. Using the template strand $3'TACATGGCAATATCCTATTCATTAC5'$, the correct complementary RNA strand formed will be $5'AUGUACCGUUAAUAGGUAGU3'$.

Quick Tip

Remember that RNA is synthesized in the 5' to 3' direction and is complementary to the DNA template strand.

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

Correct Answer: 4. (a) Skeletal - Triceps, (b) Skeletal - Legs, (c) Cardiac - Heart

Solution: Analysis of Muscle Types and Locations:

(a) Skeletal Muscle: Characterized by striations and voluntary control. Common examples include muscles such as the biceps and triceps which are used for movement of bones.

Correct identification: Triceps, a large muscle on the back of the upper limb of many vertebrates. It is responsible for extension of the elbow joint.

(b) Smooth Muscle: Lacks striations and is under involuntary control. It is found in walls of hollow organs like intestines and stomach.

Correct identification: Stomach, which extensively uses smooth muscle for the process of digestion through peristalsis.

(c) Cardiac Muscle: Striated like skeletal muscle but operates under involuntary control, found only in the heart.

Correct identification: Heart, the primary location of cardiac muscle which is specialized for continuous contractions to pump blood throughout the body.

Conclusion:

Each muscle type is correctly identified in option (4) with its location, matching the unique structural and functional characteristics necessary for their respective roles in the human

body.

Quick Tip

Muscle types include skeletal (voluntary), smooth (involuntary), and cardiac (heart-specific). Each has specific locations in the body.

---

159. 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. B-D-E-A-C

2. E-C-A-D-B

3. C-E-D-A-B

4. E-B-D-A-C

Correct Answer: 2. E-C-A-D-B

Solution: Understanding the Cell Cycle:

The cell cycle is divided into interphase and the mitotic (M) phase. Interphase includes the Gap 1 (G1), Synthesis (S), and Gap 2 (G2) phases. The mitotic phase includes mitosis (karyokinesis) and is followed by cytokinesis.

Detailed Sequence of the Cell Cycle:

Gap 1 Phase (E): This is the first part of interphase, where the cell grows physically larger, copies organelles, and makes the molecular building blocks it will need in later steps.

Synthesis Phase (C): During the S phase, the cell synthesizes a complete copy of the DNA in its nucleus. It also duplicates a microtubule-organizing structure called the centrosome, which helps separate DNA during M phase.

Gap 2 Phase (A): In the G2 phase, the cell grows more, makes proteins and organelles, and begins to reorganize its contents in preparation for mitosis. G2 ends when mitosis begins.

Karyokinesis (D): Also known as mitosis, this phase involves the division of a cell's nucleus into two nuclei, each with the same number of chromosomes. Mitosis is subdivided into stages: prophase, metaphase, anaphase, and telophase.

Cytokinesis (B): This is the final stage of cell division, where the cell cytoplasm divides, creating two daughter cells. Cytokinesis typically overlaps with the telophase stage of mitosis.

Correct Sequence:

The sequence provided in option (2), E-C-A-D-B, accurately follows the order of the cell cycle, beginning with the initial growth phase (Gap 1), followed by DNA synthesis, preparation for mitosis (Gap 2), the division of the nucleus (karyokinesis), and finally, the division of the cytoplasm (cytokinesis).

Quick Tip

Cell division involves several phases: Gap 1, Synthesis, Gap 2, Karyokinesis, and Cytokinesis.

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160. Which of the following are Autoimmune disorders?

- A. Myasthenia gravis
- B. Rheumatoid arthritis
- C. Gout
- D. Muscular dystrophy

Choose the most appropriate answer from the options given below:

1. B, C & E only
2. C, D & E only
3. A, B & D only
4. A, B & E only

Correct Answer: 4. A, B E only

Solution: Analysis of Each Condition:

A. Myasthenia gravis: An autoimmune disorder where antibodies block, alter, or destroy

the receptors for acetylcholine at the neuromuscular junction, which prevents muscle contraction from occurring. Hence, it is an autoimmune disorder.

B. Rheumatoid arthritis: This is a chronic inflammatory disorder affecting many joints, including those in the hands and feet. The immune system mistakenly attacks the body's tissues, particularly the synovium, the lining of the membranes that surround the joints.

C. Gout: Not an autoimmune disorder. It is caused by an accumulation of urate crystals within the joint, due to high levels of uric acid in the blood. It's more related to metabolic processes than immune system dysfunction. **D. Muscular dystrophy:** A group of genetic diseases that cause progressive weakness and loss of muscle mass. It is not an autoimmune disorder but a genetic condition.

E. Systemic Lupus Erythematosus (SLE): A systemic autoimmune disease that occurs when the body's immune system attacks its own tissues and organs. Inflammation caused by SLE can affect different body systems, including joints, skin, kidneys, blood cells, brain, heart, and lungs.

Quick Tip

Autoimmune disorders occur when the body's immune system mistakenly attacks its own tissues.

---

161. Match List I with List II:

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

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

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

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

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

Solution: Correct Matching: A. Lipase: This enzyme is responsible for breaking down fats and oils by hydrolyzing the ester bonds found in triglycerides into glycerol and free fatty acids. Therefore, A matches with **II. Ester bond**.

B. Nuclease: Nucleases are enzymes that hydrolyze the phosphodiester bonds between the nucleotide subunits of nucleic acids like DNA and RNA. Thus, B is correctly paired with **IV. Phosphodiester bond**.

C. Protease: Proteases, or peptidases, are enzymes that break down proteins by cleaving the peptide bonds between amino acids. This makes C correctly matched with **I. Peptide bond**.

D. Amylase: Amylase is an enzyme that catalyzes the hydrolysis of starch into sugars. It breaks the glycosidic bonds in starch, which correctly pairs D with **III. Glycosidic bond**.

Quick Tip

Enzymes catalyze reactions involving specific bonds like ester, peptide, or glycosidic bonds.

---

162. The flippers of the Penguins and Dolphins are the example of:

1. Convergent evolution
2. Divergent evolution
3. Adaptive radiation
4. Natural selection

Correct Answer: 1. Convergent evolution

Solution: Understanding Convergent Evolution:

Convergent evolution occurs when different species evolve similar traits independently, often because they adapt to similar environments or ecological niches. This process does not imply a common ancestry for the structures concerned but rather a similar pattern of natural selection.

