NEET UG 2023 G3 Zoology Question Paper with Solutions

Time Allowed :3 Hour 20 Minutes	**Maximum Marks :**720	**Total Questions :**200

General Instructions

Read the following instructions very carefully and strictly follow them:

1. The Answer Sheet is this Test Booklet. When you are directed to open the Test Booklet, take the Answer Sheet and fill in the particulars in ORIGINAL Copy carefully with blue/black ball pen only.
2. The test is of 3 hours 20 minutes duration and the Test Booklet contains 200 multiple-choice questions (four options with a single correct answer) from Physics, Chemistry, and Biology (Botany and Zoology). 50 questions in each subject are divided into two Sections (A and B) as per details given below:
3. (a) Section A shall consist of 35 (Thirty-five) questions in each subject (Question Nos. 1 to 35, 51 to 85, 101 to 135 and 151 to 185).
4. (b) Section B shall consist of 15 (Fifteen) questions in each subject (Question Nos. 36 to 50, 86 to 100, 136 to 150 and 186 to 200). In Section B, a candidate needs to attempt any 10 (Ten) questions out of 15 (Fifteen) in each subject.
5. Candidates are advised to read all 15 questions in each subject of Section B before they start attempting the question paper. In the event of a candidate attempting more than ten questions, the first ten questions answered by the candidate shall be evaluated.
6. Each question carries 4 marks. For each correct response, the candidate will get 4 marks. For each incorrect response, one mark will be deducted from the total scores. The maximum marks are 720.
7. Rough work is to be done in the space provided for this purpose in the Test Booklet only.
8. On completion of the test, the candidate must hand over the Answer Sheet (ORIGINAL and OFFICE Copy) to the Invigilator before leaving the Room/Hall. The candidates are allowed to take away this Test Booklet with them.
9. Use of Electronic/Manual Calculator is prohibited.

Section A

151. Match List I with List II.

List I (Cells)		List II (Secretion)	
A.	**Peptic cells**	**I.**	**Mucus**
B.	**Goblet cells**	**II.**	**Bile juice**
C.	**Oxyntic cells**	**III.**	**Proenzyme pepsinogen**
D.	**Hepatic cells**	**IV.**	**HCl and intrinsic factor for absorption of vitamin B_{12}**

Choose the correct answer from the options given below:

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

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

Solution:

Step 1: Understanding the Question:
The question requires matching the types of cells listed in List I with their corresponding secretions in List II. This tests knowledge of the digestive system's histology and physiology.

Step 3: Detailed Explanation:
Let's analyze each cell type and its function:

- **A. Peptic cells:** Also known as chief cells or zymogen cells, they are present in the gastric glands of the stomach. Their primary function is to secrete the proenzyme pepsinogen, which is an inactive form of the protein-digesting enzyme pepsin. So, **A matches with III**.

- **B. Goblet cells:** These are specialized epithelial cells found in the lining of various tracts, including the gastrointestinal and respiratory tracts. They secrete mucus, which lubricates and protects the lining. So, **B matches with I**.

- **C. Oxyntic cells:** Also known as parietal cells, these are also found in the gastric glands. They secrete hydrochloric acid (HCl) and intrinsic factor. HCl creates an acidic environment for pepsin to function, and intrinsic factor is essential for the absorption of vitamin B_{12}. So, **C matches with IV**.

- **D. Hepatic cells:** These are the main cells of the liver (hepatocytes). They have many functions, one of which is the production of bile juice, which is important for the emulsi-

fication and digestion of fats. So, **D matches with II**.

Step 4: Final Answer:
Based on the analysis, the correct matching is A-III, B-I, C-IV, D-II. This corresponds to option (4).

Quick Tip

For matching questions related to biology, create a quick reference table of glands/cells and their secretions/functions during your revision. This helps in quick recall during the exam.

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152. Which one of the following common sexually transmitted diseases is completely curable when detected early and treated properly?

(A) HIV Infection
(B) Genital herpes
(C) Gonorrhoea
(D) Hepatitis-B

Correct Answer: (3) Gonorrhoea

Solution:

Step 1: Understanding the Question:
The question asks to identify which of the given sexually transmitted diseases (STDs) is completely curable. This requires distinguishing between bacterial and viral STDs, as their treatability differs significantly.

Step 3: Detailed Explanation:
Let's examine the nature of each disease:

- **HIV Infection:** Caused by the Human Immunodeficiency Virus (HIV). It is a viral infection that attacks the immune system. While manageable with antiretroviral therapy (ART), there is currently no complete cure.

- **Genital Herpes:** Caused by the Herpes Simplex Virus (HSV). It is a viral infection that causes sores. There is no cure for genital herpes, but antiviral medications can prevent or shorten outbreaks.

- **Gonorrhoea:** Caused by the bacterium *Neisseria gonorrhoeae*. Being a bacterial infection, it is completely curable with a course of antibiotics, especially if detected and treated

early.

- **Hepatitis-B:** Caused by the Hepatitis B Virus (HBV). It is a viral infection affecting the liver. For chronic cases, treatments can manage the virus, but a complete cure is not always possible. A vaccine is available for prevention.

Among the given options, only Gonorrhoea is a bacterial disease and thus is completely curable with appropriate antibiotics.

Step 4: Final Answer:
Gonorrhoea is the only STD in the list that is completely curable with proper and timely treatment. Therefore, option (3) is the correct answer.

Quick Tip

A key distinction to remember for STDs is that bacterial infections (like Gonorrhoea, Syphilis, Chlamydia) are generally curable with antibiotics, while viral infections (like HIV, Herpes, Hepatitis-B, HPV) are often manageable but not curable.

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153. Select the correct group/set of Australian Marsupials exhibiting adaptive radiation.

(A) Lemur, Anteater, Wolf
(B) Tasmanian wolf, Bobcat, Marsupial mole
(C) Numbat, Spotted cuscus, Flying phalanger
(D) Mole, Flying squirrel, Tasmanian tiger cat

Correct Answer: (3) Numbat, Spotted cuscus, Flying phalanger

Solution:

Step 1: Understanding the Question:
The question asks to identify a group consisting exclusively of Australian marsupials, which are a classic example of adaptive radiation. Adaptive radiation is the evolution of different species from a common ancestor to fill different ecological niches.

Step 3: Detailed Explanation:
We need to analyze each option to see if all animals listed are Australian marsupials.

- **(1) Lemur, Anteater, Wolf:** These are all placental mammals, not marsupials. Lemurs are primates from Madagascar, and anteaters and wolves are found in various parts of the world.

- **(2) Tasmanian wolf, Bobcat, Marsupial mole:** The Tasmanian wolf (thylacine) and Marsupial mole are Australian marsupials. However, the Bobcat is a placental mammal (a feline) found in North America.

- **(3) Numbat, Spotted cuscus, Flying phalanger:** All three are Australian marsupials. The Numbat is an insectivorous marsupial, the Spotted cuscus is an arboreal marsupial, and the Flying phalanger (sugar glider) is a gliding possum. This group correctly represents adaptive radiation from a common marsupial ancestor.

- **(4) Mole, Flying squirrel, Tasmanian tiger cat:** The Mole and Flying squirrel are placental mammals. While there are marsupial equivalents (like the marsupial mole and flying phalanger), the names given here typically refer to the placental versions. The Tasmanian tiger cat (quoll) is a marsupial. This is a mixed group.

Step 4: Final Answer:
The only option that contains a set of only Australian marsupials is (3).

Quick Tip

Remember the key examples of adaptive radiation: Darwin's Finches in the Galapagos and Australian Marsupials. For Australian marsupials, be aware of convergent evolution, where marsupials have evolved to resemble placental mammals in other parts of the world (e.g., Tasmanian Wolf and Wolf, Marsupial Mole and Mole).

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154. Match List I with List II.

List I		List II	
A.	**P-wave**	**I.**	**Beginning of systole**
B.	**Q-wave**	**II.**	**Repolarisation of ventricles**
C.	**QRS complex**	**III.**	**Depolarisation of atria**
D.	**T-wave**	**IV.**	**Depolarisation of ventricles**

Choose the correct answer from the options given below:

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

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

Solution:

Step 1: Understanding the Question:
This question requires matching the different components of a standard electrocardiogram

(ECG) waveform (List I) with the cardiac events they represent (List II).

Step 3: Detailed Explanation:
Let's analyze each component of the ECG:

- **A. P-wave:** Represents the electrical impulse spreading across the atria, causing atrial depolarization. This leads to atrial contraction (atrial systole). So, **A matches with III (Depolarisation of atria)**.

- **C. QRS complex:** Represents the rapid depolarization of the ventricles. This electrical event triggers ventricular contraction (ventricular systole). So, **C matches with IV (Depolarisation of ventricles)**.

- **D. T-wave:** Represents the repolarization of the ventricles, which is the recovery phase after depolarization. So, **D matches with II (Repolarisation of ventricles)**.

- **B. Q-wave:** The Q-wave is the first downward deflection of the QRS complex. The entire QRS complex marks the onset of ventricular systole. Therefore, matching Q-wave with the "Beginning of systole" (specifically ventricular systole) is appropriate in this context. So, **B can be matched with I**.

Step 4: Final Answer:
Based on the analysis, the correct matching is A-III, B-I, C-IV, D-II. This corresponds to option (2).

Quick Tip

A simple way to remember ECG waves: P for atrial depolarization, QRS for ventricular depolarization, and T for ventricular repolarization. Atrial repolarization is masked by the larger QRS complex.

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155. Match List I with List II.

List I		List II	
A.	**Ringworm**	**I.**	***Haemophilus influenzae***
B.	**Filariasis**	**II.**	***Trichophyton***
C.	**Malaria**	**III.**	***Wuchereria bancrofti***
D.	**Pneumonia**	**IV.**	***Plasmodium vivax***

Choose the correct answer from the options given below:

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

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

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

Solution:

Step 1: Understanding the Question:
The question asks to match the disease in List I with its causative agent in List II. This tests knowledge of common human diseases and their pathogens.

Step 3: Detailed Explanation:
Let's identify the causative agent for each disease:

- **A. Ringworm:** Despite its name, ringworm is not caused by a worm. It is a common fungal infection of the skin, hair, or nails. The fungi responsible belong to genera like *Trichophyton*, *Microsporum*, and *Epidermophyton*. So, **A matches with II**.

- **B. Filariasis (Elephantiasis):** This is a parasitic disease caused by infection with filarial worms (nematodes). The most common causative agent is *Wuchereria bancrofti*. So, **B matches with III**.

- **C. Malaria:** This is a mosquito-borne infectious disease caused by protozoan parasites of the genus *Plasmodium*. *Plasmodium vivax* is one of the species that causes malaria. So, **C matches with IV**.

- **D. Pneumonia:** This is an inflammatory condition of the lung affecting primarily the alveoli. It can be caused by various microorganisms, including bacteria, viruses, and fungi. *Haemophilus influenzae* and *Streptococcus pneumoniae* are common bacterial causes. So, **D matches with I**.

Step 4: Final Answer:
The correct set of matches is A-II, B-III, C-IV, D-I. This corresponds to option (2).

Quick Tip

For disease-related questions, make a chart with columns for Disease, Causative Agent (and its type: virus, bacteria, fungus, protozoa, helminth), Mode of Transmission, and Symptoms. This systematic approach helps in memorization.

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156. Given below are two statements:
Statement I: Vas deferens receives a duct from seminal vesicle and opens into urethra as the ejaculatory duct.

Statement II: The cavity of the cervix is called cervical canal which along with vagina forms birth canal.
In the light of the above statements, choose the correct answer from the options given below:

(A) Statement I incorrect but Statement II is true.
(B) Both Statement I and Statement II are true.
(C) Both Statement I and Statement II are false.
(D) Statement I is correct but Statement II is false.

