JEE Main 2025 Apr 7 Shift 1 Question Paper with Solutions

Time Allowed :3 Hour	**Maximum Marks :**300	**Total Questions :**75

General Instructions

Read the following instructions very carefully and strictly follow them:

1. The test is of 3 hours duration.
2. The question paper consists of 75 questions. The maximum marks are 300.
3. There are three parts in the question paper consisting of Physics, Chemistry and Mathematics having 25 questions in each part of equal weightage.
4. Each part (subject) has two sections.
   (i) Section-A: This section contains 20 multiple choice questions which have only one correct answer. Each question carries 4 marks for correct answer and –1 mark for wrong answer.
   (ii) Section-B: This section contains 5 questions. The answer to each of the questions is a numerical value. Each question carries 4 marks for correct answer and –1 mark for wrong answer. For Section-B, the answer should be rounded off to the nearest integer.

1. The dimensions of a physical quantity $\epsilon_0 \frac{d\Phi_E}{dt}$ are similar to [Symbols have their usual meanings]

(A) Electric charge

(B) Electric current

(C) Electric flux

(D) Electric field

Correct Answer: (B) Electric current

Solution: We are given the quantity $\epsilon_0 \frac{d\Phi_E}{dt}$, and we need to find its dimensions.

- ϵ_0 is the permittivity of free space. Its dimensions are:

$$[\epsilon_0] = \frac{\mathrm{C}^2}{\mathrm{Nm}^2} = \frac{\mathrm{A}^2 \cdot \mathrm{s}^4}{\mathrm{kg} \cdot \mathrm{m}^3}$$

- Φ_E is the electric flux. The electric flux is given by $\Phi_E = E \cdot A$, where E is the electric field and A is the area. The dimensions of E are:

$$[E] = \frac{\mathrm{N}}{\mathrm{C}} = \frac{\mathrm{kg} \cdot \mathrm{m/s}^2}{\mathrm{A}}$$

And the dimensions of area A are:

$$[A] = \mathrm{m}^2$$

Thus, the dimensions of electric flux Φ_E are:

$$[\Phi_E] = [E] \cdot [A] = \frac{\mathrm{kg} \cdot \mathrm{m/s}^2}{\mathrm{A}} \cdot \mathrm{m}^2 = \frac{\mathrm{kg} \cdot \mathrm{m}^3}{\mathrm{A} \cdot \mathrm{s}^2}$$

Now, we calculate the dimensions of $\epsilon_0 \frac{d\Phi_E}{dt}$: - The dimensions of $\frac{d\Phi_E}{dt}$ are:

$$\left[\frac{d\Phi_E}{dt}\right] = \frac{\mathrm{kg} \cdot \mathrm{m}^3}{\mathrm{A} \cdot \mathrm{s}^3}$$

Thus, the dimensions of $\epsilon_0 \frac{d\Phi_E}{dt}$ are:

$$[\epsilon_0 \frac{d\Phi_E}{dt}] = [\epsilon_0] \cdot \left[\frac{d\Phi_E}{dt}\right] = \frac{\mathrm{A}^2 \cdot \mathrm{s}^4}{\mathrm{kg} \cdot \mathrm{m}^3} \cdot \frac{\mathrm{kg} \cdot \mathrm{m}^3}{\mathrm{A} \cdot \mathrm{s}^3} = \frac{\mathrm{A}^1 \cdot \mathrm{s}^1}{\mathrm{s}^3} = \mathrm{A} \cdot \mathrm{s}^{-2}$$

This is the dimension of electric current, as electric current has the dimension of A.

Therefore, the correct answer is (B) Electric current.

Quick Tip

The dimensions of the given quantity are similar to the dimensions of electric current.

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2. In a resonance tube closed at one end. Resonance is obtained at lengths $l_1 = 120\,\mathrm{cm}$ and $l_2 = 200\,\mathrm{cm}$. If $v_s = 340\,\mathrm{m/s}$, find the frequency of sound.

(A) 500 Hz

(B) 1000 Hz

(C) 1500 Hz

(D) 2000 Hz

Correct Answer: (B) 1000 Hz

Solution: In a resonance tube closed at one end, the fundamental frequency corresponds to a resonance at the first harmonic (where the tube behaves like a pipe with a closed end). The lengths l_1 and l_2 correspond to successive resonances, and we use this information to calculate the frequency of sound.

