VITEEE 2026 May 2 Shift 2

Question Paper with Solutions

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General Instructions

(i) **Duration:** The total duration of the examination is 2.5 hours (150 minutes).

(ii) **Total Marks:** The complete paper carries a maximum of 500 marks.

(iii) **Structure:** The paper has 4 Sections:

- **Part 1:** 35 Multiple Choice Questions (Physics).
- **Part 2:** 35 Multiple Choice Questions (Chemistry).
- **Part 3:** 40 Multiple Choice Questions (Mathematics/Biology).
- **Part 4:** 10 Multiple Choice Questions (Aptitude).
- **Part 4:** 5 Multiple Choice Questions (English)

(iv) **Compulsory Questions:** All 125 questions are compulsory.

(v) Each question has four options. Only **one** option is correct.

(vi) **Correct Answer:** +4 marks.

(vii) **Incorrect Answer:** −1 (Negative marking).

(viii) **Unanswered/Marked for Review:** 0 marks.

1. Find the value of the integral $\int_0^{\pi/2} \frac{\sqrt{\sin x}}{\sqrt{\sin x}+\sqrt{\cos x}}\,dx$.

(A) π

(B) $\pi/2$

(C) $\pi/4$

(D) 0

Correct Answer: (C) $\pi/4$

Solution:

Step 1: Understanding the Question:

The objective is to evaluate a definite integral involving trigonometric functions in the denominator and numerator over the interval from 0 to $\pi/2$.

The structure of the integrand suggests the use of symmetry properties to simplify the calculation.

Step 2: Key Formula or Approach:

The primary tool used here is the Reflection Property (also known as King's Property) of definite integrals:

$$\int_a^b f(x)\,dx = \int_a^b f(a+b-x)\,dx$$

For the interval $[0, \pi/2]$, the substitution is $x \to \pi/2 - x$.

Step 3: Detailed Explanation:

Let the given integral be I:

$$I = \int_0^{\pi/2} \frac{\sqrt{\sin x}}{\sqrt{\sin x} + \sqrt{\cos x}}\,dx \quad \ldots(1)$$

Applying the property $\int_0^a f(x)\,dx = \int_0^a f(a-x)\,dx$, we replace x with $\pi/2 - x$:

$$I = \int_0^{\pi/2} \frac{\sqrt{\sin(\pi/2-x)}}{\sqrt{\sin(\pi/2-x)} + \sqrt{\cos(\pi/2-x)}}\,dx$$

Using the trigonometric identities $\sin(\pi/2-x) = \cos x$ and $\cos(\pi/2-x) = \sin x$, we get:

$$I = \int_0^{\pi/2} \frac{\sqrt{\cos x}}{\sqrt{\cos x} + \sqrt{\sin x}}\,dx \quad \ldots(2)$$

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Now, add equation (1) and equation (2):

$$2I = \int_0^{\pi/2} \left(\frac{\sqrt{\sin x} + \sqrt{\cos x}}{\sqrt{\sin x} + \sqrt{\cos x}} \right) dx$$

$$2I = \int_0^{\pi/2} 1 \, dx$$

$$2I = [x]_0^{\pi/2} = \frac{\pi}{2} - 0$$

$$I = \frac{\pi}{4}$$

Step 4: Final Answer:

The value of the integral is $\pi/4$.

Quick Tip: Whenever you see an integral from 0 to $\pi/2$ with a symmetric structure like $\frac{\sin^n x}{\sin^n x + \cos^n x}$, the answer is almost always half the upper limit, which is $\pi/4$.

This applies to any power n, including square roots or large integers.

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2. If A is a 3×3 matrix and $|A| = 5$, find the value of $|adj(A)|$.

(A) 5

(B) 25

(C) 125

(D) 15

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Correct Answer: (B) 25

Solution:

Step 1: Understanding the Question:

The problem asks for the determinant of the adjoint of a matrix A, given the determinant of the matrix itself and its order.