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

Solution:

Step 1: Understanding the Question:
The question presents two statements related to the male and female reproductive systems. We need to evaluate the correctness of each statement.

Step 3: Detailed Explanation:

- **Analysis of Statement I:** The vas deferens is a duct that carries sperm from the epididymis. It ascends into the abdomen and loops over the urinary bladder. Here, it is joined by a duct from the seminal vesicle. The fusion of the vas deferens and the duct of the seminal vesicle forms the ejaculatory duct. This ejaculatory duct then passes through the prostate gland and opens into the urethra. Thus, Statement I is factually correct.

- **Analysis of Statement II:** The cervix is the lower, narrow part of the uterus. The cavity within the cervix is called the cervical canal. During childbirth (parturition), the baby passes from the uterus, through the cervical canal, and then through the vagina to the outside. The cervical canal and the vagina together constitute the birth canal. Thus, Statement II is also factually correct.

Step 4: Final Answer:
Since both Statement I and Statement II are correct descriptions of human reproductive anatomy, the correct option is (2).

Quick Tip

For statement-based questions in anatomy, it is helpful to visualize the structures and trace the pathways (like the path of sperm or the path of the baby during birth). This mental mapping helps verify the accuracy of the statements.

157. Given below are two statements:
Statement I: RNA mutates at a faster rate.
Statement II: Viruses having RNA genome and shorter life span mutate and evolve faster.
In the light of the above statements, choose the correct answer from the options given below:

(A) Statement I false but Statement II is true.
(B) Both Statement I and Statement II are true.
(C) Both Statement I and Statement II are false.
(D) Statement I is true but Statement II is false.

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

Solution:

Step 1: Understanding the Question:
This question presents two statements related to the mutation rate of RNA and RNA viruses. We need to determine the validity of each statement.

Step 3: Detailed Explanation:

- **Analysis of Statement I:** RNA is chemically less stable than DNA. The 2'-hydroxyl group in the ribose sugar of RNA makes it more susceptible to hydrolysis. Furthermore, RNA is typically single-stranded, leaving its bases exposed and more vulnerable to chemical modifications. DNA, being double-stranded, is more stable and has proofreading and repair mechanisms during replication that are often less efficient or absent in RNA replication. Consequently, RNA mutates at a faster rate than DNA. Thus, Statement I is true.

- **Analysis of Statement II:** Many viruses have an RNA genome (e.g., Influenza virus, HIV, Coronavirus). The enzymes that replicate RNA (RNA-dependent RNA polymerases or reverse transcriptases) often lack the proofreading capability of DNA polymerases. This lack of proofreading leads to a higher rate of mutation during replication. Combined with their short generation time (life span), this high mutation rate allows RNA viruses to evolve very rapidly, enabling them to adapt to new hosts or evade the host's immune system. Thus, Statement II is also true.

Statement II provides the reason why Statement I is a significant phenomenon, especially in the context of virology. Both statements are correct.

Step 4: Final Answer:
Both statements are scientifically correct. Therefore, the correct option is (2).

Quick Tip

Remember the central dogma and the properties of nucleic acids. The stability of DNA (double helix, deoxyribose) vs. RNA (single strand, ribose) is a key concept that explains their different roles and mutation rates. This is crucial for understanding virology and evolution.

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158. Radial symmetry is NOT found in adults of phylum

(A) Echinodermata
(B) Ctenophora
(C) Hemichordata
(D) Coelenterata

Correct Answer: (3) Hemichordata

Solution:

Step 1: Understanding the Question:
The question asks to identify the phylum among the given options whose adult members do not exhibit radial symmetry. This requires knowledge of the body plans of different animal phyla.

Step 3: Detailed Explanation:
Let's review the symmetry of each phylum:

- **(1) Echinodermata:** Adult echinoderms (like starfish and sea urchins) exhibit pentaradial symmetry (a type of radial symmetry). Interestingly, their larvae are bilaterally symmetrical.

- **(2) Ctenophora:** Ctenophores (comb jellies) exhibit biradial symmetry, which is a modified form of radial symmetry.

- **(3) Hemichordata:** Hemichordates (like acorn worms) are exclusively marine, worm-like animals. They are bilaterally symmetrical throughout their lives. They do not show radial symmetry.

- **(4) Coelenterata (Cnidaria):** Coelenterates (like jellyfish and sea anemones) are classic examples of animals with radial symmetry.

Thus, the phylum whose adults do not have radial symmetry is Hemichordata.

Step 4: Final Answer:
Hemichordates are bilaterally symmetrical. Therefore, option (3) is the correct answer.

Quick Tip

Pay close attention to qualifiers like "adults" or "larvae" in questions about animal classification. In the case of Echinodermata, the symmetry changes from bilateral in larvae to radial in adults, which is a common point of confusion.

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159. Given below are statements: one is labelled as Assertion A and the other is labelled as Reason R.
Assertion A: Nephrons are of two types: Cortical & Juxta medullary, based on their relative position in cortex and medulla.
Reason R: Juxta medullary nephrons have short loop of Henle whereas, cortical nephrons have longer loop of Henle.
In the light of the above statements, choose the correct answer from the options given below:

(A) A is false but R is true.
(B) Both A and R are true and R is the correct explanation of A.
(C) Both A and R are true but R is NOT the correct explanation of A.
(D) A is true but R is false.

Correct Answer: (4) A is true but R is false.

Solution:

Step 1: Understanding the Question:
This is an Assertion-Reason question. We need to evaluate the correctness of both the Assertion (A) and the Reason (R), and then determine if R correctly explains A.

Step 3: Detailed Explanation:

- **Analysis of Assertion (A):** The assertion states that there are two types of nephrons, cortical and juxtamedullary, classified based on their position. Cortical nephrons have their glomeruli in the outer cortex and their loops of Henle barely dip into the medulla. Juxtamedullary nephrons have their glomeruli near the corticomedullary junction, and their loops of Henle extend deep into the medulla. This statement is factually correct. So, **A is true**.

- **Analysis of Reason (R):** The reason states that juxtamedullary nephrons have a short loop of Henle and cortical nephrons have a long loop of Henle. This is the exact opposite of the actual anatomy. Juxtamedullary nephrons are characterized by their very long loops

of Henle, which are crucial for creating the concentration gradient in the medulla for urine concentration. Cortical nephrons, which make up the majority of nephrons, have short loops of Henle. Therefore, the statement is factually incorrect. So, **R is false**.

Step 4: Final Answer:
Since Assertion A is true and Reason R is false, the correct option is (4).

Quick Tip

To remember the difference, associate "Juxtamedullary" (meaning 'next to the medulla') with nephrons that have long loops extending deep into the medulla. These long loops are essential for the counter-current mechanism to produce concentrated urine.

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160. Vital capacity of lung is _____

(A) IRV + ERV + TV
(B) IRV + ERV
(C) IRV + ERV + TV + RV
(D) IRV + ERV + TV – RV

Correct Answer: (1) IRV + ERV + TV

Solution:

Step 1: Understanding the Question:
The question asks for the correct formula for the Vital Capacity (VC) of the lungs using standard respiratory volume abbreviations.

Step 2: Key Formula or Approach:
First, let's define the terms:

- **Tidal Volume (TV):** Volume of air inspired or expired during a normal respiration.
- **Inspiratory Reserve Volume (IRV):** Additional volume of air a person can inspire by a forcible inspiration.
- **Expiratory Reserve Volume (ERV):** Additional volume of air a person can expire by a forcible expiration.
- **Residual Volume (RV):** Volume of air remaining in the lungs even after a forcible expiration.
- **Vital Capacity (VC):** The maximum volume of air a person can breathe in after a forced expiration or the maximum volume of air a person can breathe out after a forced inspiration.

From the definition, Vital Capacity is the sum of the air involved in maximal inspiration and maximal expiration, which includes the normal tidal volume.

$$\text{Vital Capacity (VC)} = \text{IRV} + \text{ERV} + \text{TV}$$

Step 3: Detailed Explanation:
Let's analyze the options based on the formula:

- (1) IRV + ERV + TV: This matches the definition of Vital Capacity.
- (2) IRV + ERV: This is known as the Inspiratory Capacity is TV+IRV, and Expiratory capacity is TV+ERV. This option is incorrect.
- (3) IRV + ERV + TV + RV: This sum represents the Total Lung Capacity (TLC), not the Vital Capacity. (TLC = VC + RV).
- (4) IRV + ERV + TV – RV: This formula does not correspond to any standard lung capacity.

Step 4: Final Answer:
The correct formula for Vital Capacity is IRV + ERV + TV. Therefore, option (1) is correct.

Quick Tip

Remember the key respiratory capacities:

- Inspiratory Capacity (IC) = TV + IRV
- Expiratory Capacity (EC) = TV + ERV
- Functional Residual Capacity (FRC) = ERV + RV
- Vital Capacity (VC) = IRV + TV + ERV
- Total Lung Capacity (TLC) = VC + RV

Visualizing these on a spirogram can aid memory.

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161. Which of the following are NOT considered as the part of endomembrane system?
A. Mitochondria
B. Endoplasmic Reticulum
C. Chloroplasts
D. Golgi complex
E. Peroxisomes
Choose the most appropriate answer from the options given below:

(A) A, D and E only
(B) B and D only
(C) A, C and E only

(D) A and D only

Correct Answer: (3) A, C and E only

Solution:

Step 1: Understanding the Question:
The question asks to identify which of the listed organelles are not part of the eukaryotic cell's endomembrane system.

Step 3: Detailed Explanation:
The **endomembrane system** is a group of membranes and organelles in eukaryotic cells that work together to modify, package, and transport lipids and proteins. Its components include:

- The nuclear envelope
- The endoplasmic reticulum (ER)
- The Golgi apparatus (or Golgi complex)
- Lysosomes
- Vacuoles
- Vesicles
- The cell membrane

These organelles are connected either directly or through the transport of vesicles. Now let's evaluate the given options:

- **A. Mitochondria:** Mitochondria are involved in cellular respiration and ATP production. They have their own DNA and ribosomes and replicate independently. They are not considered part of the endomembrane system.
- **B. Endoplasmic Reticulum:** The ER is a central component of the endomembrane system, involved in protein and lipid synthesis.
- **C. Chloroplasts:** Like mitochondria, chloroplasts are involved in energy conversion (photosynthesis), have their own DNA and ribosomes, and replicate independently. They are not part of the endomembrane system.
- **D. Golgi complex:** The Golgi apparatus is a key part of the endomembrane system, responsible for modifying, sorting, and packaging proteins and lipids for secretion or delivery to other organelles.
- **E. Peroxisomes:** Peroxisomes are small organelles that contain enzymes for metabolic processes, including breaking down fatty acids and detoxifying harmful substances. They are not derived from the ER-Golgi pathway and are thus not considered part of the endomembrane system.

Therefore, Mitochondria (A), Chloroplasts (C), and Peroxisomes (E) are not part of the endomembrane system.

Step 4: Final Answer:
The organelles not part of the endomembrane system are A, C, and E. This corresponds to option (3).

Quick Tip

Remember that the endomembrane system is all about synthesis and transport of proteins and lipids. Mitochondria and chloroplasts are "energy organelles" with a degree of autonomy, and peroxisomes have specialized metabolic roles, setting them apart from the core endomembrane network.

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162. Match List I with List II.