Flippers of Penguins and Dolphins:

Penguins: Birds that have evolved to become highly proficient swimmers. Their flippers, which are modified wings, are streamlined for swimming rather than flying. This adaptation allows penguins to navigate effectively through water.

Dolphins: Mammals that are part of the cetacean family, which includes whales and

dolphins. Their flippers evolved from the forelimbs of terrestrial mammals, reshaping into paddles that provide stability and steering capabilities in the aquatic environment.

Why This is Convergent Evolution:

Despite their different evolutionary histories and being part of distinct taxonomic groups (birds and mammals), both penguins and dolphins have developed flippers. This similarity arises not from shared ancestry but because both have adapted to life in marine environments. The streamlined, flat shape of flippers is an effective adaptation for swimming and maneuvering in water, thus these similar structures have evolved due to similar selective pressures in a marine environment, rather than because of a recent common ancestor.

Conclusion:

The evolution of flippers in both penguins and dolphins is a classic example of convergent evolution, where unrelated species develop similar traits due to having to adapt to similar conditions or niches. This is distinct from divergent evolution or adaptive radiation where traits evolve from a common ancestor into diverse forms.

Quick Tip

Convergent evolution occurs when species from different evolutionary branches develop similar characteristics due to similar environmental pressures.

---

163. 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

Choose the correct answer from the options given below :

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

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

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

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

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

Solution: Correct Matching: A. Expiratory capacity: This is the total amount of air a

person can exhale after a normal inhalation, which includes the tidal volume (the volume of air inhaled or exhaled during a normal breath) plus the expiratory reserve volume (the additional amount of air that can be forcibly exhaled after the expiration of a normal tidal volume). Therefore, A matches with **II. Tidal volume + Expiratory reserve volume**.

B. Functional residual capacity: This capacity consists of the expiratory reserve volume (the volume of air that can still be exhaled after a normal exhalation) plus the residual volume (the volume of air remaining in the lungs after a maximal exhalation). Hence, B correctly pairs with **IV. Expiratory reserve volume + Residual volume**.

C. Vital capacity: The maximum amount of air a person can expel from the lungs after a maximum inhalation. It is the sum of the expiratory reserve volume, tidal volume, and inspiratory reserve volume. This makes C match with **I. Expiratory reserve volume + Tidal volume + Inspiratory reserve volume**.

D. Inspiratory capacity: This is the total amount of air a person can inhale after a normal exhalation, consisting of the tidal volume plus the inspiratory reserve volume (the additional amount of air that can be inhaled after a normal inhalation). D thus matches with **III. Tidal volume + Inspiratory reserve volume**.

Quick Tip

Understanding lung capacities helps in diagnosing and monitoring respiratory diseases.

---

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

1. Gene migration
2. Constant gene pool
3. Genetic recombination
4. Genetic drift

Correct Answer: 2. Constant gene pool

Solution: Understanding Hardy-Weinberg Equilibrium:

The Hardy-Weinberg principle provides a mathematical model that predicts how gene frequencies are transmitted from one generation to the next, under the assumption that the

population is large, mating is random, and there are no forces (like selection, mutation, migration, or genetic drift) altering the gene frequencies.

Factors Affecting Hardy-Weinberg Equilibrium:

Gene Migration: Also known as gene flow, it involves the transfer of alleles from one population to another, introducing new alleles into the gene pool and altering allele frequencies. Hence, it affects the equilibrium.

Constant Gene Pool: This condition implies that the allele frequencies in the population remain constant and no evolutionary forces (like selection, mutation, or migration) are acting on the population. This scenario is actually a requirement for the Hardy-Weinberg equilibrium to be maintained, rather than a factor that would disrupt it.

Genetic Recombination: Occurs during sexual reproduction where alleles are shuffled and new combinations can form. While genetic recombination changes the combination of genes, it does not change the overall frequency of alleles in the population; however, in real-world scenarios, it can introduce variation that selection acts upon, thus potentially affecting equilibrium.

Genetic Drift: Refers to random changes in allele frequencies that can occur in small populations due to chance events. It leads to a decrease in genetic variation and can cause significant deviations from Hardy-Weinberg equilibrium.

Conclusion: The only option that does not affect Hardy-Weinberg equilibrium is a **constant gene pool** (Option 2), as it describes a scenario where evolutionary forces are absent, thus maintaining equilibrium rather than disrupting it.

Quick Tip

The Hardy-Weinberg principle is a key concept in population genetics, indicating that allele frequencies in a population remain constant if no evolutionary influences are present.

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165. 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. C-B-D-A

2. A-D-C-B

3. D-A-C-B

4. B-A-D-C

Correct Answer: 2. A-D-C-B

Solution: Understanding the Evolutionary Timeline:

The stages listed represent significant points in the evolution of Homo, the genus that includes modern humans and their close relatives.

Analysis of Each Stage:

Homo habilis (A): Known as the ”handy man,” this species is one of the earliest members of the genus Homo, appearing around 2.4 million years ago. It is noted for its use of stone tools.

Homo erectus (D): Emerging around 1.9 million years ago, this species was highly successful and versatile, surviving for over a million years. Homo erectus is known for its upright posture and is considered a direct ancestor of modern humans.

Homo neanderthalensis (C): Often known simply as Neanderthals, this species arose around 400,000 years ago and lived until about 40,000 years ago. They are known for their robust build and adaptation to cold climates.

Homo sapiens (B): Modern humans, appearing around 300,000 years ago, with sophisticated tools, art, and technology. Our species is characterized by a high level of cognitive ability and complex social structures.

Correct Sequence:

Starting with **Homo habilis (A)**, as one of the earliest, moving to **Homo erectus (D)**, who spread out of Africa and adapted to various environments. Following this is **Homo neanderthalensis (C)**, known to have overlapped and interacted with early Homo sapiens, and finally **Homo sapiens (B)**, the most recent.

Quick Tip

Understanding human evolution helps trace the development of human traits and behavior over millennia.

---

166. 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:

1. B-D-E-C-A

2. E-A-D-B-C

3. E-C-A-D-B

4. A-E-C-B-D

Correct Answer: 3. E-C-A-D-B

Solution: Understanding the Cardiac Conduction System:

The cardiac conduction system controls the heart rate and coordinates the contraction of cardiac muscle. The electrical impulses that initiate cardiac contraction follow a specific pathway through the heart, ensuring that blood is pumped efficiently.

