AP EAPCET 2026 May 19 Shift 1

Question Paper with Solutions (Memory Based)

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General Instructions

(i) The test is of 3 hours duration.

(ii) This test paper consists of 160 questions. The maximum marks are 160.

(iii) Physics and Chemistry contains 40 questions each and Biology contains 80 questions.

(iv) Each question carries +1 marks for correct answer and there is no negative marking for wrong answer.

Physics

1. A capacitor has capacitance C. When dielectric of constant 3 completely fills it, new capacitance is:

(A) $C/3$

(B) C

(C) $3C$

(D) $9C$

Correct Answer: (C) $3C$

Solution:

Step 1: Understanding the Question:

The question asks for the new capacitance of a capacitor when a dielectric material with a dielectric constant of 3 completely fills the space between its plates.

Step 2: Key Formula or Approach:

The capacitance of a parallel plate capacitor in the presence of a dielectric medium is given by the formula:

$$C' = \frac{K\epsilon_0 A}{d} = KC$$

where C is the initial capacitance in vacuum, K is the dielectric constant of the material, ϵ_0 is the permittivity of free space, A is the area of the plates, and d is the plate separation distance.

Step 3: Detailed Explanation:

- The original capacitance of a parallel plate capacitor without any dielectric (in vacuum or air) is defined by the geometric parameters of the plates and the permittivity of free space. This is mathematically represented as $C = \frac{\epsilon_0 A}{d}$.

- When a dielectric material is introduced, its molecules undergo polarization in the presence of the electric field between the capacitor plates. This polarization creates an internal induced electric field that opposes the applied electric field.

- Due to this opposing induced field, the net electric field (E) between the plates is reduced by a factor equal to the dielectric constant (K). Thus, the new electric field becomes $E' = \frac{E}{K}$.

- Since the potential difference (V) between the plates is directly proportional to the electric field ($V = E \cdot d$), the potential difference also decreases by the same factor, $V' = \frac{V}{K}$.

- Capacitance is defined as the ratio of stored charge to potential difference, $C = \frac{Q}{V}$. When the potential difference decreases to V', the capacity of the system to store charge at a given potential increases.

- Substituting the reduced potential difference V' into the capacitance definition yields

the new capacitance: $C' = \frac{Q}{V'} = \frac{Q}{V/K} = K\left(\frac{Q}{V}\right) = KC$.

- In this specific problem, we are given that the dielectric constant $K = 3$ completely fills the space.

- Substituting the value $K = 3$ into our relationship gives the new capacitance as $C' = 3C$.

Step 4: Final Answer:

The new capacitance of the capacitor when completely filled with a dielectric constant of 3 is $3C$.

Quick Tip: Introducing any dielectric medium between the plates of a capacitor always increases its capacitance by a factor of K.

Whether the capacitor is connected to a battery or isolated, the capacitance C' is always equal to $K \cdot C$.

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2. Work done in moving a charge on an equipotential surface is:

(A) Maximum

(B) Minimum

(C) Zero

(D) Infinite

Correct Answer: (C) Zero

Solution:

Step 1: Understanding the Question:

The question asks for the amount of work required to move an electric charge from one point to another on an equipotential surface.

Step 2: Key Formula or Approach:

The work done (W) in moving a charge q between two points with a potential difference ΔV is given by:

$$W = q \cdot \Delta V = q(V_B - V_A)$$

Step 3: Detailed Explanation:

- An equipotential surface is defined as a surface where every point lies at the exact same electric potential.
- Let us consider two arbitrary points, A and B, located on this equipotential surface. By definition, the electric potential at point A (V_A) is equal to the electric potential at point B (V_B), meaning $V_A = V_B$.
- Consequently, the potential difference (ΔV) between these two points is zero: $\Delta V = V_B - V_A = 0$.
- The electrostatic work done by an external force to move a charge q from A to B is proportional to the potential difference between those two points, expressed as $W = q \cdot \Delta V$.
- Substituting $\Delta V = 0$ into the work formula, we find: $W = q \times 0 = 0$.
- Another way to analyze this is through the relationship between the electric field and the equipotential surface. The electric field lines are always perpendicular to the equipotential surface at every point.
- The electrostatic force acting on the charge is $\vec{F} = q\vec{E}$, which is perpendicular to the surface. Since the movement occurs along the surface, the displacement vector $d\vec{r}$ is perpendicular to the force vector $\vec{F}$.