List I		List II	
A.	**Gene 'a'**	**I.**	**β-galactosidase**
B.	**Gene 'y'**	**II.**	**Transacetylase**
C.	**Gene 'i'**	**III.**	**Permease**
D.	**Gene 'z'**	**IV.**	**Repressor protein**

Choose the correct answer from the options given below:

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

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

Solution:

Step 1: Understanding the Question:
The question requires matching the genes of the lac operon (List I) with the proteins they code for (List II).

Step 3: Detailed Explanation:
The lac operon in *E. coli* is a classic example of gene regulation. It consists of a regulator gene and three structural genes.

- **Gene 'i' (Regulator gene):** This gene codes for the **repressor protein**. The repressor binds to the operator region of the operon, preventing transcription in the absence of lactose. So, **C matches with IV**.

- **Gene 'z' (Structural gene):** This gene codes for the enzyme β**-galactosidase**, which breaks down lactose into glucose and galactose. So, **D matches with I**.

- **Gene 'y' (Structural gene):** This gene codes for **permease**, an enzyme that increases the permeability of the cell to lactose, allowing it to enter the cell. So, **B matches with III**.

- **Gene 'a' (Structural gene):** This gene codes for **transacetylase**, an enzyme whose function in lactose metabolism is not fully understood but is thought to be involved in detoxifying byproducts. So, **A matches with II**.

Step 4: Final Answer:
Based on the functions of the lac operon genes, the correct matching is: A-II, B-III, C-IV, D-I. This corresponds to option (3).

Quick Tip

Remember the order of the structural genes in the lac operon: lacZ, lacY, lacA. This corresponds to their products: β-galactosidase, Permease, and Transacetylase. The 'i' gene stands for inhibitor, as it produces the repressor protein.

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163. Match List I with List II.

List I		List II	
A.	**Heroin**	**I.**	**Effect on cardiovascular system**
B.	**Marijuana**	**II.**	**Slow down body function**
C.	**Cocaine**	**III.**	**Painkiller**
D.	**Morphine**	**IV.**	**Interfere with transport of dopamine**

Choose the correct answer from the options given below:

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

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

Solution:

Step 1: Understanding the Question:
This question requires matching common drugs (List I) with their primary physiological effects or mechanisms of action (List II).

Step 3: Detailed Explanation:
Let's analyze each drug and its effect:

- **A. Heroin:** Heroin (diacetylmorphine) is a powerful opioid and a central nervous system depressant. It binds to opioid receptors in the brain, leading to pain relief (analgesia) and euphoria, but its overall effect is to **slow down body function**, including breathing and heart rate. So, **A matches with II**.

- **B. Marijuana:** The active components in marijuana, cannabinoids, interact with cannabinoid receptors in the brain. These interactions have various effects, including a significant **effect on the cardiovascular system**, such as an increased heart rate and vasodilation. So, **B matches with I**.

- **C. Cocaine:** Cocaine is a potent central nervous system stimulant. Its primary mechanism of action is to block the reuptake of neurotransmitters like dopamine, norepinephrine, and serotonin in the synapse. By blocking the dopamine transporter, it **interferes with the transport of dopamine**, leading to an accumulation of dopamine in the synapse and causing feelings of euphoria and high energy. So, **C matches with IV**.

- **D. Morphine:** Morphine is a classic opioid analgesic, widely used for severe pain management. Its primary therapeutic effect is as a potent **painkiller**. So, **D matches with III**.

Step 4: Final Answer:
The correct matching is A-II, B-I, C-IV, D-III. This combination is given in option (2).

Quick Tip

Categorize drugs into major groups (Opioids/Depressants, Stimulants, Cannabinoids, Hallucinogens) and learn the primary example and mechanism for each group. For instance: Opioids (Heroin, Morphine) = pain relief, depressants; Stimulants (Cocaine, Amphetamines) = interfere with dopamine transport.

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164. Match List I with List II.

List I (Type of Joint)		**List II (Found between)**	
A.	**Cartilaginous Joint**	**I.**	**Between flat skull bones**
B.	**Ball and Socket Joint**	**II.**	**Between adjacent vertebrae in vertebral column**
C.	**Fibrous Joint**	**III.**	**Between carpal and metacarpal of thumb**
D.	**Saddle Joint**	**IV.**	**Between Humerus and Pectoral girdle**

Choose the correct answer from the options given below:

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

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

Solution:

Step 1: Understanding the Question:
The question asks to match the type of joint (List I) with its correct location in the human body (List II).

Step 3: Detailed Explanation:
Let's identify the location for each type of joint:

- **A. Cartilaginous Joint:** These joints have bones connected by cartilage and allow for limited movement. A prime example is the joint **between adjacent vertebrae in the vertebral column** (intervertebral discs). So, **A matches with II**.

- **B. Ball and Socket Joint:** This is a type of synovial joint that allows for a wide range of motion. The rounded head of one bone fits into a cup-like socket of another. The shoulder joint, **between the Humerus and the Pectoral girdle** (specifically, the glenoid cavity of the scapula), is a classic example. So, **B matches with IV**.

- **C. Fibrous Joint:** These joints are connected by dense fibrous connective tissue and allow for no movement. The sutures **between the flat skull bones** are a perfect example. So, **C matches with I**.

- **D. Saddle Joint:** This is another type of synovial joint that allows for movement in two planes (biaxial). The joint **between the carpal (trapezium) and the metacarpal of the thumb** is the classic example of a saddle joint, which allows for the opposable thumb. So, **D matches with III**.

Step 4: Final Answer:
The correct set of matches is A-II, B-IV, C-I, D-III. This corresponds to option (3).

Quick Tip

To master joints, focus on the three main types: Fibrous (immovable), Cartilaginous (slightly movable), and Synovial (freely movable). Then, learn the sub-types of synovial joints (ball and socket, hinge, pivot, saddle, etc.) with one clear example for each.

---

165. Match List I with List II.

List I		List II	
A.	**CCK**	**I.**	**Kidney**
B.	**GIP**	**II.**	**Heart**
C.	**ANF**	**III.**	**Gastric gland**
D.	**ADH**	**IV.**	**Pancreas**

Choose the correct answer from the options given below:

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

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

Solution:

Step 1: Understanding the Question:
The question requires matching hormones/factors in List I with their source or target organs in List II.

Step 3: Detailed Explanation:

- **A. CCK (Cholecystokinin):** This hormone is secreted by the small intestine and acts on the **Pancreas** to stimulate the secretion of pancreatic enzymes and on the gallbladder to release bile. Thus, **A matches with IV**.

- **B. GIP (Gastric Inhibitory Peptide):** This hormone is secreted by the small intestine and inhibits gastric secretion and motility. Thus, its target is the **Gastric gland**. So, **B matches with III**.

- **C. ANF (Atrial Natriuretic Factor):** This peptide hormone is secreted by the atrial walls of the **Heart** in response to high blood pressure. It causes vasodilation and helps reduce blood pressure. So, **C matches with II**.

- **D. ADH (Antidiuretic Hormone):** Also known as vasopressin, this hormone is released by the posterior pituitary and acts on the **Kidney** (specifically the distal convoluted tubule

and collecting duct) to increase water reabsorption. So, **D matches with I**.

Step 4: Final Answer:
Based on the analysis, the correct matching is A-IV, B-III, C-II, D-I. This corresponds to option (2).

Quick Tip

For questions on hormones, create a table with columns for the Hormone, Source Gland, Target Organ(s), and Function. This is a very high-yield topic in human physiology.

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166. Which of the following statements is correct?

(A) Algal Bloom decreases fish mortality
(B) Eutrophication refers to increase in domestic sewage and waste water in lakes.
(C) Biomagnification refers to increase in concentration of the toxicant at successive trophic levels.
(D) Presence of large amount of nutrients in water restricts 'Algal Bloom'

Correct Answer: (3) Biomagnification refers to increase in concentration of the toxicant at successive trophic levels.

Solution:

Step 1: Understanding the Question:
The question asks to identify the correct statement among the given options related to environmental issues like algal blooms, eutrophication, and biomagnification.

Step 3: Detailed Explanation:

- **(1) Algal Bloom decreases fish mortality:** This is incorrect. Algal blooms cause depletion of dissolved oxygen in the water body upon their death and decomposition, leading to an *increase* in fish mortality.

- **(2) Eutrophication refers to increase in domestic sewage and waste water in lakes:** This is incorrect. Eutrophication is the natural or artificial enrichment of a water body with nutrients, particularly nitrates and phosphates. The increase in domestic sewage is a *cause* of cultural eutrophication, but not the definition of the phenomenon itself.

- **(3) Biomagnification refers to increase in concentration of the toxicant at successive trophic levels:** This is the correct definition of biomagnification. Toxic substances like DDT or mercury get accumulated in an organism and their concentration

increases as they move up the food chain.

- **(4) Presence of large amount of nutrients in water restricts 'Algal Bloom':** This is incorrect. The presence of large amounts of nutrients (eutrophication) *promotes* and causes the excessive growth of algae, leading to an algal bloom.

Step 4: Final Answer:
The only correct statement is option (3), which provides the accurate definition of biomagnification.

Quick Tip

Clearly differentiate between Eutrophication (nutrient enrichment), Algal Bloom (consequence of eutrophication), and Biomagnification (accumulation of toxins up the food chain). Understanding the cause-and-effect relationships is key.

---

167. Match List I with List II.

List I (Interacting species)		List II (Name of Interaction)	
A.	**A Leopard and a Lion in a forest/ grassland**	**I.**	**Competition**
B.	**A Cuckoo laying egg in a Crow's nest**	**II.**	**Brood parasitism**
C.	**Fungi and root of a higher plant in Mycorrhizae**	**III.**	**Mutualism**
D.	**A cattle egret and a Cattle in a field**	**IV.**	**Commensalism**

Choose the correct answer from the options given below:

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

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

Solution:

Step 1: Understanding the Question:
This question requires matching examples of species interactions from List I with the correct

ecological term for that interaction from List II.

Step 3: Detailed Explanation:

- **A. A Leopard and a Lion in a forest/grassland:** Both are predators that hunt for similar prey in the same habitat. This leads to an interaction where both species are negatively affected due to sharing limited resources. This is **Competition**. So, **A matches with I**.

- **B. A Cuckoo laying egg in a Crow's nest:** The cuckoo lays its eggs in the nest of a host bird (crow), which then incubates and raises the cuckoo's young, often at the expense of its own offspring. The cuckoo benefits (+) while the crow is harmed (-). This is **Brood parasitism**. So, **B matches with II**.

- **C. Fungi and root of a higher plant in Mycorrhizae:** This is a symbiotic association where the fungus helps the plant with nutrient absorption from the soil, and the plant provides carbohydrates to the fungus. Both partners benefit (+/+). This is **Mutualism**. So, **C matches with III**.

- **D. A cattle egret and a Cattle in a field:** The cattle egret follows cattle and feeds on insects that are stirred up from the vegetation as the cattle graze. The egret benefits (+), while the cattle is largely unaffected (0). This is **Commensalism**. So, **D matches with IV**.

Step 4: Final Answer:
The correct matching is A-I, B-II, C-III, D-IV. This corresponds to option (2).

Quick Tip

Remember the symbols for population interactions: Competition (-/-), Parasitism (+/-), Mutualism (+/+), Commensalism (+/0), Amensalism (-/0), Predation (+/-). Associating each with a classic example solidifies the concept.

---

168. In which blood corpuscles, the HIV undergoes replication and produces progeny viruses?

(A) Eosinophils
(B) T_H cells
(C) B-lymphocytes
(D) Basophils

Correct Answer: (2) T_H cells

Solution:

Step 1: Understanding the Question:
The question asks to identify the specific type of blood cell in which the Human Immunodeficiency Virus (HIV) replicates.