Step 2: Key Formula or Approach:

The relationship between the determinant of a matrix and the determinant of its adjoint is given by the formula:

$$|adj(A)| = |A|^{n-1}$$

where n is the order of the square matrix A.

Step 3: Detailed Explanation:

From the question, we have:

The determinant of matrix A, $|A| = 5$.

The order of the matrix, $n = 3$.

Applying the formula:

$$|adj(A)| = 5^{3-1}$$

$$|adj(A)| = 5^2$$

$$|adj(A)| = 25$$

Step 4: Final Answer:

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The value of $|adj(A)|$ is 25.

Quick Tip: Memorize the property $|adj(A)| = |A|^{n-1}$ as it is a frequent favorite in competitive exams. If the question asks for $|adj(adj(A))|$, the formula becomes $|A|^{(n-1)^2}$.

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3. Calculate the de Broglie wavelength of an electron accelerated through a potential difference of $100\,V$.

(A) $1.227\,\text{Å}$
(B) $12.27\,\text{Å}$
(C) $0.1227\,\text{Å}$
(D) $122.7\,\text{Å}$

Correct Answer: (A) $1.227\,\text{Å}$

Solution:

Step 1: Understanding the Question:
We need to find the de Broglie wavelength of an electron when it is given kinetic energy by an accelerating electric potential V.

Step 2: Key Formula or Approach:
The de Broglie wavelength λ for an electron accelerated through a potential difference V (in Volts) can be calculated using the simplified formula:

$$\lambda = \frac{12.27}{\sqrt{V}}\,\text{Å}$$

Alternatively, in nanometers, it is $\lambda = \frac{1.227}{\sqrt{V}}$ nm.

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Step 3: Detailed Explanation:

Given the potential difference $V = 100\,V$.

Using the formula:

$$\lambda = \frac{12.27}{\sqrt{100}}\,\text{Å}$$

$$\lambda = \frac{12.27}{10}\,\text{Å}$$

$$\lambda = 1.227\,\text{Å}$$

Step 4: Final Answer:

The de Broglie wavelength is $1.227\,\text{Å}$.

Quick Tip: For electrons, always use the shortcut $\lambda \approx \sqrt{150/V}$ or $12.27/\sqrt{V}$ to save time.

Ensure that the potential V is in Volts before plugging it into the square root.

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4. Calculate the work done in moving a charge of $2\mu C$ between two points with a potential difference of $5V$.

(A) $10\,J$

(B) $10^{-5}\,J$

(C) $2.5\,J$

(D) $0.4\,J$

Correct Answer: (B) $10^{-5}\,J$

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Solution:

Step 1: Understanding the Question:

The question asks for the energy or work required to transport a specific amount of electric charge across a known potential difference.

Step 2: Key Formula or Approach:

The relationship between work (W), charge (q), and potential difference (ΔV) is:

$$W = q \times \Delta V$$

Step 3: Detailed Explanation:

Given values:

Charge $q = 2\mu C = 2 \times 10^{-6}\, C$.

Potential difference $\Delta V = 5\, V$.

Calculation:

$$W = (2 \times 10^{-6}\, C) \times (5\, V)$$

$$W = 10 \times 10^{-6}\, J$$

$$W = 10^{-5}\, J$$

Step 4: Final Answer:

The work done is $10^{-5}\, J$.

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Quick Tip: Pay close attention to unit prefixes like micro ($\mu = 10^{-6}$), nano ($n = 10^{-9}$), and milli ($m = 10^{-3}$).

Work done is also equal to the change in electrostatic potential energy.

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5. Calculate the half-life of a first-order reaction if the rate constant is $0.693\,\text{min}^{-1}$.

(A) 10 min

(B) 1 min

(C) 0.5 min

(D) 6.93 min

Correct Answer: (B) 1 min

Solution:

Step 1: Understanding the Question:

We are required to determine the time taken for the concentration of a reactant to reduce to half its initial value for a first-order kinetics process.