Detailed Analysis of the Correct Sequence (E-C-A-D-B):

SA node (E): The sinoatrial (SA) node, located in the right atrium, is the natural pacemaker of the heart. It generates the electrical impulses that initiate each heartbeat. This is where the conduction pathway begins.

AV node (C): After the impulse spreads over the atria, it arrives at the atrioventricular (AV) node. Located at the junction of the atria and ventricles, the AV node briefly delays the impulse, allowing the atria to complete their contraction before the ventricles contract.

AV bundle (A): The impulse travels from the AV node to the atrioventricular bundle (bundle of His). This bundle is the only electrical connection between the atria and the ventricles.

Bundle branches (D): The AV bundle splits into the right and left bundle branches which conduct the impulses down either side of the interventricular septum.

Purkinje fibres (B): The bundle branches terminate in the Purkinje fibres, which spread throughout the ventricular myocardium. The Purkinje fibres transmit the impulse rapidly and ensure coordinated contraction of both ventricles.

Conclusion:

The sequence E-C-A-D-B correctly represents the progression of an action potential through the heart's conduction system, starting from the initiation at the SA node and ending with the transmission through the Purkinje fibers, leading to ventricular contraction.

Quick Tip

The heart's conduction system controls the timing of contractions to ensure efficient blood flow.

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

1. Low pCO_2 and High H^+ concentration
2. Low pCO_2 and High temperature
3. High pO_2 and High pCO2
4. High pO_2 and Lesser H^+ concentration

Correct Answer: 4. High pO2 and Lesser H^+ concentration

Solution: Stepwise Analysis of the Correct Answer:

Step 1: Understanding Oxyhaemoglobin Formation.

Oxyhemoglobin formation occurs when oxygen molecules bind to the hemoglobin in red blood cells. This process is highly dependent on the partial pressures of oxygen and carbon dioxide, as well as the pH level of the blood.

Step 2: The Role of High pO_2.

High partial pressure of oxygen (pO_2) in the alveoli increases the affinity of hemoglobin for oxygen, promoting the formation of oxyhemoglobin. This is because hemoglobin binds oxygen more readily when there is a higher concentration of oxygen in the lungs.

Step 3: The Effect of Lesser H^+ Concentration (Higher pH). Lower hydrogen ion

concentration (or higher pH) reduces the protonation of hemoglobin, which enhances its capacity to bind oxygen. This condition is known as the Bohr effect, where a higher pH (alkaline condition) favors the formation of oxyhemoglobin.

Step 4: Exclusion of Other Options.

Option (1) suggests conditions that actually promote the release of oxygen from hemoglobin (favoring deoxygenated blood).

Option (2) includes high temperature, which generally reduces hemoglobin's affinity for oxygen, facilitating oxygen release rather than uptake.

Option (3) includes high pCO_2, which would lead to increased H^+ concentration and lower pH, again promoting oxygen release rather than binding.

Quick Tip

Oxyhaemoglobin increases oxygen transport efficiency from the lungs to tissues.

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168. Match List I with List II:

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

Choose the correct answer from the options given below:

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

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

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

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

Correct Answer: (1) A-III, B-IV, C-I, D-II **Solution: Correct Matching:** - **A. α–I antitrypsin:** This protein is involved in protecting the lungs from the enzyme neutrophil elastase, which can destroy the lung tissue if not inhibited. Deficiency in α–I antitrypsin can lead to diseases like emphysema, particularly in smokers. Therefore, A matches with **III. Emphysema**. - **B. Cry IAb:** This is a type of Bt toxin (Bacillus thuringiensis toxin) used in genetically modified crops to provide resistance against specific pests. Cry IAb specifically

targets the corn borer, a common pest of corn. Thus, B is correctly paired with **IV. Corn borer**. - **C. Cry IAc:** Similar to Cry IAb, Cry IAc is another variant of the Bt toxin but engineered to target different pests, such as the cotton bollworm, which is a significant pest affecting cotton crops. Hence, C matches with **I. Cotton bollworm**. - **D. Enzyme replacement therapy:** This treatment method involves replacing a deficient or absent enzyme in individuals with certain genetic disorders. One notable application is for ADA (adenosine deaminase) deficiency, which leads to severe combined immunodeficiency (SCID). D therefore matches with **II. ADA deficiency**.

Quick Tip

When studying biotechnology applications or therapeutic treatments, it's essential to link the specific mechanisms or treatments to their target conditions or pests. This knowledge can be crucial for applications in medical treatment plans and agricultural management.

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169. Given below are two statements: one is labelled as Assertion and the other is labelled as Reason:

- **Assertion A:** FSH acts upon ovarian follicles in female and Leydig cells in male.
- **Reason R:** Growing ovarian follicles secrete estrogen in female while interstitial cells secrete androgen in male human being.

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

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

Correct Answer: 2. A is false but R is true

Solution: Evaluation of Assertion A:

Follicle Stimulating Hormone (FSH) in females indeed stimulates the growth and maturation of ovarian follicles, which is correctly stated. However, in males, FSH does not act on the

Leydig cells but rather on the Sertoli cells. Leydig cells are primarily stimulated by Luteinizing Hormone (LH), which triggers the secretion of testosterone. Therefore, the assertion A is false.

Evaluation of Reason R:

The Reason R correctly describes the hormonal activity in both genders. In females, growing ovarian follicles indeed secrete estrogen. In males, the interstitial cells (Leydig cells) of Leydig indeed secrete androgens, predominantly testosterone. Thus, Reason R is true.

Quick Tip

Understanding the role of hormones in the reproductive system aids in comprehending various reproductive health issues and treatments.

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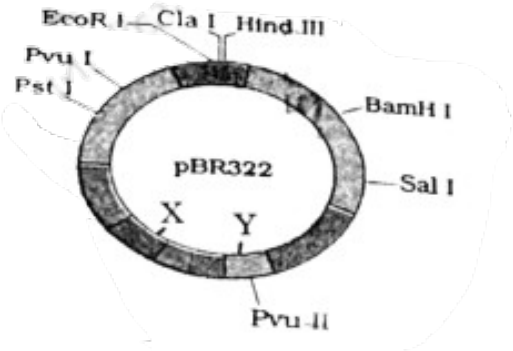
170. The following diagram showing restriction sites in *E. coli* cloning vector pBR322. Find the role of 'X' and 'Y' genes:



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

Correct Answer: 4. 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: Analyze the function of genes in pBR322.