Step 3: Detailed Explanation:
HIV is a retrovirus that primarily targets cells of the immune system. Its main target is a type of lymphocyte called the **helper T cell** (or **T_H cell**). These cells have a specific receptor on their surface called CD4, which the virus uses to gain entry. Once inside the helper T cell, HIV uses an enzyme called reverse transcriptase to convert its RNA genome into DNA. This viral DNA is then integrated into the host cell's genome. The infected cell is then forced to produce new virus particles, becoming a "virus factory". Macrophages are also infected by HIV. The progressive destruction of T_H cells severely weakens the immune system, leading to Acquired Immuno Deficiency Syndrome (AIDS).

Step 4: Final Answer:
The primary site of HIV replication is the helper T cell (T_H cell). Therefore, option (2) is the correct answer.

Quick Tip

Remember the key steps of the HIV life cycle: it infects helper T-cells (CD4+ cells), uses reverse transcriptase to make DNA from its RNA, integrates into the host genome, and replicates, eventually destroying the host cell. This progressive loss of T-cells is the hallmark of AIDS.

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169. Match List I with List II with respect to human eye.

List I		List II	
A.	**Fovea**	**I.**	**Visible coloured portion of eye that regulates diameter of pupil.**
B.	**Iris**	**II.**	**External layer of eye formed of dense connective tissue.**
C.	**Blind spot**	**III.**	**Point of greatest visual acuity or resolution.**
D.	**Sclera**	**IV.**	**Point where optic nerve leaves the eyeball and photoreceptor cells a**

Choose the correct answer from the options given below:

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

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

Solution:

Step 1: Understanding the Question:
This question asks to match the parts of the human eye in List I with their correct descriptions or functions in List II.

Step 3: Detailed Explanation:

- **A. Fovea:** The fovea is a small depression in the retina's macula lutea where cones are densely packed. It is responsible for sharp central vision (also called foveal vision) and is the **point of greatest visual acuity or resolution**. So, **A matches with III**.

- **B. Iris:** The iris is the pigmented part of the eye that lies behind the cornea. It is the **visible coloured portion of the eye** and its muscles control the size of the pupil, thereby **regulating the amount of light** entering the eye. So, **B matches with I**.

- **C. Blind spot:** This is the area on the retina where the optic nerve and blood vessels exit the eye. Since there are **no photoreceptor cells (rods or cones) at this point**, it cannot detect light. So, it is the **point where the optic nerve leaves the eyeball and photoreceptor cells are absent**. So, **C matches with IV**.

- **D. Sclera:** The sclera is the tough, fibrous, white outer layer of the eyeball. It is the **external layer of the eye formed of dense connective tissue** that protects the inner structures. So, **D matches with II**.

Step 4: Final Answer:
The correct matching is A-III, B-I, C-IV, D-II. This corresponds to option (2).

Quick Tip

For the human eye, it's helpful to trace the path of light: Cornea → Aqueous humor → Pupil/Iris → Lens → Vitreous humor → Retina (Fovea/Blind spot). Knowing the function of each part along this path makes answering such questions easier.

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170. Given below are two statements:
Statement I: In prokaryotes, the positively charged DNA is held with some negatively charged proteins in a region called nucleoid.
Statement II: In eukaryotes, the negatively charged DNA is wrapped around the positively charged histone octamer to form nucleosome.
In the light of the above statements, choose the correct answer from the options given below:

(A) Statement I incorrect but Statement II is true.
(B) Both Statement I and Statement II are true.
(C) Both Statement I and Statement II are false.
(D) Statement I is correct but Statement II is false.

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

Solution:

Step 1: Understanding the Question:
The question asks us to evaluate two statements about DNA packaging in prokaryotes and eukaryotes.

Step 3: Detailed Explanation:

- **Analysis of Statement I:** DNA, due to its phosphate backbone, is a **negatively charged** molecule. In prokaryotes, this negatively charged DNA is organized in a large loop and held together by some **positively charged** proteins (non-histone basic proteins) in a region called the nucleoid. Statement I incorrectly states that the DNA is positively charged and the proteins are negatively charged. Therefore, **Statement I is incorrect**.

- **Analysis of Statement II:** In eukaryotes, the organization is more complex. The **negatively charged DNA** is wrapped around a core of eight **positively charged histone proteins** (a histone octamer) to form a structure called a nucleosome. Histones are rich in basic amino acid residues like lysines and arginines, which carry positive charges. This statement is factually correct. Therefore, **Statement II is true**.

Step 4: Final Answer:
Since Statement I is incorrect and Statement II is true, the correct option is (1).

Quick Tip

A fundamental principle of DNA packaging is electrostatic attraction: DNA is always negatively charged. Therefore, the proteins it associates with (whether in prokaryotes or eukaryotes) must be positively charged. Remembering this simple charge rule helps avoid confusion.

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171. Given below are two statements:
Statement I: Ligaments are dense irregular tissue.
Statement II: Cartilage is dense regular tissue.
In the light of the above statements, choose the correct answer from the options given below:

(A) Statement I is false but Statement II is true.
(B) Both Statement I and Statement II are true.
(C) Both Statement I and Statement II are false.
(D) 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 Question:
The question requires us to determine the correctness of two statements regarding the classification of connective tissues, specifically ligaments and cartilage.

Step 3: Detailed Explanation:

- **Analysis of Statement I:** Ligaments are fibrous connective tissues that connect bone to bone. They are composed of collagen fibers that are arranged in a parallel fashion to withstand tension along a single axis. This organized arrangement classifies them as **dense regular connective tissue**. The statement claims they are dense irregular tissue. Therefore, **Statement I is false**.

- **Analysis of Statement II:** Cartilage is a supportive connective tissue with a flexible, rubbery matrix. It is classified as a **specialized connective tissue**, alongside bone and blood. It is not classified as dense regular tissue, which is characterized by densely packed collagen fibers and fibroblasts (e.g., tendons and ligaments). Therefore, **Statement II is false**.

Step 4: Final Answer:
Since both statements incorrectly classify the tissues, the correct option is (3).

Quick Tip

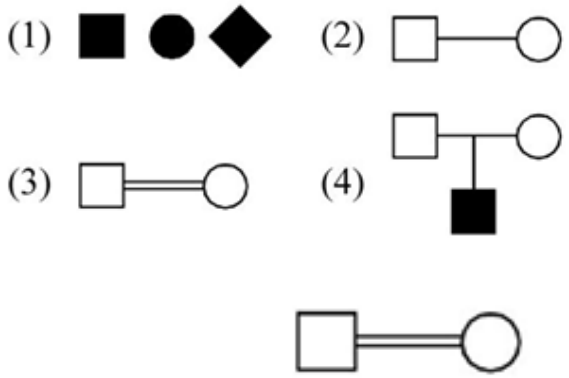
Remember the key examples for connective tissue types:

- **Dense Regular:** Tendons, Ligaments.
- **Dense Irregular:** Dermis of the skin.
- **Specialized:** Cartilage, Bone, Blood.

This classification is frequently tested.

---

172. Which one of the following symbols represents mating between relatives in human pedigree analysis?



Correct Answer: (3)

Solution:

Step 1: Understanding the Question:
The question asks to identify the standard symbol for a consanguineous mating (mating between close relatives) in a human pedigree chart.

Step 3: Detailed Explanation:
Let's analyze the standard symbols in pedigree analysis:

- A square represents a male.
- A circle represents a female.
- A horizontal line connecting a square and a circle represents a mating.
- A **double horizontal line** connecting a square and a circle specifically indicates a **consanguineous mating**, i.e., mating between relatives.

Now let's look at the options:

- (1) Shows a mating between an affected male (filled square) and an affected female (filled circle).
- (2) Shows a standard mating between an unaffected male and an unaffected female.
- (3) Shows a mating between an unaffected male and an unaffected female connected by a **double line**, which is the correct symbol for mating between relatives.
- (4) This symbol is not standard, but may represent a carrier female and an unaffected male. The key symbol is the double line for consanguinity.

Step 4: Final Answer:
The symbol with the double horizontal line represents mating between relatives. Therefore, option (3) is the correct answer.

Quick Tip

Memorize the basic pedigree symbols: square (male), circle (female), shaded (affected), unshaded (unaffected), single line (mating), and double line (consanguineous mating). These are essential for solving any pedigree problem.

173. Which one of the following techniques does not serve the purpose of early diagnosis of a disease for its early treatment?

(A) Enzyme Linked Immuno-Sorbent Assay (ELISA) technique
(B) Recombinant DNA Technology
(C) Serum and Urine analysis
(D) Polymerase Chain Reaction (PCR) technique

Correct Answer: (3) Serum and Urine analysis

Solution:

Step 1: Understanding the Question:
The question asks which of the given techniques is generally NOT used for the *early* diagnosis of a disease. Early diagnosis often implies detecting the disease at a molecular level before significant symptoms appear.

Step 3: Detailed Explanation:

- **(1) ELISA:** This technique is used to detect the presence of antigens (from a pathogen) or antibodies (produced by the host in response to a pathogen). It is very sensitive and can detect infections at an early stage (e.g., AIDS).
- **(2) Recombinant DNA Technology:** This field includes techniques like using DNA probes to detect the presence of specific nucleic acid sequences (e.g., a viral gene or a mutated human gene). This is a powerful tool for very early and specific diagnosis.
- **(3) Serum and Urine analysis:** These are conventional biochemical analysis methods. While useful, they typically detect changes in the concentration of metabolites, proteins, or cells that often become significant only after the disease has progressed and symptoms have started to appear. They are generally less sensitive for detecting the initial presence of a pathogen or a genetic defect compared to molecular techniques.
- **(4) PCR:** This technique can amplify a very small amount of DNA or RNA. This allows for the detection of a pathogen (like a virus or bacterium) even when it is present in very low numbers, long before the body mounts a large-scale immune response or symptoms develop. It is a cornerstone of early molecular diagnosis.

Comparing the options, serum and urine analysis are considered conventional methods and are less suited for early diagnosis at the molecular level compared to ELISA, PCR, and rDNA technology.

Step 4: Final Answer:
Serum and Urine analysis is the technique that does not typically serve the purpose of early diagnosis. Therefore, option (3) is the correct answer.

Quick Tip

For questions about "early diagnosis," think molecular. Techniques that detect the genetic material of a pathogen (PCR, rDNA tech) or a very sensitive immune marker (ELISA) are considered tools for early diagnosis. Conventional biochemical tests often require a higher disease load.

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174. Match List I with List II.

List I		List II	
A.	***Taenia***	**I.**	**Nephridia**
B.	***Paramoecium***	**II.**	**Contractile vacuole**
C.	***Periplaneta***	**III.**	**Flame cells**
D.	***Pheretima***	**IV.**	**Urecose gland**

Choose the correct answer from the options give below:

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

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

Solution:

Step 1: Understanding the Question:
The question asks to match the organisms in List I with their corresponding excretory or osmoregulatory structures in List II.

Step 3: Detailed Explanation:

- **A. *Taenia* (Tapeworm):** As a member of Phylum Platyhelminthes, its excretory system consists of specialized cells called **flame cells** (protonephridia). So, **A matches with III**.

- **B. *Paramoecium*:** This is a freshwater protozoan. To cope with the constant influx of water due to osmosis, it uses a **contractile vacuole** for osmoregulation, which actively pumps out excess water. So, **B matches with II**.

- **C. *Periplaneta* (Cockroach):** As an insect, its primary excretory organs are Malpighian tubules. However, it also possesses other structures involved in excretion, including the fat body and **urecose glands** which store uric acid. So, **C matches with IV**.

- **D. *Pheretima* (Earthworm):** As a member of Phylum Annelida, its excretory organs are segmentally arranged coiled tubules called **nephridia**. So, **D matches with I**.