Step 2: Key Formula or Approach:

For a first-order reaction, the half-life ($t_{1/2}$) is related to the rate constant (k) by the expression:

$$t_{1/2} = \frac{\ln(2)}{k} \approx \frac{0.693}{k}$$

Step 3: Detailed Explanation:

The given rate constant $k = 0.693\,\text{min}^{-1}$.

Plugging this into the half-life formula:

$$t_{1/2} = \frac{0.693}{0.693\,\text{min}^{-1}}$$

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$$t_{1/2} = 1\,\text{min}$$

Step 4: Final Answer:

The half-life of the reaction is 1 minute.

Quick Tip: In first-order reactions, the half-life is constant and independent of the initial concentration. If the rate constant is exactly 0.693 or a multiple of it, the calculation becomes very simple.

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6. What is the major product formed when Propene reacts with HBr in the presence of peroxide?

(A) 2-Bromopropane

(B) 1-Bromopropane

(C) 1, 2-Dibromopropane

(D) Propane

Correct Answer: (B) 1-Bromopropane

Solution:

Step 1: Understanding the Question:

The question asks for the outcome of an addition reaction between an asymmetric alkene (propene) and hydrogen bromide under specific radical-forming conditions (peroxide).

Step 2: Key Formula or Approach:

Normally, addition follows Markovnikov's rule. However, in the presence of organic peroxides, HBr adds via a free-radical mechanism.

This is known as the Anti-Markovnikov addition or the Kharasch effect.

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Step 3: Detailed Explanation:

Propene structure: $CH_3 - CH = CH_2$.

In the peroxide-induced mechanism, the bromine radical attacks the terminal carbon to form a more stable secondary carbon radical.

1. Initiation: Peroxide decomposes to form radicals.
2. Propagation: $Br^\bullet$ adds to the terminal carbon of propene.

$$CH_3 - CH = CH_2 + Br^\bullet \rightarrow CH_3 - \dot{C}H - CH_2Br$$

3. The resulting secondary radical then abstracts a hydrogen from another HBr molecule.

$$CH_3 - \dot{C}H - CH_2Br + HBr \rightarrow CH_3 - CH_2 - CH_2Br + Br^\bullet$$

The final product is 1-bromopropane.

Step 4: Final Answer:

The major product is 1-bromopropane.

Quick Tip: The Peroxide Effect is only valid for HBr.

If the reagent was HCl or HI, even in the presence of peroxide, the product would still follow Markovnikov's rule (2-chloropropane or 2-iodopropane).

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7. Complete the series: $3, 7, 15, 31, 63, \ldots$

(A) 95

(B) 111

(C) 127

(D) 128

Correct Answer: (C) 127

Solution:

Step 1: Understanding the Question:

The goal is to identify the logical progression in the given sequence of numbers to find the next term.

Step 2: Key Formula or Approach:

Examine the difference between consecutive terms or look for a multiplier-addition pattern.

Pattern 1: $\text{Term}_n \times 2 + 1$.

Pattern 2: Difference increases as powers of 2 $(4, 8, 16, 32 \ldots)$.

Step 3: Detailed Explanation:

Let's check the multiplier pattern:

$3 \times 2 + 1 = 7$

$7 \times 2 + 1 = 15$

$15 \times 2 + 1 = 31$

$31 \times 2 + 1 = 63$

The pattern is consistent. Following this for the next term:

$63 \times 2 + 1 = 126 + 1 = 127$

Alternatively, using differences:

$7 - 3 = 4 = 2^2$

$15 - 7 = 8 = 2^3$

$31 - 15 = 16 = 2^4$

$63 - 31 = 32 = 2^5$

The next difference should be $2^6 = 64$.

$63 + 64 = 127$

Step 4: Final Answer:

The next number in the series is 127.

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Quick Tip: Notice that these numbers are all one less than a power of 2:

$2^2-1, 2^3-1, 2^4-1, 2^5-1, 2^6-1$.

The next term is $2^7-1=128-1=127$.

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