- Therefore, the work done, which is the line integral of force, becomes zero because the dot product of two perpendicular vectors is zero: $dW = \vec{F} \cdot d\vec{r} = F \cdot dr \cdot \cos(90^\circ) = 0$.

Step 4: Final Answer:

The total work done in moving a charge along an equipotential surface is zero.

Quick Tip: Since potential remains constant everywhere on an equipotential surface, the potential difference is zero. No potential difference means no work is done.
Additionally, remember that electric field lines and equipotential surfaces are always at a 90° angle to each other.

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3. A wire is stretched to double its length. New resistance becomes:

(A) $R/2$

(B) R

(C) $2R$

(D) $4R$

Correct Answer: (D) $4R$

Solution:

Step 1: Understanding the Question:

This problem requires determining the change in the electrical resistance of a conductive wire when it is mechanically stretched such that its final length becomes twice its original length.

Step 2: Key Formula or Approach:

The resistance of a uniform conductor is given by:

$$R = \rho \frac{l}{A}$$

where ρ is the resistivity of the material, l is the length, and A is the cross-sectional area. Since the material volume remains constant during stretching, we use $V = A \cdot l = \text{constant}$.

Step 3: Detailed Explanation:

- The initial resistance of the wire is represented as $R_1 = \rho \frac{l_1}{A_1}$, where l_1 is the initial length and A_1 is the initial cross-sectional area.
- When a wire is physically stretched, its total volume (V) remains constant because no material is added or removed. The volume of a cylinder is $V = A \cdot l$.
- Thus, the relationship between initial and final parameters is: $V_1 = V_2 \implies A_1 l_1 = A_2 l_2$.
- We are given that the wire is stretched to double its initial length, so the new length is $l_2 = 2l_1$.
- Using the conservation of volume, we can solve for the new cross-sectional area A_2:

$$A_2 = A_1 \left(\frac{l_1}{l_2}\right) = A_1 \left(\frac{l_1}{2l_1}\right) = \frac{A_1}{2}$$

- The new resistance R_2 of the stretched wire is given by:

$$R_2 = \rho \frac{l_2}{A_2}$$

- Substituting the values of $l_2 = 2l_1$ and $A_2 = \frac{A_1}{2}$ into the formula:

$$R_2 = \rho \frac{2l_1}{\left(\frac{A_1}{2}\right)} = 4\left(\rho \frac{l_1}{A_1}\right) = 4R_1$$

- This calculation shows that as the length increases and the cross-sectional area simultaneously decreases, both factors work together to increase the total resistance of the wire.

- Specifically, doubling the length doubles the resistance, and halving the area doubles it again, resulting in a net increase of four times the original value.

Step 4: Final Answer:

The new resistance of the stretched wire is $4R$.

Quick Tip: For any wire stretched by a factor of n (where $l' = n \cdot l$), the new resistance is given by the shortcut formula:

$$R' = n^2 \cdot R$$

Since the length is doubled ($n = 2$), the new resistance is $2^2 \cdot R = 4R$.

Chemistry

4. For which of the following process entropy change (ΔS) is negative ?

I) Sublimation of dry ice

II) Freezing of water

III) Crystallisation of the dissolved substance

IV) Burning of rocket fuel

(A) I, II only

(B) II, III only

(C) III, IV only

(D) I, IV only

Correct Answer: (B) II, III only

Solution:

Step 1: Understanding the Question:
The question asks to identify the processes among the given choices where the change in entropy (ΔS) is negative, meaning the process leads to a decrease in randomness or disorder in the system.

Step 2: Detailed Explanation:

- Entropy (S) is a thermodynamic state function that measures the degree of randomness, molecular disorder, or chaos in a system. A positive change in entropy ($\Delta S > 0$) indicates an increase in disorder, while a negative change ($\Delta S < 0$) indicates an increase in order.