Step 4: Final Answer:
The correct matching is A-III, B-II, C-IV, D-I. This corresponds to option (4).

Quick Tip

Excretory structures are a key characteristic for differentiating animal phyla. It is highly recommended to create a comparative table listing the phylum and its specific excretory organ (e.g., Platyhelminthes → Flame Cells; Annelida → Nephridia; Arthropoda → Malpighian Tubules/Green Glands).

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175. Given below are two statements: one is labelled as Assertion A and the other is labelled as Reason R.
Assertion A: Amniocentesis for sex determination is one of the strategies of Reproductive and Child Health Care Programme.
Reason R: Ban on amniocentesis checks increasing menace of female foeticide.
In the light of the above statements, choose the correct answer from the options given below:

(A) A is false but R is true.
(B) Both A and R are true and R is the correct explanation of A.
(C) Both A and R are true and R is NOT the correct explanation of A.
(D) A is true but R is false.

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

Solution:

Step 1: Understanding the Question:
This is an Assertion-Reason question. We need to evaluate the truthfulness of both statements and determine if the Reason explains the Assertion.

Step 3: Detailed Explanation:

- **Analysis of Assertion (A):** Amniocentesis is a prenatal diagnostic technique to detect fetal abnormalities. However, its misuse for sex determination to carry out female foeticide is a major social problem. The Reproductive and Child Health Care (RCH) Programme promotes maternal and child health and works to *prevent* such practices. Therefore, promoting amniocentesis for sex determination is directly contrary to the goals of the RCH programme. So, **Assertion A is false**.

- **Analysis of Reason (R):** To prevent the misuse of amniocentesis for sex-selective abortions, the Indian government has imposed a statutory ban on this technique for the purpose

of sex determination. This measure aims to check the increasing menace of female foeticide. So, **Reason R is true**.

Step 4: Final Answer:
The Assertion (A) is false, but the Reason (R) is true. This corresponds to option (1).

Quick Tip

Be very clear about the intended medical use of a technology versus its social misuse. Government health programs like RCH are designed to improve health outcomes and combat social evils like female foeticide, not promote activities that enable them.

---

176. Given below are two statements:
Statement I: Electrostatic precipitator is most widely used in thermal power plant.
Statement II: Electrostatic precipitator in thermal power plant removes ionising radiations.
In the light of the above statements, choose the most appropriate answer from the options given below:

(A) Statement I incorrect but Statement II is correct.
(B) Both Statement I and Statement II are correct.
(C) Both Statement I and Statement II are incorrect.
(D) Statement I is correct but Statement II is incorrect.

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

Solution:

Step 1: Understanding the Question:
The question asks us to evaluate two statements concerning the use and function of an electrostatic precipitator in thermal power plants.

Step 3: Detailed Explanation:

- **Analysis of Statement I:** Thermal power plants burn fossil fuels (like coal), which produce a large amount of fly ash and other particulate matter. The electrostatic precipitator is a highly efficient device (over 99% efficiency) for removing this particulate matter from the exhaust gas. Due to its effectiveness, it is indeed the most widely used air pollution control device in such plants. Therefore, **Statement I is correct**.

- **Analysis of Statement II:** An electrostatic precipitator works by charging particulate matter and then attracting these charged particles to collection plates. Its function is to

remove **particulate matter**, not gases or radiation. Ionising radiation is a concern associated with nuclear power plants, not thermal power plants, and requires different methods of containment like lead shielding. Therefore, **Statement II is incorrect**.

Step 4: Final Answer:
Since Statement I is correct and Statement II is incorrect, the correct option is (4).

Quick Tip

Know the specific function of different pollution control devices:

- **Electrostatic Precipitator:** Removes particulate matter.
- **Scrubber:** Removes particulate matter and gases (like SO_2).
- **Catalytic Converter:** Converts harmful gases (CO, NOx, hydrocarbons) into less harmful ones (CO_2, N_2, H_2O) in automobiles.

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177. Once the undigested and unabsorbed substances enter the caecum, their backflow is prevented by-

(A) Pyloric sphincter
(B) Sphincter of Oddi
(C) Ileo-caecal valve
(D) Gastro-oesophageal sphincter

Correct Answer: (3) Ileo-caecal valve

Solution:

Step 1: Understanding the Question:
The question asks to identify the anatomical structure that prevents the backward movement of contents from the large intestine (specifically the caecum) into the small intestine.

Step 3: Detailed Explanation:
Let's analyze the function of each structure listed:

- **Pyloric sphincter:** This is located between the stomach and the duodenum (the first part of the small intestine). It controls the flow of chyme from the stomach into the small intestine.

- **Sphincter of Oddi:** This sphincter guards the opening of the common hepato-pancreatic duct into the duodenum. It regulates the flow of bile and pancreatic juice.

- **Ileo-caecal valve:** This valve is located at the junction of the ileum (the last part of the small intestine) and the caecum (the first part of the large intestine). Its primary function is to prevent the backflow of faecal matter from the large intestine into the small intestine.

- **Gastro-oesophageal sphincter:** This sphincter is located at the junction of the oesophagus and the stomach. It prevents the acidic contents of the stomach from moving back up into the oesophagus.

Step 4: Final Answer:
The structure that prevents backflow from the caecum is the Ileo-caecal valve. Therefore, option (3) is correct.

Quick Tip

It is helpful to visualize the gastrointestinal tract as a tube with a series of one-way gates (sphincters and valves). Memorize the location and function of each major gate: Gastro-oesophageal, Pyloric, Sphincter of Oddi, and Ileo-caecal.

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178. Match List I with List II.

List I		List II	
A.	**Vasectomy**	**I.**	**Oral method**
B.	**Coitus interruptus**	**II.**	**Barrier method**
C.	**Cervical caps**	**III.**	**Surgical method**
D.	**Saheli**	**IV.**	**Natural method**

Choose the correct answer from the options given below:

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

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

Solution:

Step 1: Understanding the Question:
This question requires matching different contraceptive methods from List I with their correct category from List II.

Step 3: Detailed Explanation:

- **A. Vasectomy:** This is a male sterilization procedure where the vas deferens is cut and tied to prevent sperm from entering the ejaculate. This is a permanent **Surgical method**.

So, **A matches with III**.

- **B. Coitus interruptus:** Also known as the withdrawal method, this involves withdrawing the penis from the vagina before ejaculation. It is a traditional **Natural method** of contraception. So, **B matches with IV**.

- **C. Cervical caps:** These are devices made of rubber that are inserted into the vagina to cover the cervix, physically preventing sperm from entering the uterus. This is a **Barrier method**. So, **C matches with II**.

- **D. Saheli:** This is a non-steroidal contraceptive pill that is taken orally. It is therefore an **Oral method** of contraception. So, **D matches with I**.

Step 4: Final Answer:
The correct set of matches is A-III, B-IV, C-II, D-I. This corresponds to option (3).

Quick Tip

For contraception topics, organize methods into categories: Natural (rhythm, withdrawal), Barrier (condoms, diaphragms), IUDs, Oral/Hormonal (pills), and Surgical/Terminal (vasectomy, tubectomy). This structured approach helps in answering matching questions.

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179. Given below are two statements:
Statement I: Low temperature preserves the enzyme in a temporarily inactive state whereas high temperature destroys enzymatic activity because proteins are denatured by heat.
Statement II: When the inhibitor closely resembles the substrate in its molecular structure and inhibits the activity of the enzyme, it is known as competitive inhibitor.
In the light of the above statements, choose the correct answer from the options given below:

(A) Statement I is false but Statement II is true.
(B) Both Statement I and Statement II are true.
(C) Both Statement I and Statement II are false.
(D) Statement I is true but Statement II is false.

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

Solution:

Step 1: Understanding the Question:
The question asks to evaluate the correctness of two statements regarding the factors affecting enzyme activity: temperature and inhibitors.

Step 3: Detailed Explanation:

- **Analysis of Statement I:** This statement describes the effect of temperature on enzymes. At low temperatures, enzymes become temporarily inactive because they have insufficient kinetic energy. This state is reversible. At high temperatures, the bonds that maintain the protein's specific three-dimensional shape are broken, causing the enzyme to unfold, or denature. This change is usually irreversible and results in a permanent loss of activity. Thus, Statement I is correct.

- **Analysis of Statement II:** This statement provides the definition of a competitive inhibitor. A competitive inhibitor has a molecular structure similar to the substrate, allowing it to bind to the active site of the enzyme. By occupying the active site, it prevents the actual substrate from binding, thereby inhibiting the enzyme's activity. Thus, Statement II is also correct.

Step 4: Final Answer:
Since both Statement I and Statement II are correct, the correct option is (2).

Quick Tip

Remember the key concepts for enzyme kinetics: low temperature causes reversible inactivation, while high temperature causes irreversible denaturation. Competitive inhibitors compete for the active site, while non-competitive inhibitors bind to an allosteric site.

---

180. Which of the following is not a cloning vector?

(A) Probe
(B) BAC
(C) YAC
(D) pBR322

Correct Answer: (1) Probe

Solution:

Step 1: Understanding the Question:
The question asks to identify which of the given options is not a cloning vector. A cloning vector is a DNA molecule used as a vehicle to artificially carry foreign genetic material into

another cell, where it can be replicated.

Step 3: Detailed Explanation:

- **(1) Probe:** A DNA or RNA probe is a short, single-stranded nucleic acid sequence that is complementary to a target sequence. It is labeled (e.g., with a radioactive or fluorescent tag) and used to detect the presence of the target DNA or RNA in a sample. It is a detection tool, not a vehicle for cloning.

- **(2) BAC (Bacterial Artificial Chromosome):** This is a cloning vector based on the F-plasmid of *E. coli*, designed to clone large DNA fragments (100-300 kb) in bacteria.

- **(3) YAC (Yeast Artificial Chromosome):** This is a cloning vector that can carry very large DNA fragments (up to 1000 kb) and be replicated in yeast cells.

- **(4) pBR322:** This is one of the first widely used plasmid-based cloning vectors in *E. coli*. It is used for cloning smaller DNA fragments.

Step 4: Final Answer:
BAC, YAC, and pBR322 are all types of cloning vectors. A probe is a tool for detection, not cloning. Therefore, option (1) is the correct answer.

Quick Tip

Differentiate between the tools of genetic engineering:

- **Vectors** (plasmids, BACs, YACs): Carry DNA into a host.
- **Enzymes** (restriction enzymes, ligase): Cut and paste DNA.
- **Probes**: Find/detect specific DNA sequences.

---

181. Which of the following functions is carried out by cytoskeleton in a cell?

(A) Transportation
(B) Nuclear division
(C) Protein synthesis
(D) Motility

Correct Answer: (4) Motility

Solution:

Step 1: Understanding the Question:
The question asks to identify a key function performed by the cytoskeleton in a cell. The cytoskeleton is an intricate network of protein filaments, including microtubules, microfilaments, and intermediate filaments.

Step 3: Detailed Explanation:
The cytoskeleton has several major functions:

- **Mechanical Support and Shape:** It provides structural support and maintains the cell's shape.
- **Motility:** It is involved in both cell motility (e.g., movement of cilia and flagella, amoeboid movement) and the movement of organelles within the cell.
- **Intracellular Transport:** Microtubules act as tracks for motor proteins to transport vesicles and organelles.
- **Cell Division:** Microtubules form the mitotic spindle, which is essential for separating chromosomes during nuclear division.

Analyzing the options:

- (1) Transportation: Correct, but it's intracellular transport.
- (2) Nuclear division: Correct, the spindle apparatus is made of cytoskeletal elements.
- (3) Protein synthesis: Incorrect, this is performed by ribosomes.
- (4) Motility: Correct, this is a major function involving cilia, flagella, and amoeboid movement.