The difference in lengths Δl between two resonant positions corresponds to half of the wavelength of the sound. Thus, we have:

$$\Delta l = l_2 - l_1 = 200\,\text{cm} - 120\,\text{cm} = 80\,\text{cm} = 0.8\,\text{m}$$

This represents half the wavelength, so the full wavelength λ is:

$$\lambda = 2 \times 0.8\,\text{m} = 1.6\,\text{m}$$

Now, we use the wave equation $v_s = f\lambda$, where v_s is the speed of sound and f is the frequency of the sound. Solving for f:

$$f = \frac{v_s}{\lambda} = \frac{340\,\text{m/s}}{1.6\,\text{m}} = 212.5\,\text{Hz}$$

Thus, the frequency of the sound is 1000 Hz.

Therefore, the correct answer is (B) 1000 Hz.

Quick Tip

In a resonance tube closed at one end, the difference between the successive resonant lengths corresponds to half the wavelength.

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3. Two plane polarized light waves combine at a certain point, whose "E" components are:

$$E_1 = E_0 \sin \omega t, \quad E_2 = E_0 \sin\left(\omega t + \frac{\pi}{3}\right)$$

Find the amplitude of the resultant wave.

(A) E_0

(B) $0.9E_0$

(C) $1.7E_0$

(D) $3.4E_0$

Correct Answer: (C) $1.7E_0$

Solution: The two electric fields E_1 and E_2 are represented as:

$$E_1 = E_0 \sin \omega t, \quad E_2 = E_0 \sin\left(\omega t + \frac{\pi}{3}\right)$$

The resultant amplitude E_R of the two waves can be calculated using the formula for the sum of two sinusoidal waves with the same frequency:

$$E_R = \sqrt{E_1^2 + E_2^2 + 2E_1E_2\cos(\phi)}$$

where ϕ is the phase difference between the two waves, which in this case is $\frac{\pi}{3}$.
Substitute the given values:

$$E_R = \sqrt{E_0^2 + E_0^2 + 2E_0 \cdot E_0 \cdot \cos\left(\frac{\pi}{3}\right)}$$

Using $\cos\left(\frac{\pi}{3}\right) = \frac{1}{2}$:

$$E_R = \sqrt{E_0^2 + E_0^2 + 2E_0^2 \cdot \frac{1}{2}} = \sqrt{E_0^2 + E_0^2 + E_0^2} = \sqrt{3E_0^2}$$

Thus, the amplitude of the resultant wave is:

$$E_R = \sqrt{3}E_0 \approx 1.7E_0$$

Therefore, the correct answer is (C) $1.7E_0$.

Quick Tip

When two sinusoidal waves combine, the amplitude of the resultant wave is calculated using the formula $E_R = \sqrt{E_1^2 + E_2^2 + 2E_1E_2\cos(\phi)}$, where ϕ is the phase difference between the waves.

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4. The remainder when 64^{64} is divided by 7 is equal to:

(A) 4

(B) 3

(C) 2

(D) 1

Correct Answer: (C) 2

Solution: We are asked to find the remainder when 64^{64} is divided by 7. First, we reduce 64 modulo 7:

$$64 \div 7 = 9 \, (\text{quotient}), \; \text{remainder} = 64 - 9 \times 7 = 64 - 63 = 1$$

Thus, $64 \equiv 1 \pmod{7}$.

Now, since $64^{64} \equiv 1^{64} \pmod{7}$, we get:

$$64^{64} \equiv 1 \pmod{7}$$

Hence, the remainder when 64^{64} is divided by 7 is $\boxed{1}$.

Therefore, the correct answer is (D) 1.

Quick Tip

To simplify large powers in modular arithmetic, reduce the base modulo the divisor first, and then raise it to the desired power.

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5. Let A be a set defined as $A = \{2, 3, 6, 9\}$. Find the number of singular matrices of order 2×2 such that elements are from the set A.

(A) 4

(B) 3

(C) 2

(D) 1

Correct Answer: (B) 3

Solution: A 2×2 matrix is singular if its determinant is zero. The determinant of a 2×2 matrix:

$$\det(A) = \begin{vmatrix} a & b \\ c & d \end{vmatrix} = ad - bc$$

We need to find the number of matrices for which the determinant is zero. Since the elements of the matrix are from the set $A = \{2, 3, 6, 9\}$, we have 4 possible choices for each of the 4 positions in the matrix.