The gene ‘X‘ in pBR322, often referred to as the ‘copA‘ gene, controls the copy number of the plasmid, regulating how many copies of the plasmid exist per cell. Gene ‘Y‘, typically the ‘rop‘ gene, helps in the stabilization and efficient replication of the plasmid.

Quick Tip

Knowledge of cloning vectors like pBR322 is crucial for genetic engineering and biotechnology applications.

---

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

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

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

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

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

Solution: Correct Matching:

A. Cocaine: Cocaine is an alkaloid derived from the leaves of the coca plant, which belongs to the genus **Erythroxylum**. Thus, A matches with **III. Erythroxylum**.

B. Heroin: Although heroin itself is synthesized from morphine, which is an extract from the opium poppy, it’s important to trace heroin back to its primary source, which is **Papaver somniferum**, the opium poppy.

Therefore, B is correctly paired with **IV. Papaver somniferum**.

C. Morphine: Morphine is a powerful analgesic and sedative, widely used in medical settings, particularly in surgery to alleviate severe pain.

Therefore, C correctly matches with **I. Effective sedative in surgery**.

D. Marijuana: Marijuana is made from the cannabis plant, specifically from the leaves, flowers, and buds of **Cannabis sativa**. Hence, D matches with **II. Cannabis sativa**.

Quick Tip

Recognizing the source plants and typical uses of different narcotics can aid in understanding their biological and social impacts.

---

172. 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. C only

2. D only

3. B only

4. A only

Correct Answer: 4. A only

Solution: Analysis of Each Statement:

Statement A (Annelids are true coelomates): This statement is **correct**. Annelids, which include earthworms, leeches, and polychaetes, possess a true coelom, which is a fluid-filled body cavity completely lined with mesoderm tissue. This coelom serves various functions, including acting as a hydrostatic skeleton.

Statement B (Poriferans are pseudocoelomates): This statement is **incorrect**. Poriferans, or sponges, do not have a true coelom nor a pseudocoelom; they are instead classified as parazoans, lacking true tissues and organs, and certainly lacking any type of body cavity.

Statement C (Aschelminthes are acoelomates): This statement is **incorrect**. Aschelminthes, more commonly referred to as nematodes or roundworms, are actually pseudocoelomates, not acoelomates. They have a body cavity, known as a pseudocoel, which is only partially lined with mesoderm tissue.

Statement D (Platyhelminthes are pseudocoelomates): This statement is **incorrect**. Platyhelminthes, which are flatworms, are acoelomates, meaning they lack a coelom entirely. Their bodies are solid between the digestive tract and the outer body wall.

Conclusion:

Only statement A is correct, as annelids are indeed true coelomates, having a well-developed, completely mesoderm-lined coelom. The other statements incorrectly categorize the other groups of animals regarding their body cavity status.

Quick Tip

Understanding the basic body plans of different animal phyla is crucial for distinguishing their evolutionary relationships and anatomical features.

---

173. Given below are two statements:

- **Statement I:** In the nephron, the descending limb of 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.

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

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

Correct Answer: 4. Both Statement I and Statement II are false

Solution: Evaluation of Each Statement:

Statement I: This statement is false. In the nephron, the descending limb of the loop of Henle is actually highly permeable to water but largely impermeable to electrolytes. This structure allows for the passive reabsorption of water back into the bloodstream, concentrating the urine.

Statement II: This statement is also false. The proximal convoluted tubule (PCT) is indeed

crucial for reabsorption but it is lined by simple cuboidal epithelium with a brush border, not simple columnar epithelium. The brush border significantly increases the surface area for reabsorption of water and solutes from the filtrate back into the blood.

Quick Tip

The correct understanding of nephron structure and function is essential for grasping how kidneys filter blood and regulate body fluids.

---

174. Match List I with List II:

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

Choose the correct answer from the options given below :

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

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

Solution: Fibrous joints (such as those in the skull) allow minimal movement (A-III), cartilaginous joints (like those between vertebrae) allow some movement but are primarily for cushioning (B-I), hinge joints (such as the knee) facilitate bending and straightening (C-IV), and ball and socket joints (like the shoulder, connecting humerus and pectoral girdle) allow rotational and other movements (D-II).

Quick Tip

Understanding different types of joints helps in comprehending their roles in body mechanics and movements.

---

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

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

Correct Answer: (2) Vaults

Solution: Among the options, Vaults are not a natural or traditional method of contraception. Vaults refer to cervical caps, which are barrier methods of contraception and not traditional. Lactational amenorrhea (natural postpartum infertility), coitus interruptus (withdrawal method), and periodic abstinence (calendar method) are all traditional methods of contraception.

Quick Tip

Vaults are a form of barrier contraceptive method and not a natural or traditional method.

---

176. Match List I with List II:

	List I	**List II**
A.	Pleurobrachia	I. Mollusca
B.	Radula	II. Ctenophora
C.	Stomochord	III. Osteichthyes
D.	Air bladder	IV. Hemichordata

Choose the correct answer from the options given below :

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

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

Solution:

Detailed Analysis of Each Match:

Pleurobrachia (A): This is a species found in the phylum **Ctenophora**, commonly known as comb jellies. These marine organisms are characterized by their gelatinous bodies and

distinctive combs, which are rows of cilia used for swimming. Therefore, **A matches with II**.

Radula (B): The radula is a unique anatomical feature found in most mollusks (**Mollusca**). It functions as a file-like structure used by these animals to scrape or cut food before ingestion. Thus, **B matches with I**.

Stomochord (C): The stomochord is a flexible, rod-like structure in the collar region of **Hemichordata**, which was once thought to be homologous to the notochord of chordates. Hemichordata includes animals like acorn worms. Hence, **C matches with IV**.

Air bladder (D): Also known as the swim bladder, it is an internal gas-filled organ that contributes to the ability of a fish to control its buoyancy, and is found in most **Osteichthyes** (bony fish). This feature helps the fish maintain its depth without floating upward or sinking. Therefore, **D matches with III**.

Quick Tip

Linking anatomical features to the correct phyla can help clarify evolutionary relationships and organism classification.