- Let us evaluate each process individually:

- **I) Sublimation of dry ice:** Sublimation is the direct transition of a substance from the solid phase to the gaseous phase. Dry ice is solid carbon dioxide (CO_2). When it sublimes, highly ordered solid molecules transition into highly disordered gaseous molecules. Thus, the randomness increases, leading to a positive entropy change ($\Delta S > 0$).

- **II) Freezing of water:** Freezing is the phase change from liquid water to solid ice. In the liquid state, water molecules move randomly and have high translational kinetic energy. Upon freezing, they lose kinetic energy and arrange themselves into a highly structured, rigid crystalline lattice. This transition from liquid to solid decreases the randomness, resulting in a negative entropy change ($\Delta S < 0$).

- **III) Crystallisation of a dissolved substance:** In a solution, solute particles are dissociated and randomly dispersed among solvent molecules, possessing high disorder. During crystallisation, these dissolved solute particles precipitate out of the solution to form a highly ordered solid crystal structure. The system moves from a state of higher

dispersion to a highly ordered state, so the entropy decreases ($\Delta S < 0$).

- **IV) Burning of rocket fuel:** Combustion is a highly exothermic process that typically converts solid or liquid chemical propellants into a vast volume of hot, rapidly expanding gases (such as water vapor, CO_2, nitrogen, etc.). The conversion of a condensed phase into numerous gaseous molecules dramatically increases molecular chaos, meaning the entropy change is highly positive ($\Delta S > 0$).

- Combining these evaluations, we see that both freezing of water (II) and crystallisation of a dissolved substance (III) exhibit a negative entropy change ($\Delta S < 0$).

Step 3: Final Answer:

The processes with a negative entropy change are II and III.

Quick Tip: To easily determine the sign of ΔS, look at the physical states involved in the transition:
- Phase changes from more ordered to less ordered states (solid → liquid → gas) have $\Delta S > 0$.
- Phase changes from less ordered to more ordered states (gas → liquid → solid) have $\Delta S < 0$.

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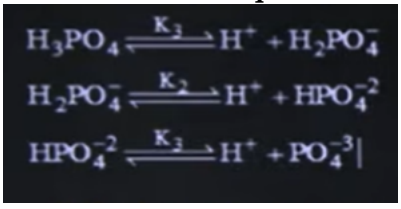
5. Consider the equilibrium reactions:



The equilibrium constant, K_c for the following dissociation $H_3PO_4 \rightleftharpoons 3H^+ + PO_4^{3-}$ is:

(A) $\frac{K_1}{K_2K_3}$

(B) $K_1K_2K_3$

(C) $\frac{K_2}{K_1K_3}$

(D) $K_1 + K_2 + K_3$

Correct Answer: (B) $K_1K_2K_3$

Solution:

Step 1: Understanding the Question:

The question asks to find the relationship between the overall equilibrium constant (K_c) for the complete dissociation of phosphoric acid (H_3PO_4) and the individual stepwise dissociation constants (K_1, K_2, K_3).

Step 2: Key Formula or Approach:

For a multi-step chemical reaction, if the overall reaction is obtained by adding several stepwise reactions, the overall equilibrium constant is the product of the equilibrium constants of the individual steps:

$$K_{overall} = K_1 \times K_2 \times K_3 \times \cdots \times K_n$$

Step 3: Detailed Explanation:

- Let us write the mathematical expression for each of the given step-wise dissociation processes:

- For the first step:

$$H_3PO_4 \rightleftharpoons H^+ + H_2PO_4^- \implies K_1 = \frac{[H^+][H_2PO_4^-]}{[H_3PO_4]}$$

- For the second step:

$$H_2PO_4^- \rightleftharpoons H^+ + HPO_4^{2-} \implies K_2 = \frac{[H^+][HPO_4^{2-}]}{[H_2PO_4^-]}$$

- For the third step:

$$HPO_4^{2-} \rightleftharpoons H^+ + PO_4^{3-} \implies K_3 = \frac{[H^+][PO_4^{3-}]}{[HPO_4^{2-}]}$$