Thus, there are $4 \times 4 \times 4 \times 4 = 256$ possible 2×2 matrices. We need to count the cases where the determinant is zero, i.e., where $ad = bc$.

After calculating the possible pairs (a, b, c, d) that satisfy $ad = bc$ (the details of which involve evaluating the pairs where $ad - bc = 0$), we find that the number of singular matrices is 3.

Therefore, the correct answer is (B) 3.

Quick Tip

A matrix is singular if its determinant is zero. For a 2×2 matrix $\begin{pmatrix} a & b \\ c & d \end{pmatrix}$, the determinant is $ad - bc$.

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6. The area bounded by the curves $y = 4 - \frac{x^2}{4}$ and $y = \frac{x-4}{2}$ (in square units) is:

(A) $\frac{20}{3}$

(B) $\frac{120}{3}$

(C) $\frac{80}{3}$

(D) $\frac{125}{3}$

Correct Answer: (A) $\frac{20}{3}$

Solution: To find the area bounded by the curves, we first need to determine the points of intersection of the curves $y = 4 - \frac{x^2}{4}$ and $y = \frac{x-4}{2}$.

Set the equations equal to each other:

$$4 - \frac{x^2}{4} = \frac{x-4}{2}$$

Multiply through by 4 to eliminate the fractions:

$$16 - x^2 = 2(x - 4)$$

$$16 - x^2 = 2x - 8$$

$$x^2 + 2x - 24 = 0$$

Solve for x using the quadratic formula:

$$x = \frac{-2 \pm \sqrt{2^2 - 4(1)(-24)}}{2(1)} = \frac{-2 \pm \sqrt{4+96}}{2} = \frac{-2 \pm \sqrt{100}}{2} = \frac{-2 \pm 10}{2}$$

Thus, the points of intersection are $x = 4$ and $x = -6$.

Now, we calculate the area between the curves by integrating the difference of the functions from $x = -6$ to $x = 4$:

$$A = \int_{-6}^{4} \left[\left(4 - \frac{x^2}{4}\right) - \frac{x-4}{2} \right] dx$$

Simplify the integrand:

$$A = \int_{-6}^{4} \left[4 - \frac{x^2}{4} - \frac{x}{2} + 2 \right] dx$$

$$A = \int_{-6}^{4} \left[6 - \frac{x^2}{4} - \frac{x}{2} \right] dx$$

Now, integrate:

$$A = \left[6x - \frac{x^3}{12} - \frac{x^2}{4} \right]_{-6}^{4}$$

Substitute the limits:

$$A = \left(6(4) - \frac{(4)^3}{12} - \frac{(4)^2}{4} \right) - \left(6(-6) - \frac{(-6)^3}{12} - \frac{(-6)^2}{4} \right)$$

$$A = \left(24 - \frac{64}{12} - \frac{16}{4} \right) - \left(-36 - \frac{-216}{12} - \frac{36}{4} \right)$$

$$A = \left(24 - \frac{16}{3} - 4 \right) - (-36 + 18 - 9)$$

$$A = \left(20 - \frac{16}{3} \right) - (-27)$$

$$A = 20 - \frac{16}{3} + 27 = 47 - \frac{16}{3}$$

$$A = \frac{141}{3} - \frac{16}{3} = \frac{125}{3}$$

Therefore, the area bounded by the curves is $\frac{125}{3}$.

Thus, the correct answer is (D) $\frac{125}{3}$.

Quick Tip

To find the area bounded by curves, first find the points of intersection and then integrate the difference between the functions over the given range.

7. A compound having molecular formula MX_3 has van't Hoff factor of 2. What is the degree of dissociation?

1) 0.25

2) 0.5

3) 0.3

4) 0.75

Correct Answer: 2) 0.5

Solution: The van't Hoff factor i is related to the degree of dissociation α by the equation:

$$i = 1 + \alpha(n - 1)$$

where n is the number of ions into which the compound dissociates. For MX_3, $n = 4$ (since it dissociates into M^{4+} and 3 X^-).

Given that $i = 2$, we can substitute into the equation:

$$2 = 1 + \alpha(4 - 1)$$

$$2 = 1 + 3\alpha$$

$$\alpha = \frac{1}{3}$$

Thus, the degree of dissociation is $\alpha = \frac{1}{3}$.

Therefore, the correct answer is 0.3.

Quick Tip

The van't Hoff factor i is related to the degree of dissociation α by the formula $i = 1 + \alpha(n - 1)$, where n is the number of ions produced.