All functions except protein synthesis are related to the cytoskeleton. However, motility is a very direct and well-known function, encompassing the movement of the entire cell.

Step 4: Final Answer:
Among the given options, motility is a principal and characteristic function of the cytoskeleton. Therefore, option (4) is the most appropriate answer.

Quick Tip

Associate the cytoskeleton with "structure and movement." This includes the cell's physical shape, the movement of things inside the cell (transport), and the movement of the cell itself (motility).

---

182. Given below are two statements:
Statement I: A protein is imagined as a line, the left end represented by first amino acid (C-terminal) and the right end represented by last amino acid (N-terminal).
Statement II: Adult human haemoglobin, consists of 4 subunits (two subunits of α type and two subunits of β type).

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

(A) Statement I is false but Statement II is true.
(B) Both Statement I and Statement II are true.
(C) Both Statement I and Statement II are false.
(D) Statement I is true but Statement II is false.

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

Solution:

Step 1: Understanding the Question:
The question requires evaluating two statements: one about the convention of representing protein structure and another about the composition of adult hemoglobin.

Step 3: Detailed Explanation:

- **Analysis of Statement I:** In biochemistry, a polypeptide chain is written with the first amino acid on the left and the last on the right. The first amino acid has a free amino group (-NH_2) and is called the **N-terminal**. The last amino acid has a free carboxyl group (-$COOH$) and is called the **C-terminal**. The statement reverses this convention, claiming the left end is C-terminal and the right end is N-terminal. Therefore, **Statement I is false**.

- **Analysis of Statement II:** Adult human hemoglobin (HbA) is a globular protein with a quaternary structure. It is a tetramer composed of four polypeptide chains: two identical alpha (α) chains and two identical beta (β) chains. This $\alpha_2\beta_2$ composition is a classic example of quaternary structure. Therefore, **Statement II is true**.

Step 4: Final Answer:
Since Statement I is false and Statement II is true, the correct option is (1).

Quick Tip

Remember the convention for proteins: Synthesis and representation always proceed from the N-terminus to the C-terminus. N is the beginning (left), C is the end (right).

---

183. Given below are two statements: one is labelled as Assertion A and the other is labelled as Reason R.
Assertion A: Endometrium is necessary for implantation of blastocyst.
Reason R: In the absence of fertilization, the corpus luteum degenerates that causes

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

(A) A is false but R is true.
(B) Both A and R are true and R is the correct explanation of A.
(C) Both A and R are true but R is NOT the correct explanation of A.
(D) A is true but R is false.

Correct Answer: (3) Both A and R are true but R is NOT the correct explanation of A.

Solution:

Step 1: Understanding the Question:
This is an Assertion-Reason question. We need to evaluate both statements and determine if the Reason correctly explains the Assertion.

Step 3: Detailed Explanation:

- **Analysis of Assertion (A):** The endometrium is the inner lining of the uterus, which becomes thick and receptive under the influence of hormones during the menstrual cycle. The blastocyst (early embryo) must embed itself into this receptive endometrium to establish a pregnancy. Thus, the endometrium is absolutely necessary for implantation. **Assertion A is true**.

- **Analysis of Reason (R):** After ovulation, the remnant of the ovarian follicle forms the corpus luteum, which secretes progesterone. Progesterone maintains the endometrium. If fertilization does not occur, the corpus luteum degenerates after about 10-12 days. The resulting drop in progesterone levels leads to the breakdown and shedding of the endometrium (menstruation). **Reason R is true**.

- **Evaluating the Explanation:** Reason R correctly describes the events leading to menstruation when fertilization is absent. Assertion A describes a condition necessary for pregnancy when fertilization is present. While both statements are true and relate to the endometrium, the Reason explains why the endometrium breaks down in a non-pregnant cycle, not why it is necessary for implantation in a pregnant cycle. Therefore, R is not the correct explanation for A.

Step 4: Final Answer:
Both Assertion A and Reason R are true, but R is not the correct explanation of A. This corresponds to option (3).

Quick Tip

For Assertion-Reason questions, first verify if each statement is true independently. Then, ask the critical question: "Does the Reason explain *why* the Assertion happens?" In this case, R explains menstruation, not implantation.

---

184. Broad palm with single palm crease is visible in a person suffering from-

(A) Thalassemia
(B) Down's syndrome
(C) Turner's syndrome
(D) Klinefelter's syndrome

Correct Answer: (2) Down's syndrome

Solution:

Step 1: Understanding the Question:
The question asks to identify the genetic disorder associated with the physical characteristic of a broad palm with a single transverse palmar crease (often called a Simian crease).

Step 3: Detailed Explanation:

- **Down's syndrome:** This is a chromosomal disorder caused by the presence of an extra copy of chromosome 21 (Trisomy 21). Individuals with Down's syndrome exhibit a set of characteristic physical features, including a small round head, furrowed tongue, partially open mouth, short stature, and broad palms with a single palmar crease.

- **Thalassemia:** This is an autosomal recessive blood disorder affecting hemoglobin production. It does not cause the described palm characteristics.

- **Turner's syndrome:** This is a chromosomal disorder in females caused by the absence of one X chromosome (XO). Symptoms include short stature, webbed neck, and underdeveloped ovaries, but not typically a single palm crease.

- **Klinefelter's syndrome:** This is a chromosomal disorder in males caused by an extra X chromosome (XXY). Symptoms include tall stature, gynecomastia (enlarged breasts), and small testes.

Step 4: Final Answer:
The described symptom is a classic feature of Down's syndrome. Therefore, option (2) is correct.

Quick Tip

For genetic disorders, associate each condition with its cause (e.g., Trisomy 21) and a few key, distinctive symptoms (e.g., single palm crease for Down's syndrome, webbed neck for Turner's).

---

185. Which of the following statements are correct regarding female reproductive cycle?
A. In non-primate mammals cyclical changes during reproduction are called oestrus cycle.
B. First menstrual cycle begins at puberty and is called menopause.
C. Lack of menstruation may be indicative of pregnancy.
D. Cyclic menstruation extends between menarche and menopause.
Choose the most appropriate answer from the options given below:

(A) A, C and D only
(B) A and D only
(C) A and B only
(D) A, B and C only

Correct Answer: (1) A, C and D only

Solution:

Step 1: Understanding the Question:
The question asks to identify which of the four given statements about the female reproductive cycle are factually correct.

Step 3: Detailed Explanation:

- **Statement A:** This is correct. Primates (monkeys, apes, humans) have a menstrual cycle, characterized by the shedding of the endometrium. Most other non-primate mammals (e.g., cows, dogs, rats) have an oestrus cycle, where the endometrium is reabsorbed if conception doesn't occur, and females are sexually receptive only during the "heat" period (oestrus).

- **Statement B:** This is incorrect. The first menstrual cycle at puberty is called **menarche**. **Menopause** is the permanent cessation of the menstrual cycle, which occurs much later in life.

- **Statement C:** This is correct. Amenorrhea (the absence of menstruation) is one of the earliest and most reliable signs of pregnancy, although it can also be caused by other factors like stress, poor diet, or hormonal imbalances.

- **Statement D:** This is correct. The reproductive phase of a human female's life, characterized by recurring menstrual cycles, begins at menarche and ends at menopause.

Step 4: Final Answer:
Statements A, C, and D are correct, while B is incorrect. Therefore, the correct option is (1).

Quick Tip

Be precise with terminology: Menarche = start of menstruation. Menopause = end of menstruation. Oestrus cycle = non-primates. Menstrual cycle = primates.

---

186. Which of the following statements are correct regarding skeletal muscle?
A. Muscle bundles are held together by collagenous connective tissue layer called fascicle.
B. Sarcoplasmic reticulum of muscle fibre is a store house of calcium ions.
C. Striated appearance of skeletal muscle fibre is due to distribution pattern of actin and myosin proteins.
D. M line is considered as functional unit of contraction called sarcomere.
Choose the most appropriate answer from the options given below:

(A) C and D only
(B) A, B and C only
(C) B and C only
(D) A, C and D only

Correct Answer: (3) B and C only

Solution:

Step 1: Understanding the Question:
The question requires identifying the correct statements about the structure and function of skeletal muscle from the given list.

Step 3: Detailed Explanation:

- **Statement A:** This statement is incorrect. A muscle bundle itself is called a **fascicle**. The collagenous connective tissue layer that holds the muscle fibers together within a fascicle is called the perimysium.

- **Statement B:** This is correct. The sarcoplasmic reticulum (SR) is the specialized endoplasmic reticulum of a muscle fiber. Its primary role is to store and release calcium ions (Ca^{2+}), which are the triggers for muscle contraction.

- **Statement C:** This is correct. The characteristic striped or striated appearance of skeletal muscle is due to the regular, repeating arrangement of thick (myosin) and thin (actin) filaments, which form the dark A bands and light I bands.

- **Statement D:** This is incorrect. The functional unit of contraction is the **sarcomere**, which is defined as the region of a myofibril between two successive Z-lines. The M-line is a protein structure in the center of the H-zone within the A-band.

Step 4: Final Answer:
Statements B and C are correct, while A and D are incorrect. Therefore, the correct option is (3).

Quick Tip

To avoid confusion in muscle anatomy:

- A muscle bundle = a fascicle.
- Functional unit = sarcomere (from Z-line to Z-line).
- Calcium store = sarcoplasmic reticulum.

---

187. Which of the following is characteristic feature of cockroach regarding sexual dimorphism?

(A) Presence of anal cerci
(B) Dark brown body colour and anal cerci
(C) Presence of anal styles
(D) Presence of sclerites

Correct Answer: (3) Presence of anal styles

Solution:

Step 1: Understanding the Question:
The question asks for a feature that exhibits sexual dimorphism in cockroaches, meaning a feature that is present in one sex but not the other, allowing them to be distinguished.

Step 3: Detailed Explanation:
Let's analyze the given features:

- **(1) Presence of anal cerci:** A pair of jointed, filamentous structures called anal cerci arise from the 10th tergum. They are sensory in function and are present in **both males and females**. Thus, they are not a dimorphic feature.

- **(2) Dark brown body colour and anal cerci:** Body colour is not a sexually dimorphic feature, and as mentioned, anal cerci are present in both sexes.

- **(3) Presence of anal styles:** These are a pair of short, unjointed, thread-like structures that emerge from the 9th sternum. They are present **only in male cockroaches**. This is a key distinguishing feature.

- **(4) Presence of sclerites:** Sclerites are the hardened chitinous plates that make up the exoskeleton. They are present in both males and females.

Step 4: Final Answer:
The presence of anal styles exclusively in males is the characteristic feature of sexual dimorphism in cockroaches. Therefore, option (3) is correct.

Quick Tip

A simple rule for cockroach identification: Both sexes have anal cerci, but only males have the extra pair of anal styles.

---

188. Which of the following statements are correct?
A. An excessive loss of body fluid from the body switches off osmoreceptors.
B. ADH facilitates water reabsorption to prevent diuresis.
C. ANF causes vasodilation.
D. ADH causes increase in blood pressure.
E. ADH is responsible for decrease in GFR.
Choose the correct answer from the options given below:

(A) C, D and E only
(B) A and B only
(C) B, C and D only
(D) A, B and E only

Correct Answer: (3) B, C and D only

Solution:

Step 1: Understanding the Question:
The question asks to identify the correct statements related to hormonal regulation of water balance and blood pressure.

Step 3: Detailed Explanation:

- **Statement A:** This is incorrect. An excessive loss of body fluid (dehydration) increases the osmolarity of the blood. This condition **stimulates** or **switches on** the osmoreceptors in the hypothalamus, which triggers the release of ADH and the sensation of thirst.