---

177. Match List I with List II:

	List I	**List II**
A.	Axoneme	I. Centriole
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-IV, C-I, D-III
2. A-II, B-I, C-IV, D-III
3. A-IV, B-III, C-II, D-I
4. A-IV, B-II, C-III, D-I

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

Solution: Detailed Analysis of Each Match:

Axoneme (A): The axoneme is the central shaft found within cilia and flagella, consisting of

microtubules arranged in a characteristic ”9+2” pattern. It is essential for the beating motion of these organelles. Thus, **A matches with II**.

Cartwheel pattern (B): This refers to the structural appearance of the centriole when viewed in cross-section, particularly evident in the early stages of centriole formation. The cartwheel structure is key in microtubule organization. Hence, **B matches with I**.

Crista (C): Cristae are the inner foldings of the mitochondrial membrane and are sites where the electron transport chain components are located. They increase the surface area for ATP production activities within mitochondria. Therefore, **C matches with IV**.

Satellite (D): Satellites are segments of DNA located at the end of chromosomes, important for the stability and integrity of chromosomes. They are often involved in the formation of telomeres. Consequently, **D matches with III**.

Quick Tip

Understanding the structural components of cells helps in comprehending their functions and interactions within the cell.

---

178. Which of the following statements is incorrect?

(1) Bio-reactors are used to produce small scale bacterial cultures.

(2) Bio-reactors have an agitator system, an oxygen delivery system and foam control system.

(3) A bio-reactor provides optimal growth conditions for achieving the desired product.

(4) Most commonly used bio-reactors are of stirring type.

Correct Answer: (1) Bio-reactors are used to produce small scale bacterial cultures.

Solution: Understanding bio-reactors.

Bio-reactors are generally used for large-scale production processes, not just small-scale as stated in option (1). They are designed to support the growth of bacteria or other cells in a controlled and scalable way. Therefore, the incorrect statement is that bio-reactors are primarily used for small-scale bacterial cultures.

Quick Tip

When reviewing statements about equipment or processes, consider the scale and context of their use, which is often specified in scientific definitions or typical applications.

---

179. 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

Choose the correct answer from the options given below

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

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

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

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

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

Solution: Overview of Prophase I:

Prophase I is a crucial phase in meiosis where chromosomes undergo various processes critical for genetic recombination and proper segregation. This phase is subdivided into several distinct stages, each characterized by unique chromosomal behaviors and structural changes.

Detailed Analysis:

Leptotene (D): During this initial stage, chromosomes begin to condense, becoming visible under the microscope as thin threads, aligning with **III. Chromosomes look like thin threads**.

Zygotene (C): This stage is marked by the pairing (synapsis) of homologous chromosomes. The formation of the synaptonemal complex between homologs is essential for subsequent recombination, corresponding to **I. Synaptonemal complex formation**.

Pachytene (B): As synapsis completes, recombination nodules appear and crossing over

(recombination) between homologous chromosomes occurs. This stage is defined by the **IV. Appearance of recombination nodules**.

Diakinesis (A): The final stage of Prophase I involves the further condensation of chromosomes and the clear visualization of chiasmata (sites of crossing over). The chiasmata move toward the ends of the chromosomes in a process known as terminalisation, which matches **II. Completion of terminalisation of chiasmata**.

Quick Tip

Remember the sequence of events in meiosis to correctly associate phases of Prophase I with their characteristic features.

---

180. Match List I with List II:

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

Choose the correct answer from the options given below

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

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

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

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

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

Solution: Detailed Analysis of Each Match:

Common cold (A): The common cold is primarily caused by rhinoviruses, which are a group of infectious agents responsible for upper respiratory infections. This makes the correct match **A-III**.

Haemozoin (B): Haemozoin is a byproduct formed from the digestion of blood by certain parasites, including Plasmodium species, which cause malaria. Therefore, the correct match is **B-I**.

Widal test (C): The Widal test is a diagnostic test for typhoid fever, which detects the presence of serum agglutinins (H and O) in a patient with suspected typhoid fever caused by the bacterium *Salmonella* typhi. Thus, the correct pairing is **C-II**.

Allergy (D): Allergies can be triggered by various environmental agents, including dust mites, which are a common cause of allergic reactions such as asthma and allergic rhinitis. This leads to the correct association **D-IV**.

Quick Tip

Knowing the specific pathogens and their associated diagnostic tests can greatly simplify answering these matching questions.

181. Given below are two statements: One is labelled as Assertion (A) and the other 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 correct but R is not correct

(2) A is not correct but R is correct

(3) Both A and R are correct and R is the correct explanation of A

(4) Both A and R are correct but R is NOT the correct explanation of A

Correct Answer: (3) Both A and R are correct and R is the correct explanation of A

Solution: Analysis of Assertion A: - Assertion A states that breast-feeding during the initial period of infant growth is recommended by doctors for a healthy baby. This is true as breast-feeding provides optimal nutrition tailored to the infant's needs and supports early development and health.

Analysis of Reason R:

Reason R explains that colostrum, the first form of milk produced immediately following delivery, is rich in antibodies. These antibodies are crucial for building the newborn's immune system. Colostrum provides high levels of immunoglobulin A (IgA), as well as several other immune factors, which protect the newborn against numerous diseases and infections.

Relationship Between A and R:

The reason R directly supports the assertion A by detailing the biological mechanism through which breast-feeding contributes to a healthy baby. The presence of antibodies in colostrum is one of the key reasons why breast-feeding during the initial period is so crucial, as it helps the newborn develop necessary resistance to infections.

Quick Tip

Colostrum, often referred to as ”liquid gold,” is incredibly nutrient-rich and packed with antibodies that are crucial during the early days of an infant’s life.

---

182. Match List I with List II:

	List I	**List II**
A.	Pterophyllum	I. Hag fish
B.	Myxine	II. Saw fish
C.	Pristis	III. Angel fish
D.	Exocoetus	IV. Flying fish

Choose the correct answer from the options given below :

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

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

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

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

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

Solution: Matching fish species with their common names.

Pterophyllum (A) is commonly known as **Angel fish (III)**.

Myxine (B) is known as **Hag fish (I)**.

Pristis (C) is known as **Saw fish (II)**.

Exocoetus (D) is known as **Flying fish (IV)**.