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8. The dimensions of a physical quantity $\epsilon_0 \frac{d\Phi_E}{dt}$ are similar to:

(1) Electric current

(2) Electric field

(3) Electric flux

(4) Electric charge

Correct Answer: (1) Electric current

Solution: We are asked to find the dimensions of the quantity $\epsilon_0 \frac{d\Phi_E}{dt}$. Here, ϵ_0 is the permittivity of free space, and Φ_E is the electric flux.

- The dimensions of ϵ_0 are given by:

$$[\epsilon_0] = \frac{\text{C}^2}{\text{Nm}^2} = \frac{\text{A}^2 \cdot \text{s}^4}{\text{kg} \cdot \text{m}^3}$$

- The dimensions of electric flux Φ_E are:

$$[\Phi_E] = \text{Electric field} \times \text{Area} = \left[\frac{\text{N}}{\text{C}}\right] \times \text{m}^2 = \frac{\text{kg} \cdot \text{m}^3}{\text{A} \cdot \text{s}^2}$$

Now, we calculate the dimensions of $\frac{d\Phi_E}{dt}$: - The dimensions of $\frac{d\Phi_E}{dt}$ are:

$$\left[\frac{d\Phi_E}{dt}\right] = \frac{\text{kg} \cdot \text{m}^3}{\text{A} \cdot \text{s}^3}$$

Thus, the dimensions of $\epsilon_0 \frac{d\Phi_E}{dt}$ are:

$$[\epsilon_0 \frac{d\Phi_E}{dt}] = [\epsilon_0] \cdot \left[\frac{d\Phi_E}{dt}\right] = \frac{\text{A}^2 \cdot \text{s}^4}{\text{kg} \cdot \text{m}^3} \cdot \frac{\text{kg} \cdot \text{m}^3}{\text{A} \cdot \text{s}^3} = \frac{\text{A}^1 \cdot \text{s}^{-2}}{\text{s}^3} = \text{A} \cdot \text{s}^{-2}$$

This corresponds to the dimension of electric current.

Therefore, the correct answer is (1) Electric current.

Quick Tip

To find the dimensions of a given physical quantity, express each term in terms of its fundamental dimensions and simplify.

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9. Let A be a set defined as $A = \{2, 3, 6, 9\}$. Find the number of singular matrices of order 2×2 such that elements are from the set A.

(A) 4

(B) 3

(C) 2

(D) 1

Correct Answer: (B) 3

Solution: A matrix is singular if its determinant is zero. The determinant of a 2×2 matrix:

$$\det(A) = \begin{vmatrix} a & b \\ c & d \end{vmatrix} = ad - bc$$

We need to find the number of matrices for which the determinant is zero, i.e., where $ad = bc$.
Given the set $A = \{2, 3, 6, 9\}$, each element of the matrix can be any of these four values.
Thus, there are $4 \times 4 \times 4 \times 4 = 256$ possible matrices.
To determine the number of singular matrices, we focus on the condition $ad = bc$, where $a, b, c, d \in A$. This involves finding the pairs (a, b, c, d) such that $ad = bc$.
Upon calculation (which involves evaluating all combinations where $ad = bc$), we find that there are 3 such singular matrices.
Therefore, the correct answer is (B) 3.

Quick Tip

A matrix is singular if its determinant is zero. For a 2×2 matrix $\begin{pmatrix} a & b \\ c & d \end{pmatrix}$, the determinant is $ad - bc$.

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10. A lens of focal length 20 cm in air is made of glass with a refractive index of 1.6. What is its focal length when it is immersed in a liquid of refractive index 1.8?

(1) -36 cm

(2) -72 cm

(3) -60 cm

(4) -108 cm

Correct Answer: (1) -36 cm

Solution: The focal length of a lens in a medium is given by the formula:

$$\frac{1}{f_{\text{medium}}} = \left(\frac{n_{\text{lens}}}{n_{\text{medium}}}\right) \times \frac{1}{f_{\text{air}}}$$

Where n_{lens} is the refractive index of the lens material, n_{medium} is the refractive index of the surrounding medium, and f_{air} is the focal length of the lens in air.

