

Moderate

Assistant Engineer (Electrical), Class 2025

Building Department

Find the power, given energy $E = 2J$ and current density $J = x^2$ varies from $x = 0$ and $x = 1$.

A

 $1/3$

B

 $2/3$

Correct

C

1

D

 $4/3$

Correct Answer: B

Full Detailed Explanation

Concept & Reasoning: Electromagnetic power density delivered to charges is $p_v = E \cdot J$ in W/m^3 . Interpreting the problem as a one-dimensional unit cross-section with $E=2$ and $J=x^2$, total power is obtained by integrating the power density along x from 0 to 1. The integral of x^2 is $x^3/3$, so the result is $2/3$ in the implied power units. The key is not to integrate J alone; the electric field factor must multiply it.

How to Solve It in the Exam: Power density in a conductor/field region = $E \cdot J$. Important Exam Point: Check whether the problem implies unit area/volume when geometry is omitted. Related Revision Path: This question sits in the revision path: Electromagnetic Fields → Energy and Power → Field Power Density.

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