Quick Tip

Familiarize yourself with scientific names and their common counterparts to easily tackle matching questions in biology.

---

183. The ”Ti plasmid” of Agrobacterium tumefaciens stands for

(1) Tumor inducing plasmid

(2) Temperature independent plasmid

(3) Tumour inhibiting plasmid

(4) Tumor independent plasmid

Correct Answer: (1) Tumor inducing plasmid

Solution: Understanding the Ti Plasmid:

The Ti plasmid, or Tumor inducing plasmid, is a type of plasmid (a small circular DNA molecule that is separate from chromosomal DNA) found in Agrobacterium tumefaciens, a bacterium that causes crown gall disease in plants. This disease is characterized by the formation of tumors (galls) at the infection site.

Mechanism of Action:

When Agrobacterium tumefaciens infects a plant, the Ti plasmid transfers part of its DNA, specifically the T-DNA (transfer DNA) region, into the plant cell. This integration of bacterial DNA into the plant genome occurs at wound sites where the plant tissue has been damaged.

The T-DNA carries genes that are expressed in the plant cells, leading to the production of proteins that stimulate plant cells to produce opines, which are nitrogen and carbon compounds that the bacteria use as nutrients. Additionally, some genes in the T-DNA encode enzymes that cause the plant cells to proliferate uncontrollably, leading to tumor formation.

Importance in Biotechnology:

The ability of the Ti plasmid to transfer genes into plant cells has been harnessed in biotechnology to create genetically modified plants. By modifying the T-DNA region of the Ti plasmid to carry desirable genes instead of tumor-inducing genes, researchers can introduce new traits into plants, such as resistance to pests, diseases, or environmental conditions.

Quick Tip

The Ti plasmid is a key tool in genetic engineering for creating genetically modified plants, as it can be used to introduce new genes into plant genomes.

---

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

(1) Infundibulum

(2) Ampulla

(3) Uterine fundus

(4) Isthmus

Correct Answer: (3) Uterine fundus

Solution: Overview of the Fallopian Tube:

The Fallopian tubes, also known as oviducts or uterine tubes, are part of the female reproductive system. They play a critical role in transporting eggs from the ovaries to the uterus. Each Fallopian tube can be divided into several sections, each with distinct anatomical and functional characteristics.

Components of the Fallopian Tube:

Infundibulum: This is the funnel-shaped portion of the Fallopian tube closest to the ovary. It has finger-like projections called fimbriae that help capture the egg released from the ovary.

Ampulla: This is the widest section of the Fallopian tube, where fertilization typically occurs. The ampulla's large diameter provides a suitable environment for the egg and sperm to meet.

Isthmus: This is the narrower part of the tube that links the ampulla to the uterus. It is typically thicker and more muscular than the ampulla, helping to move the fertilized egg towards the uterus.

Incorrect Component:

Uterine Fundus: The uterine fundus is not part of the Fallopian tube. It refers to the top portion of the uterus, which is opposite the cervical opening into the vagina. The fundus of the uterus is the site where the Fallopian tubes connect to the uterus, but it is not a component of the tubes themselves.

Quick Tip

Clarifying anatomical structures and their functions is crucial in understanding and answering questions in human biology.

---

185. 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

Choose the correct answer from the options given below :

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

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

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

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

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

Solution: Matching genetic conditions with their related chromosomes.

Down's syndrome (A) is associated with an extra copy of **chromosome 21 (III)**.

α-Thalassemia (B) is related to mutations in genes on the **16th chromosome (IV)**.

β-Thalassemia (C) involves mutations on the **11th chromosome (I)**.

Klinefelter's syndrome (D) involves one or more extra **'X' chromosomes (II)**.

Quick Tip

Memorizing the chromosome numbers associated with specific genetic disorders can aid in diagnostics and understanding pathology.

SECTION-B

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

Here are the statements:

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.

(1) B, D & E only

(2) B, C & D only

(3) A & C only

(4) A, B & D only

Correct Answer: (1) B, D & E only

Solution: Evaluating statements about non-chordate characteristics.

B: Notochord is absent in non-chordates, which is correct.

D: Non-chordates do not typically have a dorsal heart; any heart-like structures are ventral or absent, thus this statement is also correct.

E: Non-chordates often lack a post-anal tail, aligning with this correct statement.

Statements A and C are incorrect for non-chordates as they have neither a dorsal central nervous system nor gill slits on the pharynx typically.

Quick Tip

Familiarize yourself with the basic anatomical and physiological differences between chordates and non-chordates for clearer distinctions in taxonomy.

---

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

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

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

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

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

Solution: Detailed Analysis of Each Match:

A. Mesozoic Era (III): The Mesozoic Era, often referred to as the ”Age of Reptiles,” is

notable for the dominance and diversification of reptiles, including the dinosaurs, as well as the early evolution of birds. Hence, A matches with **III (Birds & Reptiles)**.

B. Proterozoic Era (I): The Proterozoic Era spans from 2.5 billion to 540 million years ago and is characterized by the emergence of the first complex life forms, including the first multicellular organisms, which were predominantly lower invertebrates. Thus, B matches with **I (Lower invertebrates)**.

C. Cenozoic Era (IV): Known as the ”Age of Mammals,” the Cenozoic Era follows the Mesozoic and features the extensive diversification and dominance of mammals following the extinction of the non-avian dinosaurs. Therefore, C matches with **IV (Mammals)**.

D. Paleozoic Era (II): The Paleozoic Era is known for the ”Cambrian Explosion,” leading to the appearance and evolution of a wide variety of life forms, including the first fish and later amphibians. Hence, D is correctly paired with **II (Fish & Amphibia)**.

Quick Tip

Linking geological time periods with characteristic life forms can enhance your understanding of evolutionary biology.

---

188. 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 correct but Statement II is incorrect.

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

(3) Both Statement I and Statement II are correct.

(4) Both Statement I and Statement II are incorrect.

Correct Answer: (1) Statement I is correct but Statement II is incorrect.

Solution: Step 1: Verifying Statement I.

The corpus callosum is indeed the nerve tract that connects the two cerebral hemispheres,

making Statement I correct.

Step 2: Verifying Statement II.