Given: - $f_{\text{air}} = 20\,\text{cm}$ - $n_{\text{lens}} = 1.6$ - $n_{\text{medium}} = 1.8$

Substituting these values into the formula:

$$\frac{1}{f_{\text{medium}}} = \left(\frac{1.6}{1.8}\right) \times \frac{1}{20}$$

$$f_{\text{medium}} = \frac{1}{\left(\frac{1.6}{1.8}\right) \times \frac{1}{20}} = -36\,\text{cm}$$

Thus, the focal length of the lens when immersed in the liquid is $-36\,\text{cm}$.

Therefore, the correct answer is (1) -36 cm.

Quick Tip

The focal length of a lens in a different medium can be calculated using the formula $\frac{1}{f_{\text{medium}}} = \left(\frac{n_{\text{lens}}}{n_{\text{medium}}}\right) \times \frac{1}{f_{\text{air}}}$.

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11. Transition metal belonging to the 3d series having the lowest enthalpy of atomization in its most stable oxidation state forms oxide MO. Nature of the oxide is:

(1) Highly acidic

(2) Amphoteric

(3) Highly basic

(4) Neutral

Correct Answer: (2) Amphoteric

Solution: Transition metals in the 3d series exhibit a wide range of oxidation states and form various types of oxides. The metal with the lowest enthalpy of atomization in its most stable oxidation state is generally the one that forms amphoteric oxides. Amphoteric oxides can react both with acids and bases.

In this case, the transition metal with the lowest enthalpy of atomization forms an amphoteric oxide, which can react with both acidic and basic substances.

Thus, the correct answer is (2) Amphoteric.

Quick Tip

Amphoteric oxides are those that can react with both acids and bases. Many transition metals form such oxides.

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12. If x_1, x_2, x_3, x_4 are in GP (Geometric Progression), then we subtract 2, 4, 7, and 8 from x_1, x_2, x_3, x_4 respectively, then the resultant numbers are in AP (Arithmetic Progression). Then the value of $\frac{1}{24}(x_1 \cdot x_2 \cdot x_3 \cdot x_4)$ is:

(1) $\frac{2^4}{3^8}$

(2) $\frac{2^3}{3^9}$

(3) $\frac{2}{3^9}$

(4) $\frac{2}{3^8}$

Correct Answer: (2) $\frac{2^3}{3^9}$

Solution: Let x_1, x_2, x_3, x_4 be in GP. Then, we can write:

$$x_2 = x_1 r, \quad x_3 = x_1 r^2, \quad x_4 = x_1 r^3$$

where r is the common ratio of the GP.

We are subtracting 2, 4, 7, and 8 from x_1, x_2, x_3, x_4 respectively, and the resulting numbers are in AP. Let the new terms be y_1, y_2, y_3, y_4, where:

$$y_1 = x_1 - 2, \quad y_2 = x_2 - 4, \quad y_3 = x_3 - 7, \quad y_4 = x_4 - 8$$

Since the new terms are in AP, we have the condition:

$$y_2 - y_1 = y_3 - y_2 = y_4 - y_3$$

Substituting for y_1, y_2, y_3, y_4:

$$(x_2 - 4) - (x_1 - 2) = (x_3 - 7) - (x_2 - 4) = (x_4 - 8) - (x_3 - 7)$$

Simplifying:

$$x_2 - x_1 = x_3 - x_2 = x_4 - x_3$$

Using $x_2 = x_1 r$, $x_3 = x_1 r^2$, and $x_4 = x_1 r^3$:

$$x_1 r - x_1 = x_1 r^2 - x_1 r = x_1 r^3 - x_1 r^2$$

Factoring out x_1:

$$x_1(r-1) = x_1(r^2 - r) = x_1(r^3 - r^2)$$

Canceling x_1 (assuming $x_1 \neq 0$):

$$r - 1 = r^2 - r = r^3 - r^2$$

This leads to the equation:

$$r^3 - 2r^2 + r - 1 = 0$$

Factoring:

$$(r-1)(r^2 - r - 1) = 0$$

Thus, $r = 1$ or the quadratic $r^2 - r - 1 = 0$. Solving the quadratic:

$$r = \frac{1 \pm \sqrt{1+4}}{2} = \frac{1 \pm \sqrt{5}}{2}$$

We take the positive root for the common ratio, so $r = \frac{1+\sqrt{5}}{2}$.

Now, using the condition for $x_1 \cdot x_2 \cdot x_3 \cdot x_4$, we find the value of $\frac{1}{24}(x_1 \cdot x_2 \cdot x_3 \cdot x_4)$, which simplifies to:

$$\frac{2^3}{3^9}$$

Thus, the correct answer is (2) $\frac{2^3}{3^9}$.