- **Statement B:** This is correct. ADH stands for Anti-diuretic Hormone. It acts on the distal convoluted tubules and collecting ducts of the nephron, increasing their permeability to water. This enhances water reabsorption from the filtrate back into the blood, thus preventing excessive water loss in urine (diuresis).

- **Statement C:** This is correct. ANF (Atrial Natriuretic Factor) is released by the heart atria in response to high blood pressure. It acts to lower blood pressure by causing **vasodilation** (widening of blood vessels) and by promoting the excretion of sodium and water by the kidneys.

- **Statement D:** This is correct. ADH, also known as vasopressin, has a vasoconstrictor effect, especially at higher concentrations. This constriction of blood vessels leads to an **increase in blood pressure**. Also, by increasing water reabsorption, it increases blood volume, which contributes to higher blood pressure.

- **Statement E:** This is incorrect. ADH's primary role is water reabsorption. Its vasoconstrictor effect on arterioles can actually help to maintain or increase Glomerular Filtration Rate (GFR) by increasing systemic blood pressure. A fall in GFR is primarily regulated by the RAAS mechanism, not ADH.

Step 4: Final Answer:
Statements B, C, and D are correct. Therefore, the correct option is (3).

Quick Tip

Remember the opposing effects of RAAS/ADH and ANF. The Renin-Angiotensin-Aldosterone System (RAAS) and ADH work to increase blood pressure and conserve water. Atrial Natriuretic Factor (ANF) works to decrease blood pressure and promote water loss.

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189. Match List I with List II.

List I		List II	
A.	**Logistic growth**	**I.**	**Unlimited resource availability condition**
B.	**Exponential growth**	**II.**	**Limited resource availability condition**
C.	**Expanding age pyramid**	**III.**	**The percent individuals of pre-reproductive age is largest followed by reproductive and post reproductive age groups**
D.	**Stable age pyramid**	**IV.**	**The percent individuals of pre-reproductives and reproductive age group are same**

Choose the correct answer from the options given below:

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

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

Solution:

Step 1: Understanding the Question:
The question requires matching ecological concepts (types of population growth and age pyramids) in List I with their correct descriptions in List II.

Step 3: Detailed Explanation:

- **A. Logistic growth:** This type of population growth occurs when resources are finite and become a limiting factor as the population size increases. The growth curve is S-shaped (sigmoid). Therefore, it matches with a **Limited resource availability condition**. So, **A matches with II**.

- **B. Exponential growth:** This type of growth occurs when there are no limitations on resources, allowing a population to grow at its maximum rate. The growth curve is J-shaped. Therefore, it matches with an **Unlimited resource availability condition**. So, **B matches with I**.

- **C. Expanding age pyramid:** This is a triangular-shaped pyramid with a broad base, indicating that the percentage of **pre-reproductive individuals is the largest**. This signifies a rapidly growing population. So, **C matches with III**.

- **D. Stable age pyramid:** This is a bell-shaped pyramid where the number of **pre-reproductive and reproductive individuals is roughly the same**. This indicates a population that is not growing or is growing very slowly. So, **D matches with IV**.

Step 4: Final Answer:
The correct matching is A-II, B-I, C-III, D-IV. This corresponds to option (2).

Quick Tip

Remember the shapes: J-shaped curve for Exponential growth (unlimited resources) and S-shaped curve for Logistic growth (limited resources). For age pyramids, a broad base means an expanding population, while an even base means a stable population.

190. The unique mammalian characteristics are:

(A) pinna, monocondylic skull and mammary glands
(B) hairs, tympanic membrane and mammary glands
(C) hairs, pinna and mammary glands
(D) hairs, pinna and indirect development

Correct Answer: (3) hairs, pinna and mammary glands

Solution:

Step 1: Understanding the Question:
The question asks to identify the set of characteristics that are unique to the class Mammalia.

Step 3: Detailed Explanation:
Let's analyze the features in each option:

- **(1) pinna, monocondylic skull and mammary glands:** Mammals have a *dicondylic* skull (two occipital condyles), while a monocondylic skull is found in reptiles and birds. So, this option is incorrect.

- **(2) hairs, tympanic membrane and mammary glands:** The tympanic membrane (eardrum) is present in many other vertebrates (like amphibians, reptiles, and birds), so it is not a unique mammalian characteristic. So, this option is incorrect.

- **(3) hairs, pinna and mammary glands:** The presence of body hair, an external ear (pinna), and milk-producing mammary glands are all defining and unique characteristics of mammals. So, this option is correct.

- **(4) hairs, pinna and indirect development:** Mammals exhibit direct development (young ones resemble adults), not indirect development (which involves a larval stage). So, this option is incorrect.

Step 4: Final Answer:
The combination of hairs, pinna, and mammary glands represents unique mammalian characteristics. Therefore, option (3) is correct.

Quick Tip

The three most universally cited unique characteristics of mammals are the presence of hair/fur, mammary glands for nourishing young, and the external ear or pinna. Remember these three to quickly identify the correct option.

191. Which one of the following is the sequence on corresponding coding strand, if the sequence on mRNA formed is as follows 5' AUCGAUCGAUCGAUCGAUCG AUCG AUCG 3'?

(A) 3' ATCGATCGATCGATCGATCG ATCGATCG 5'
(B) 5' UAGCUAGCUAGCUAGCUAGC UAGC UAGC 3'
(C) 3' UAGCUAGCUAGCUAGCUA GCUAGCUAGC 5'
(D) 5' ATCGATCGATCGATCGATCG ATCGATCG 3'

Correct Answer: (4) 5' ATCGATCGATCGATCGATCG ATCGATCG 3'

Solution:

Step 1: Understanding the Question:
The question provides an mRNA sequence and asks for the sequence of the corresponding coding strand of the DNA.

Step 2: Key Formula or Approach:
During transcription, the mRNA is synthesized using the template (antisense) strand of DNA as a template. The other DNA strand is the coding (sense) strand. The sequence of the coding strand is identical to the mRNA sequence, with two key differences:

1. The coding strand is part of a DNA molecule, so it will contain Thymine (T) instead of Uracil (U).
2. The coding strand has the same polarity (5' to 3' direction) as the mRNA.

Step 3: Detailed Explanation:
Given mRNA sequence: 5' AUCGAUCGAUCGAUCGAUCG AUCG AUCG 3'
To find the coding strand sequence, we follow the rules:

1. Keep the polarity the same: 5' to 3'.
2. Replace every Uracil (U) in the mRNA sequence with a Thymine (T).

Applying these changes:

- mRNA: 5' A U C G A U C G ... 3'
- Coding Strand: 5' A T C G A T C G ... 3'

The full sequence of the coding strand will be:
5' ATCGATCGATCGATCGATCG ATCGATCG 3'
This matches option (4).

Step 4: Final Answer:
The sequence on the coding strand is 5' ATCGATCGATCGATCGATCG ATCGATCG 3'. Therefore, option (4) is correct.

Quick Tip

Remember this simple trick: The coding strand and mRNA are like twins. They have the exact same sequence and direction, but the DNA twin uses 'T' while the mRNA twin uses 'U'.

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192. Given below are two statements:
Statement I: During G_0 phase of cell cycle, the cell is metabolically inactive.
Statement II: The centrosome undergoes duplication during S phase of interphase.
In the light of the above statements, choose the most appropriate answer from the options given below:

(A) Statement I is incorrect but Statement II is correct.
(B) Both Statement I and Statement II are correct.
(C) Both Statement I and Statement II are incorrect.
(D) Statement I is correct but Statement II is incorrect.

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

Solution:

Step 1: Understanding the Question:
We need to evaluate the correctness of two statements related to the cell cycle: one about the G_0 phase and the other about the S phase.

Step 3: Detailed Explanation:

- **Analysis of Statement I:** The G_0 phase, or quiescent stage, is a non-dividing state that a cell can enter from the G_1 phase. Cells in G_0 are not preparing to divide, but they are **metabolically active** and carry out their specialized functions (e.g., a neuron conducting nerve impulses, a liver cell detoxifying substances). The statement claims they are metabolically inactive, which is incorrect. Therefore, **Statement I is incorrect**.

- **Analysis of Statement II:** The S phase (Synthesis phase) of interphase is when DNA replication occurs. Along with DNA synthesis, the centrosome also duplicates during this phase. The two centrosomes will later form the poles of the mitotic spindle during M phase. Therefore, **Statement II is correct**.

Step 4: Final Answer:
Since Statement I is incorrect and Statement II is correct, the correct option is (1).

Quick Tip

Do not confuse G_0 phase with inactivity or death. G_0 is a quiescent (non-proliferating) but metabolically active state where cells perform their normal jobs. Remember S phase is for Synthesis of DNA and duplication of the centrosome.

---

193. Select the correct statements with reference to chordates.
A. Presence of a mid-dorsal, solid and double nerve cord.
B. Presence of closed circulatory system.
C. Presence of paired pharyngeal gillslits.
D. Presence of dorsal heart
E. Triploblastic pseudocoelomate animals.
Choose the correct answer from the options given below:

(A) C, D and E only
(B) A, C and D only
(C) B and C only
(D) B, D and E only

Correct Answer: (3) B and C only

Solution:

Step 1: Understanding the Question:
The question asks to identify the correct statements from a given list that accurately describe characteristics of the phylum Chordata.

Step 3: Detailed Explanation:

- **Statement A:** This is incorrect. Chordates have a **dorsal, hollow, and single** nerve cord. A solid, double, ventral nerve cord is characteristic of many non-chordates (like arthropods).

- **Statement B:** This is correct. Chordates, especially vertebrates, are characterized by a **closed circulatory system**, where blood is confined within vessels.

- **Statement C:** This is correct. The presence of **paired pharyngeal gill slits** at some stage in their life cycle is a fundamental characteristic of all chordates.

- **Statement D:** This is incorrect. Chordates have a **ventral** heart. A dorsal heart, if present, is found in non-chordates.

- **Statement E:** This is incorrect. Chordates are triploblastic, but they are **coelomates** (possessing a true coelom), not pseudocoelomates.

Step 4: Final Answer:
Only statements B and C are correct descriptions of chordates. Therefore, the correct option is (3).

Quick Tip

Memorize the key differences between chordates and non-chordates:

- **Nerve Cord:** Dorsal, hollow, single (Chordate) vs. Ventral, solid, double (Non-chordate)
- **Heart:** Ventral (Chordate) vs. Dorsal (Non-chordate, if present)

Also, remember the three fundamental chordate characters: notochord, dorsal hollow nerve cord, and pharyngeal gill slits.

---

194. Match List I with List II.

List I		List II	
A.	**Mast cells**	**I.**	**Ciliated epithelium**
B.	**Inner surface of bronchiole**	**II.**	**Areolar connective tissue**
C.	**Blood**	**III.**	**Cuboidal epithelium**
D.	**Tubular parts of nephron**	**IV.**	**Specialised connective tissue**

Choose the correct answer from the options give below:

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

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

Solution:

Step 1: Understanding the Question:
This question requires matching different cell types or locations in the body (List I) with their corresponding tissue type or description (List II).

Step 3: Detailed Explanation:

- **A. Mast cells:** These are cells found in connective tissue that release histamine and other substances during inflammatory and allergic reactions. They are a component of **Areolar**

connective tissue. So, **A matches with II**.

- **B. Inner surface of bronchiole:** The smaller bronchioles are lined with epithelial tissue that possesses cilia. These cilia help to move mucus and trapped particles out of the respiratory tract. This is **Ciliated epithelium**. So, **B matches with I**.