- The final overall dissociation reaction represents the complete deprotonation of phosphoric acid:

$$H_3PO_4 \rightleftharpoons 3H^+ + PO_4^{3-}$$

- The equilibrium constant expression for this target reaction is:

$$K_c = \frac{[H^+]^3[PO_4^{3-}]}{[H_3PO_4]}$$

- Let us evaluate the mathematical product of the three step-wise constants, $K_1 \times K_2 \times K_3$:

$$K_1 \cdot K_2 \cdot K_3 = \left(\frac{[H^+][H_2PO_4^-]}{[H_3PO_4]}\right) \times \left(\frac{[H^+][HPO_4^{2-}]}{[H_2PO_4^-]}\right) \times \left(\frac{[H^+][PO_4^{3-}]}{[HPO_4^{2-}]}\right)$$

- Looking at the terms in the numerator and denominator, we can cancel out the intermediate species $[H_2PO_4^-]$ and $[HPO_4^{2-}]$ as they appear in both places.

- After cancellation, the remaining terms in the product are:

$$K_1 \cdot K_2 \cdot K_3 = \frac{[H^+] \cdot [H^+] \cdot [H^+] \cdot [PO_4^{3-}]}{[H_3PO_4]} = \frac{[H^+]^3[PO_4^{3-}]}{[H_3PO_4]}$$

- This simplified expression is exactly equal to the equilibrium constant of the overall reaction, K_c. Therefore, we have established that $K_c = K_1K_2K_3$.

Step 4: Final Answer:

The overall equilibrium constant K_c is equal to $K_1K_2K_3$.

Quick Tip: Remember the golden rule of chemical equilibrium arithmetic:
- Adding chemical equations $\Longrightarrow$ Multiply their equilibrium constants (K).
- Subtracting chemical equations $\Longrightarrow$ Divide their equilibrium constants.
- Multiplying an equation by a factor n $\Longrightarrow$ Raise the constant to power n (K^n).

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6. The conjugate acid of NH_2^- is:

(A) NH_3

(B) NH_2OH

(C) NH_4^+

(D) N_2H_4

Correct Answer: (A) NH_3

Solution:

Step 1: Understanding the Question:

The question asks to identify the conjugate acid of the amide ion (NH_2^-) according to the Brønsted-Lowry acid-base concept.

Step 2: Key Formula or Approach:

According to the Brønsted-Lowry theory:

$$\text{Conjugate Acid} = \text{Base} + H^+$$

A conjugate acid is formed when a base accepts a proton (H^+).

Step 3: Detailed Explanation:

- The Brønsted-Lowry model defines an acid as any chemical species that can donate a proton (H^+), and a base as any chemical species that can accept a proton.
- When a base accepts a proton, it transforms into its conjugate acid. The conjugate acid has one additional hydrogen atom and a charge that is one unit more positive than the starting base.
- Conversely, when an acid loses a proton, it transitions into its conjugate base, which has one less hydrogen atom and a charge that is one unit more negative.
- Here, we are starting with the amide ion, which is represented by the formula NH_2^-. Since we want to find its conjugate acid, we treat NH_2^- as a Brønsted-Lowry base.

- To form the conjugate acid of NH_2^-, we add a proton (H^+) to the species:

$$NH_2^- + H^+ \rightleftharpoons NH_3$$

- In this protonation process, the chemical composition changes by adding one hydrogen atom (increasing the number of hydrogen atoms from two to three).

- The electrical charge also changes. The initial charge on the amide ion is -1, and adding a proton with a $+1$ charge results in a neutral species: $(-1) + (+1) = 0$.

- The resulting neutral molecule is ammonia, NH_3. Therefore, NH_3 is the conjugate acid of the NH_2^- ion.

Step 4: Final Answer:

The conjugate acid of NH_2^- is NH_3.

Quick Tip: To easily find the conjugate partner:

- For a conjugate acid: Add one H^+ to the formula.

- For a conjugate base: Remove one H^+ from the formula.

For example, the conjugate acid of NH_2^- is NH_3, and the conjugate acid of NH_3 is NH_4^+.