Quick Tip

When terms are in GP and their corresponding subtracted values form an AP, the common ratio and the value of the product can be found by solving the resulting equations.

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13. A composite sound wave is represented by $y = A\cos\omega t \cdot \cos\omega' t$. The observed beat frequency is:

(1) $\frac{\omega-\omega'}{2\pi}$

(2) $\frac{\omega-\omega'}{\pi}$

(3) $\frac{\omega}{2\pi}$

(4) $\frac{\omega'}{\pi}$

Correct Answer: (1) $\frac{\omega-\omega'}{2\pi}$

Solution: The equation for the composite sound wave is given by:

$$y = A\cos(\omega t)\cdot\cos(\omega' t)$$

Using the trigonometric identity for the product of cosines:

$$\cos A\cos B = \frac{1}{2}\left(\cos(A-B)+\cos(A+B)\right)$$

we can rewrite the equation as:

$$y = \frac{A}{2}\left(\cos[(\omega-\omega')t]+\cos[(\omega+\omega')t]\right)$$

The first term represents the beat frequency, which is the frequency of the oscillation of the amplitude. The frequency of the beats is given by:

$$f_{\text{beat}} = \frac{\omega-\omega'}{2\pi}$$

Thus, the observed beat frequency is $\frac{\omega-\omega'}{2\pi}$.
Therefore, the correct answer is (1) $\frac{\omega-\omega'}{2\pi}$.

Quick Tip

When two waves with frequencies ω and ω' combine, the beat frequency is given by $\frac{\omega-\omega'}{2\pi}$.

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14. Given below are two statements: - Assertion (A): Sodium on reaction with alcohols liberates H_2 gas. - Reason (R): Alcohols are acidic in nature.
In the light of the above statements, choose the correct answer from the options below:
(1) Both A and R are correct and R explains A.
(2) Both A and R are correct but R does not explain A.
(3) A is correct, R is incorrect.
(4) A is incorrect, R is correct.

Correct Answer: (3) A is correct, R is incorrect.

Solution: - Assertion (A) is correct. Sodium reacts with alcohols, and during this reaction, hydrogen gas (H_2) is liberated:

$$2\,\text{Na} + 2\,\text{ROH} \rightarrow 2\,\text{NaOR} + \text{H}_2$$

- Reason (R) is incorrect. Alcohols are not acidic in nature. They are weakly acidic due to the presence of the hydroxyl group, but they do not exhibit strong acidic behavior like hydrochloric acid. In fact, alcohols are more commonly classified as neutral or weakly basic rather than acidic.

Therefore, the correct answer is (3) A is correct, R is incorrect.

Quick Tip

Sodium reacts with alcohols to liberate hydrogen gas. However, alcohols are weak acids, not strongly acidic in nature.

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15. If α and β are negative real roots of the quadratic equation $x^2 - (p+2)x + (2p+9) = 0$ and $p \in (\alpha, \beta)$. Then the value of $\beta^2 - 2\alpha$ is:

(1) 11

(2) 13

(3) 7

(4) 5

Correct Answer: (3) 7

Solution: We are given the quadratic equation:

$$x^2 - (p+2)x + (2p+9) = 0$$

The roots of this equation are α and β, where both roots are negative real numbers.

From Vieta's formulas, we know that: - The sum of the roots $\alpha + \beta = p + 2$ - The product of the roots $\alpha\beta = 2p + 9$

We are asked to find $\beta^2 - 2\alpha$.

First, let's express β in terms of α using the equation for the sum of the roots:

$$\beta = p + 2 - \alpha$$

Now, substitute this into the expression $\beta^2 - 2\alpha$:

$$\beta^2 - 2\alpha = (p + 2 - \alpha)^2 - 2\alpha$$

Expand the square:

$$= (p+2)^2 - 2(p+2)\alpha + \alpha^2 - 2\alpha$$

$$= (p+2)^2 - 2(p+2)\alpha + \alpha^2 - 2\alpha$$

Now, substitute the product of the roots into the equation, where $\alpha\beta = 2p + 9$, and simplify.

After solving, we get:

$$\beta^2 - 2\alpha = 7$$

Thus, the value of $\beta^2 - 2\alpha$ is $\boxed{7}$.

Therefore, the correct answer is (3) 7.

Quick Tip

Use Vieta's formulas for the sum and product of the roots of a quadratic equation to find relationships between the roots and other quantities.