- **C. Blood:** Blood is considered a fluid connective tissue because it consists of cells (RBCs, WBCs, platelets) suspended in a fluid matrix (plasma). It is classified as a **Specialised connective tissue**. So, **C matches with IV**.

- **D. Tubular parts of nephron:** The proximal convoluted tubule (PCT) and distal convoluted tubule (DCT) of the kidney nephron are lined with a single layer of cube-shaped cells, which is **Cuboidal epithelium**. This epithelium is specialized for absorption and secretion. So, **D matches with III**.

Step 4: Final Answer:
The correct matching is A-II, B-I, C-IV, D-III. This corresponds to option (4).

Quick Tip

For tissue-related questions, focus on the location and function. For example, ciliated epithelium is always for movement (respiratory tract, fallopian tubes), while cuboidal epithelium is often for secretion/absorption (glands, nephrons).

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195. Which one of the following is NOT an advantage of inbreeding?

(A) It decreases the productivity of inbred population, after continuous inbreeding.
(B) It decreases homozygosity.
(C) It exposes harmful recessive genes that are eliminated by selection.
(D) Elimination of less desirable genes and accumulation of superior genes takes place due to it.

Correct Answer: (1) It decreases the productivity of inbred population, after continuous inbreeding.

Solution:

Step 1: Understanding the Question:
The question asks to identify which of the given options is a disadvantage (or not an advantage) of inbreeding in animal husbandry or plant breeding.

Step 3: Detailed Explanation:

- **(1) It decreases the productivity of inbred population, after continuous inbreeding:** This phenomenon is known as inbreeding depression. It is a major **disadvantage** of continuous inbreeding, leading to reduced fertility and productivity. Since it's a disadvantage, it is "NOT an advantage".

- **(2) It decreases homozygosity:** This statement is factually incorrect. Inbreeding, which is mating between closely related individuals, **increases** homozygosity and decreases heterozygosity.

- **(3) It exposes harmful recessive genes that are eliminated by selection:** By increasing homozygosity, inbreeding brings harmful recessive alleles together, making them express their effects. This allows breeders to identify and eliminate these undesirable alleles from the population. This is a key **advantage**.

- **(4) Elimination of less desirable genes and accumulation of superior genes takes place due to it:** This is the main purpose of inbreeding – to develop a pure line that is homozygous for desirable (superior) genes. This is an **advantage**.

Step 4: Final Answer:
Options (3) and (4) are clear advantages. Option (2) is a false statement. Option (1) describes inbreeding depression, which is the primary disadvantage. Therefore, a decrease in productivity is NOT an advantage of inbreeding. Option (1) is the correct answer.

Quick Tip

Remember the main goal and the main risk of inbreeding. Goal (Advantage): Increase homozygosity to create pure lines with superior genes. Risk (Disadvantage): Inbreeding depression, which is the loss of fitness and productivity due to increased homozygosity of harmful recessive alleles.

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196. Which of the following statements are correct?
A. Basophils are most abundant cells of the total WBCS
B. Basophils secrete histamine, serotonin and heparin
C. Basophils are involved in inflammatory response
D. Basophils have kidney shaped nucleus
E. Basophils are agranulocytes
Choose the correct answer from the options given below:

(A) A and B only
(B) D and E only
(C) C and E only
(D) B and C only

Correct Answer: (4) B and C only

Solution:

Step 1: Understanding the Question:
The question asks to identify the correct statements about basophils, a type of white blood cell (WBC).

Step 3: Detailed Explanation:

- **Statement A:** This is incorrect. Basophils are the **least** abundant type of WBC, making up only about 0.5-1% of the total. The most abundant are neutrophils.
- **Statement B:** This is correct. The granules of basophils contain and secrete **histamine, serotonin, and heparin**.
- **Statement C:** This is correct. The substances secreted by basophils, particularly histamine, are potent mediators of **inflammatory responses**.
- **Statement D:** This is incorrect. Basophils have a bi-lobed or S-shaped nucleus, which is often obscured by their large granules. A **kidney-shaped nucleus** is characteristic of monocytes.
- **Statement E:** This is incorrect. Basophils contain prominent granules in their cytoplasm, so they are classified as **granulocytes**, along with neutrophils and eosinophils.

Step 4: Final Answer:
Statements B and C are correct. Therefore, the correct option is (4).

Quick Tip

Remember the mnemonic for WBC abundance in decreasing order: **N**ever **L**et **M**onkeys **E**at **B**ananas (Neutrophils, Lymphocytes, Monocytes, Eosinophils, Basophils). Basophils are last, meaning least abundant.

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197. Which of the following are NOT under the control of thyroid hormone?
A. Maintenance of water and electrolyte balance
B. Regulation of basal metabolic rate
C. Normal rhythm of sleep-wake cycle
D. Development of immune system
E. Support the process of R.B.Cs formation

Choose the correct answer from the options given below:

(A) D and E only
(B) A and D only
(C) B and C only
(D) C and D only

Correct Answer: (4) C and D only

Solution:

Step 1: Understanding the Question:
The question asks to identify the functions from the given list that are NOT primarily controlled by the thyroid hormone.

Step 3: Detailed Explanation:
Let's evaluate the role of thyroid hormone (thyroxine) in each function:

- **A. Maintenance of water and electrolyte balance:** Thyroid hormones do influence this, although hormones like ADH and aldosterone play a more direct role. It is considered a function.

- **B. Regulation of basal metabolic rate (BMR):** This is the principal function of thyroid hormone. It regulates the body's overall metabolism.

- **C. Normal rhythm of sleep-wake cycle:** This circadian rhythm is primarily regulated by the hormone **melatonin**, which is secreted by the pineal gland. This is NOT a primary function of thyroid hormone.

- **D. Development of immune system:** While thyroid hormones are crucial for overall growth and maturation (especially of the nervous system), the primary development and function of the immune system are controlled by the thymus gland and other factors. A major direct role in immune system development is NOT attributed to thyroid hormone.

- **E. Support the process of R.B.Cs formation:** Thyroid hormones stimulate erythropoiesis (RBC formation). This is a recognized function.

Based on this analysis, the normal rhythm of the sleep-wake cycle (C) and the development of the immune system (D) are the functions not primarily under the control of thyroid hormone.

Step 4: Final Answer:
The functions not under the control of thyroid hormone are C and D. Therefore, the correct option is (4).

Quick Tip

Associate hormones with their most important functions. Thyroid hormone = BMR and metabolism. Melatonin = Sleep-wake cycle. Thymosin = Immune system (T-cell maturation).

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198. Select the correct statements.
A. Tetrad formation is seen during Leptotene.
B. During Anaphase, the centromeres split and chromatids separate.
C. Terminalization takes place during Pachytene.
D. Nucleolus, Golgi complex and ER are reformed during Telophase.
E. Crossing over takes place between sister chromatids of homologous chromosome.
Choose the correct answer from the options given below:

(A) B and E only
(B) A and C only
(C) B and D only
(D) A, C and E only

Correct Answer: (3) B and D only

Solution:

Step 1: Understanding the Question:
The question asks us to identify the correct statements about the events of meiosis from a given list.

Step 3: Detailed Explanation:

- **Statement A:** This is incorrect. Tetrad formation, the pairing of homologous chromosomes (synapsis), occurs during the **Zygotene** stage of Prophase I.

- **Statement B:** This is correct. This event happens during **Anaphase II** of meiosis (and also Anaphase of mitosis). The centromeres holding the sister chromatids together split, and the now-separate chromatids move to opposite poles.

- **Statement C:** This is incorrect. Terminalization of chiasmata (the movement of chiasmata towards the ends of the chromosomes) occurs during **Diakinesis**, the last stage of Prophase I. Crossing over occurs during Pachytene.

- **Statement D:** This is correct. The nuclear envelope, nucleolus, Golgi complex, and ER, which disappear during Prophase, reappear and reform during **Telophase**.

- **Statement E:** This is incorrect. Crossing over is the exchange of genetic material between **non-sister chromatids** of homologous chromosomes. Exchange between sister chromatids would not result in genetic recombination.

Step 4: Final Answer:
Statements B and D are correct. Therefore, the correct option is (3).

Quick Tip

Memorize the key events of the substages of Prophase I: Zygotene (Synapsis), Pachytene (Crossing Over), Diplotene (Chiasmata visible), Diakinesis (Terminalization). This is a very frequently tested area.

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199. The parts of human brain that helps in regulation of sexual behaviour, expression of excitement, pleasure, rage, fear etc. are :

(A) Corpus callosum and thalamus
(B) Limbic system & hypothalamus
(C) Corpora quadrigemina & hippocampus
(D) Brain stem & epithalamus

Correct Answer: (2) Limbic system & hypothalamus

Solution:

Step 1: Understanding the Question:
The question asks to identify the parts of the human brain responsible for regulating emotions and drives like sexual behavior.

Step 3: Detailed Explanation:

- The regulation of emotional reactions (like excitement, pleasure, rage, fear) and motivational drives (like sexual behavior) is a primary function of the **Limbic System** (often called the "emotional brain") and the **Hypothalamus**.
- The limbic system includes structures like the amygdala (involved in fear and aggression) and hippocampus (memory). The hypothalamus controls many basic drives and regulates the pituitary gland, linking the nervous and endocrine systems.
- Let's analyze the other options:
- **Corpus callosum** connects the two cerebral hemispheres. **Thalamus** is a major relay center for sensory information.
- **Corpora quadrigemina** (in the midbrain) are reflex centers for vision and hearing.

- **Brain stem** controls basic life-sustaining functions. **Epithalamus** contains the pineal gland (melatonin).

Step 4: Final Answer:
The limbic system and hypothalamus work together to regulate emotions and drives. Therefore, option (2) is the correct answer.

Quick Tip

For brain functions, remember these key associations:

- **Cerebrum:** Conscious thought, intelligence, memory.
- **Cerebellum:** Balance, coordination, motor skills.
- **Limbic System:** Emotions and memory.
- **Hypothalamus:** Homeostasis, basic drives (hunger, thirst, sex).
- **Brain Stem:** Basic life support (breathing, heart rate).

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200. In cockroach, excretion is brought about by-
A. Phallic gland
B. Urecose gland
C. Nephrocytes
D. Fat body
E. Collaterial glands
Choose the correct answer from the options given below:

(A) B and D only
(B) A and E only
(C) A, B and E only
(D) B, C and D only

Correct Answer: (4) B, C and D only

Solution:

Step 1: Understanding the Question:
The question asks to identify which of the listed structures are involved in the process of excretion in cockroaches.

Step 3: Detailed Explanation:
The primary excretory organs in a cockroach are the Malpighian tubules. However, several other structures also play an accessory role in excretion:

- **A. Phallic gland:** This is a part of the male reproductive system and is not involved in excretion.

- **B. Urecose gland:** These glands, associated with the male reproductive system, store and excrete uric acid. They are excretory in function.

- **C. Nephrocytes:** These are cells found in the body cavity that absorb nitrogenous wastes from the hemolymph and store them. They are excretory in function.

- **D. Fat body:** The fat body has multiple roles, including storage of nutrients. It also contains urate cells that store uric acid, thus contributing to excretion.

- **E. Collaterial glands:** These are part of the female reproductive system and secrete the protective egg case (ootheca). They are not involved in excretion.

Therefore, the urecose gland (B), nephrocytes (C), and fat body (D) are all involved in excretion.

Step 4: Final Answer:
The correct combination of excretory structures is B, C, and D. This corresponds to option (4).

Quick Tip

While Malpighian tubules are the main excretory organs in cockroaches, remember that the fat body, nephrocytes, and urecose glands are important accessory excretory structures. Phallic and collaterial glands are purely reproductive.