Botany

7. In the context of DNA fingerprinting, VNTRs are used as probes. What does VNTR stand for?

(A) Variable Number of Tandem Repeats

(B) Various Nucleotide Template Regions

(C) Validated Nitrogenous Triple Replicates

(D) Viral Nucleoside Transfer Rates

Correct Answer: (A) Variable Number of Tandem Repeats

Solution:

Step 1: Understanding the Question:
The question asks for the full form of the abbreviation "VNTR," which represents a crucial biological tool used as a probe during DNA fingerprinting.

Step 2: Detailed Explanation:

- DNA fingerprinting (also called DNA profiling) is a forensic technique used to identify individuals based on unique regions within their genomes. Much of the human genome is identical among individuals, but repetitive DNA sequences provide high variability.
- VNTR stands for Variable Number of Tandem Repeats.
- VNTRs are location-specific, repetitive DNA sequences where a short nucleotide sequence is organized in tandem (one after another).
- These sequences belong to a class of satellite DNA known as mini-satellites. The length of the repeated unit can range from 10 to 100 base pairs.
- The total number of repeats at any given locus varies significantly among individuals, making VNTRs highly polymorphic. This variation is inherited from parents, providing a unique genetic marker.
- During the Southern blot hybridization step of DNA fingerprinting, radiolabeled or fluorescently tagged VNTR sequences are used as probes.

- These probes bind to complementary single-stranded DNA fragments on a membrane. Because the length and number of VNTRs vary from person to person, the resulting band pattern on an autoradiogram is unique to each individual (except for identical twins).

Step 3: Final Answer:

The abbreviation VNTR stands for Variable Number of Tandem Repeats.

Quick Tip: VNTRs are the foundational basis of restriction fragment length polymorphism (RFLP) analysis used in forensic investigations and paternity testing. They are characterized by a high degree of sequence polymorphism.

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8. A Mendelian "Dihybrid Cross" (e.g., RRYY × rryy) results in a phenotypic ratio of 9:3:3:1 in the F_2 generation. This ratio supports which law?

(A) Law of Dominance

(B) Law of Segregation

(C) Law of Independent Assortment

(D) Law of Purity of Gametes

Correct Answer: (C) Law of Independent Assortment

Solution:

Step 1: Understanding the Question:

The question asks to identify which of Mendel's laws of inheritance is validated and demonstrated by the classic 9 : 3 : 3 : 1 phenotypic ratio obtained from a dihybrid cross in the F_2 generation.

Step 2: Detailed Explanation:

- A dihybrid cross is a genetic cross that tracks the inheritance of two different traits governed by two different genes.

- Mendel crossed homozygous dominant pea plants having round and yellow seeds (RRYY) with homozygous recessive plants having wrinkled and green seeds (rryy).

- The resulting F_1 generation plants were all heterozygous round and yellow (RrYy), as the dominant alleles masked the expression of the recessive alleles.

- When F_1 plants were self-pollinated (RrYy × RrYy), the F_2 generation exhibited a phenotypic ratio of 9 : 3 : 3 : 1. This represents 9 round-yellow, 3 round-green, 3 wrinkled-yellow, and 1 wrinkled-green offspring.

- This ratio occurs because the alleles for seed shape (R and r) assort into gametes completely independently of the alleles for seed color (Y and y).

- This independent behavior allows for the formation of novel non-parental recombinant phenotypes, which are round-green and wrinkled-yellow.

- Mathematically, the dihybrid ratio of 9 : 3 : 3 : 1 is the product of two independent monohybrid crosses: (3 dominant : 1 recessive) × (3 dominant : 1 recessive).

- This independent segregation and recombination of alleles for different traits is the definition of Mendel's Law of Independent Assortment.

Step 3: Final Answer:

The 9 : 3 : 3 : 1 dihybrid ratio supports Mendel's Law of Independent Assortment.

Quick Tip: Remember the genetic ratios:

- Monohybrid phenotypic ratio (3 : 1) supports the Law of Dominance and Law of Segregation.
- Dihybrid phenotypic ratio (9 : 3 : 3 : 1) supports the Law of Independent Assortment.