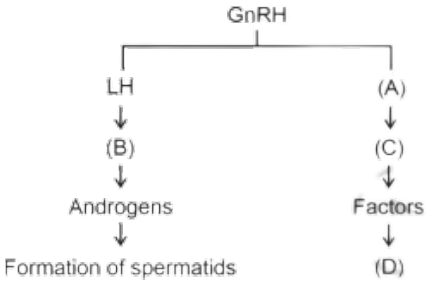
The brain stem is composed of the medulla oblongata, pons, and midbrain, not the cerebrum, making Statement II incorrect.

Quick Tip

When studying brain anatomy, visualizing the brain structures can help in retaining their functions and relationships more effectively.

---

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



(1) FSH, Sertoli cells, Leydig cells, spermatogenesis.

(2) ICSH, Leydig cells, Sertoli cells, spermatogenesis.

(3) FSH, Leydig cells, Sertoli cells, spermiogenesis.

(4) ICSH, Interstitial cells, Leydig cells, spermiogenesis.

Correct Answer: (3) FSH, Leydig cells, Sertoli cells, spermiogenesis

Solution: Detailed Analysis of the Correct Match:

FSH (A): Follicle Stimulating Hormone influences Sertoli cells which are crucial for nourishing developing sperm cells and are instrumental in the process termed spermatogenesis.

Leydig cells (B): Stimulated by LH, Leydig cells are responsible for producing testosterone (Androgens), which is essential for the development of male secondary sexual characteristics and influencing spermatogenesis.

Sertoli cells (C): Act under the influence of FSH and testosterone to support the maturation of sperm cells, particularly during the phase called spermiogenesis, where spermatids are transformed into mature spermatozoa.

Spermiogenesis (D): This is the final stage of spermatogenesis where spermatids are converted into spermatozoa (mature sperm cells). This step involves significant morphological changes which are supported by Sertoli cells.

Quick Tip

Understanding hormonal interactions in biological processes can significantly aid in grasping complex physiological pathways.

---

190. 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

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

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

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

Solution: Matching transcription elements and processes with their descriptions.

RNA polymerase III (A) primarily transcribes SnRNAs and tRNA (IV).

Termination of transcription (B) often involves the **Rho factor (III)**, especially in prokaryotes.

Splicing of Exons (C) is facilitated by snRNPs (I), crucial components of the spliceosome.

TATA box (D) is a promoter element recognized by transcription factors that help in initiating transcription (II).

Quick Tip

Linking the functions of molecular biology elements to their roles in gene expression can help you understand and remember their importance in cellular processes.

---

191. 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.

Choose the correct answer from the options given below:

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

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

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

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

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

Solution: Step 1: Matching endocrine disorders with their symptoms.

Exophthalmic goiter (A) is associated with **hypersecretion of thyroid hormone and protruding eyeballs (III)**.

Acromegaly (B) results from **excessive secretion of growth hormone (IV)**.

Cushing's syndrome (C) is characterized by **excess cortisol secretion, moon face, and hyperglycemia (I)**.

Cretinism (D) involves **hypo-secretion of thyroid hormone and stunted growth (II)**.

Quick Tip

Linking the symptoms and hormone imbalances can help in quickly identifying endocrine disorders.

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192. 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

Choose the correct answer from the options given below:

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

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

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

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

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

Solution: Matching types of epithelial tissues with their locations.

Unicellular glandular epithelium (A) refers to **goblet cells of the alimentary canal (III)**, which secrete mucus.

Compound epithelium (B) is found on the **moist surface of the buccal cavity (IV)**, offering protection.

Multicellular glandular epithelium (C) includes **salivary glands (I)**, which contain many cells working together to produce saliva.

Endocrine glandular epithelium (D) characterizes glands like the **pancreas (II)**, which secretes hormones directly into the blood.

Quick Tip

Understanding the structure and function of different epithelial tissues helps in studying their roles in various organs and systems.

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193. 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 micro environments 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 correct but Statement II is incorrect.

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

(3) Both Statement I and Statement II are correct.

(4) Both Statement I and Statement II are incorrect.

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

Solution: Step 1: Verifying Statement I.

Bone marrow is indeed the primary site for the production of all types of blood cells, including lymphocytes, making Statement I correct.

Step 2: Verifying Statement II.

Both bone marrow and thymus are critical for the development and maturation of T-lymphocytes, with bone marrow producing the cells and the thymus providing the environment for their maturation, making Statement II correct.

Quick Tip

Understanding the roles of different lymphoid organs can help clarify their functions in the immune system.

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194. Match List I with List II related to the 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

Choose the correct answer from the options given below:

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

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

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

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

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

Solution: Matching anatomical structures to their functions in cockroaches.

The structures used for storing of food (A) in cockroaches is the **Crop (IV)**, which serves as a storage compartment.

Ring of 6-8 blind tubules at junction of foregut and midgut (B) refers to the **Gastric Caeca (II)**, which aid in digestion and absorption.

Ring of 100-150 yellow coloured thin filaments at junction of midgut and hindgut (C) are the **Malpighian Tubules (III)**, involved in excretion and osmoregulation.

The structures used for grinding the food (D) in cockroaches is the **Gizzard (I)**, which mechanically breaks down food.

Quick Tip

Understanding the specialized structures in the digestive systems of different organisms, like insects, reveals their adaptation to ecological niches.

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

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

(2) Juxta medullary nephrons belong beneath the cortical nephrons.

(3) Juxta medullary nephrons are located in the columns of Bertini.

(4) Renal corpuscle of juxta medullary nephron lies in the outer portion of the renal medulla.

Correct Answer: (1) Loop of Henle of juxta medullary nephron runs deep into medulla.

Solution: Analysis of Each Statement:

Statement 1: This statement is **correct**. Juxta medullary nephrons have their renal corpuscles located near the medulla, and their loops of Henle extend deeply into the renal medulla. This deep extension is crucial for the process of concentrating urine, as it allows for the creation of a significant osmotic gradient along the loop, facilitating efficient water and

solute reabsorption.

Statement 2: This statement is **incorrect**. Juxta medullary nephrons do not outnumber cortical nephrons. In fact, cortical nephrons make up the majority of nephrons in the kidney.

Statement 3: This statement is **incorrect**. Juxta medullary nephrons are not located in the columns of Bertini, but their renal corpuscles are located at the boundary of the cortex and the medulla, hence the name ”juxta medullary.”