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9. During which stage does the synaptonemal complex dissolve?

(A) Leptotene

(B) Pachytene

(C) Diplotene

(D) Zygotene

Correct Answer: (C) Diplotene

Solution:

Step 1: Understanding the Question:

The question asks to identify the specific sub-stage of Prophase I of Meiosis I during which the protein structure known as the synaptonemal complex undergoes dissolution.

Step 2: Detailed Explanation:

- Prophase I of Meiosis I is divided into five sequential stages based on chromosomal behavior: Leptotene, Zygotene, Pachytene, Diplotene, and Diakinesis.
- During the Leptotene stage, chromatin fibers condense into distinct chromosomes.
- During the Zygotene stage, homologous chromosomes begin to pair up in a highly specific alignment called synapsis. This pairing is facilitated by the assembly of a ladder-like protein structure called the synaptonemal complex.
- During the Pachytene stage, crossing over (genetic recombination) takes place between

non-sister chromatids of the synapsed homologous chromosomes, mediated by recombination nodules.

- The beginning of the Diplotene stage is characterized by the dissolution and breakdown of this synaptonemal complex.
- As the synaptonemal complex dissolves, the homologous chromosomes begin to separate from one another.
- However, they remain temporarily held together at the specific sites where crossing over occurred. These persistent, X-shaped points of contact are known as chiasmata, which become clearly visible during Diplotene.

Step 3: Final Answer:

The synaptonemal complex dissolves during the Diplotene stage of Prophase I.

Quick Tip: Use this simple mnemonic to remember the sequence of Prophase I stages and their key events:
- Leptotene: Condensation.
- Zygotene: Synapsis (complex forms).
- Pachytene: Crossing over.
- Diplotene: Dissolution of complex (chiasmata appear).
- Diakinesis: Terminalisation of chiasmata.

Zoology

10. Birds are Uricotelic, meaning they excrete nitrogenous waste primarily as:

(A) Urea

(B) Amino acids

(C) Ammonia

(D) Uric acid

Correct Answer: (D) Uric acid

Solution:

Step 1: Understanding the Question:

The question defines birds as "Uricotelic" and asks for the identity of the primary nitrogenous waste product they excrete.

Step 2: Detailed Explanation:

- Metabolism of proteins and nucleic acids produces highly toxic nitrogenous byproducts that must be eliminated from the animal body. The three main waste products are ammonia, urea, and uric acid.
- Animals are classified into three major groups based on their primary excretory product: ammonotelic, ureotelic, and uricotelic.
- Uricotelic animals are those that primarily excrete nitrogenous wastes in the form of uric acid or its salts (urates).
- Examples of uricotelic organisms include birds, terrestrial reptiles, land snails, and insects.
- Uric acid is highly insoluble in water and is the least toxic of the three major nitrogenous wastes.
- Because of its low solubility and low toxicity, uric acid can be stored and excreted as a thick, semi-solid paste or pellet with very little water loss.

- This is an extremely important evolutionary adaptation for water conservation in animals that fly (such as birds) or live in dry, terrestrial environments, as it minimizes the weight of stored water in the body.

Step 3: Final Answer:

Uricotelic animals, including birds, excrete nitrogenous waste primarily as uric acid.

Quick Tip: Remember the three excretory types and their water requirements:
- Ammonotelic: Excretes Ammonia (requires huge amounts of water, highly toxic).
- Ureotelic: Excretes Urea (requires moderate water, moderately toxic).
- Uricotelic: Excretes Uric Acid (requires almost no water, least toxic).

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11. Differentiate between Red Muscle Fibers (A) and White Muscle Fibers (B) based on the following traits:

(i) Low mitochondria count

(ii) High mitochondria count

(iii) High Myoglobin content

(iv) Low Myoglobin content

(v) Aerobic respiration

(vi) Anaerobic respiration

(A) A: (i), (iv), (vi) | B: (ii), (iii), (v)

(B) A: (ii), (iii), (v) | B: (i), (iv), (vi)

(C) A: (ii), (iv), (v) | B: (i), (iii), (vi)

(D) A: (i), (iii), (vi) | B: (ii), (iv), (v)

Correct Answer: (B) A: (ii), (iii), (v) | B: (i), (iv), (vi)

Solution:

Step 1: Understanding the Question:

The question asks to categorize six specific structural and metabolic traits into two main types of skeletal muscle fibers: Red Muscle Fibers (A) and White Muscle Fibers (B).

Step 2: Detailed Explanation:

- Skeletal muscle fibers vary in their physical appearance, myoglobin concentration, organelle count, and metabolic pathways. They are broadly classified into Red (slow-twitch) and White (fast-twitch) fibers.

- **Red Muscle Fibers (A):**
  - These fibers are characterized by a high content of myoglobin (iii), an iron-containing, oxygen-binding pigment. This high concentration of myoglobin gives them their deep red color.
  - To match their oxygen-binding capability, these fibers contain a very high density of mitochondria (ii), which are the site of cellular respiration.
  - Because they have abundant oxygen stored in myoglobin and numerous mitochondria, they rely primarily on aerobic respiration (v) to synthesize ATP. This allows them to sustain continuous contractions for long periods without fatiguing quickly.

- **White Muscle Fibers (B):**
  - These fibers have a very low content of myoglobin (iv), which gives them a pale, whitish appearance.
  - They have a low mitochondria count (i) but possess a highly developed sarcoplasmic reticulum for rapid calcium release.
  - Because of the limited mitochondria and oxygen storage, they rely mainly on anaerobic respiration (vi) (glycolysis) to generate ATP quickly. This supports rapid, powerful movements, but results in rapid fatigue due to lactic acid accumulation.

- Matching these characteristics:
  - Red Muscle Fibers (A) exhibit traits (ii), (iii), and (v).
  - White Muscle Fibers (B) exhibit traits (i), (iv), and (vi).

Step 3: Final Answer:
The correct option is (B), where A corresponds to (ii), (iii), (v) and B corresponds to (i), (iv), (vi).

Quick Tip: Think of Red Muscle Fibers as "marathon runner muscles" (aerobic, high oxygen, slow fatigue) and White Muscle Fibers as "sprinter muscles" (anaerobic, fast energy, rapid fatigue).

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12. The immediate chemical source of energy for muscle contraction is:

(A) Actin
(B) Myosin
(C) ATP
(D) Creatine Phosphate

Correct Answer: (C) ATP

Solution:

Step 1: Understanding the Question:
The question asks to identify the immediate, direct biochemical molecule that supplies energy to power the sliding filament mechanism of muscle contraction.

Step 2: Detailed Explanation:

- Muscle contraction operates via the sliding filament theory, which involves actin (thin filaments) and myosin (thick filaments) sliding past each other.

- The head of the myosin molecule contains an active site with ATPase enzymatic activity, which can bind and hydrolyze adenosine triphosphate (ATP).

- During the contraction cycle, the binding of ATP to the myosin head is required to release myosin from actin.

- The subsequent hydrolysis of this ATP molecule into adenosine diphosphate (ADP) and an inorganic phosphate (P_i) releases free energy, which alters the conformation of the myosin head into a high-energy "cocked" state.

- This energized head binds to actin, forms a cross-bridge, and performs the "power stroke" to slide the actin filament. Thus, ATP is the direct and immediate chemical energy donor for this cross-bridge cycle.

- While Creatine Phosphate (D) is a highly concentrated energy reserve in muscle tissue, it cannot be utilized directly by the contractile proteins. Instead, creatine phosphate must transfer its high-energy phosphate group to ADP to regenerate ATP via the enzyme creatine kinase.

- Actin (A) and Myosin (B) are structural, contractile proteins that participate in the movement but do not act as energy molecules themselves.

Step 3: Final Answer:

The immediate chemical source of energy for muscle contraction is ATP (Adenosine Triphosphate).

Quick Tip: Always distinguish between direct energy and storage energy in muscles:
- Direct and immediate energy source = ATP.
- Storage / backup energy reservoir = Creatine Phosphate.