Statement 4: This statement is **incorrect**. The renal corpuscle of the juxta medullary nephron is located at the cortex-medulla junction, not in the outer portion of the renal medulla.

Significance of Juxta Medullary Nephrons:

Juxta medullary nephrons play a critical role in the kidney’s ability to produce concentrated urine, which is essential for water conservation in the body. Their deep loops of Henle and the associated vasa recta create and maintain a high osmolarity in the surrounding interstitial fluid, enabling effective water reabsorption from the collecting ducts.

Quick Tip

The length and depth of the Loop of Henle in nephrons play crucial roles in the kidney’s ability to concentrate urine, which is vital for maintaining water and salt balance in the body.

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196. 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.

Choose the correct answer from the options given below :

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

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

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

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

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

Solution: Matching ECG components with their physiological meanings.

P wave (A) represents the **depolarisation of atria (III)**.

QRS complex (B) indicates the **depolarisation of ventricles (II)**.

T wave (C) is associated with the **repolarisation of ventricles (IV)**.

T-P gap (D) corresponds to a period when the **heart muscles are electrically silent (I)**.

Quick Tip

Understanding ECG patterns is crucial for diagnosing heart function and identifying any abnormalities in cardiac rhythms.

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197. 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. $I^Bi/I^Ai/ii$

B. $I^BI^B/I^AI^A/ii$

C. $I^AI^B/iI^A/I^Bi$

D. $I^Ai/I^Bi/I^Ai$

E. $iI^B/iI^A/I^AI^B$

Choose the most appropriate answer from the options given below:

(1) $C\&B$ only

(2) $D\&E$ only

(3) A only

(4) B only

Correct Answer: (3) A only

Solution: Analysis of Blood Groups and Genotypes:

The ABO blood group system is determined by a single gene with three alleles: I^A, I^B, and i. I^A and I^B are codominant, and i is recessive.

Father (Blood Group B+):

To have a B blood type, the father can be either I^BI^B or I^Bi.

Mother (Blood Group A+):

To have an A blood type, the mother can be either I^AI^A or I^Ai.

Child (Blood Group O+):

To have an O blood type, the child must be ii. This means each parent must contribute an i allele.

Evaluating Options:

Option A (I^Bi/I^Ai/ii): This is the only scenario that can produce a child with blood type O (ii) from parents with blood types B (I^Bi) and A (I^Ai). Both parents possess one i allele, which they can pass to their child, resulting in the child having ii genotype. **Other Options:** They either lack the necessary i alleles or specify impossible combinations for the given blood types (e.g., parents with both dominant alleles cannot produce a child with an O blood type).

Quick Tip

Remember, the presence of IA or IB alone does not determine phenotype without considering the second allele because of the recessive nature of i.

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198. 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 true but Statement II is false.

(2) Statement I is false but Statement II is true.

(3) Both Statement I and Statement II are true.

(4) Both Statement I and Statement II are false.

Correct Answer: (2) Statement I is false but Statement II is true.

Solution: Step 1: Understanding Gause's competitive exclusion principle.

Gause's principle states that two species competing for the same limited resources cannot coexist at constant population values if other ecological factors remain constant. Thus, when the resources are limited, one species will outcompete the other.

Step 2: Analyzing the statements.

Statement I is false because it incorrectly states that the species compete for different resources; the principle actually involves the same resource. Statement II correctly interprets the principle in the context of limited resources.

Quick Tip

Gause's competitive exclusion principle is a fundamental concept in ecology, emphasizing the role of direct competition in species survival and adaptation.

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199. 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) B, A, C, D, E

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

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

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

Correct Answer: (3) E, A, D, C, B

Solution: Analysis of the Correct Sequence (E, A, D, C, B):

Step E (Substrate binding to active site): This is the first step in the catalytic cycle of enzyme action. The substrate approaches and binds to the specific active site of the enzyme, forming a stable complex. This step is crucial as it ensures specificity and the correct alignment of the substrate for the chemical reaction.

Step A (Substrate-enzyme complex formation): Following substrate binding, the

enzyme-substrate complex is fully formed. This complex is typically stabilized by multiple interactions between the substrate and specific amino acid residues within the active site.

Step D (Chemical bonds of the substrate broken): Within the complex, the enzyme catalyzes the conversion of the substrate into the product(s) by breaking the chemical bonds. This transformation often involves rearrangement of electrons and breaking/formation of new bonds.

Step C (Release of products): After the reaction, the newly formed product(s) are released from the enzyme's active site. The enzyme's active site returns to its original state, ready to interact with a new substrate molecule.

Step B (Free enzyme ready to bind with another substrate): With the active site cleared of the product, the enzyme is now free again and can bind another substrate molecule, repeating the catalytic cycle.

Quick Tip

Understanding each step in enzyme catalysis can enhance comprehension of biochemical reactions and their regulation within living systems.

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200. Given below are two statements:

Statement I: Mitochondria and chloroplasts both double membranes bound organelles.

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

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

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

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

(3) Both Statement I and Statement II are correct.

(4) Both Statement I and Statement II are incorrect.

Correct Answer: (1) Statement I is correct but Statement II is incorrect.

Solution: Evaluation of Statement I:

Mitochondria and chloroplasts as double-membrane organelles: This statement is

correct. Both mitochondria and chloroplasts are organelles that possess two membranes—an outer membrane that encapsulates the organelle, and an inner membrane that contains many of the biochemical mechanisms vital to their function. The presence of these double membranes is key to their roles in cellular metabolism and photosynthesis, respectively.

Evaluation of Statement II:

Comparative permeability of inner membranes: This statement is **incorrect**. The inner membrane of the mitochondria is indeed relatively impermeable, which is crucial for maintaining the proton gradient essential for ATP synthesis through oxidative phosphorylation. However, the inner membrane of chloroplasts, particularly the thylakoid membrane, must also maintain a proton gradient to facilitate ATP synthesis during the light reactions of photosynthesis. Thus, it is also selectively permeable and designed to regulate ion and protein movement strictly. The assertion that the mitochondrial inner membrane is ”less permeable” compared to that of chloroplasts lacks context, as both membranes have evolved to tightly regulate ion gradients critical for their energy-transforming functions.

Quick Tip

Recognizing the structural similarities and functional differences between mitochondria and chloroplasts can aid in understanding their roles in cellular energy dynamics.
