

PAPER-1 [Code – 5]
JEE(ADVANCED) 2013
PART - I: PHYSICS

SECTION – 1: (Only one option correct Type)

This section contains 10 multiple choice questions. Each question has four choice (A), (B), (C) and (D) out of which **ONLY ONE** is correct.

- * 1. One end of a horizontal thick copper wire of length $2L$ and radius $2R$ is welded to an end of another horizontal thin copper wire of length L and radius R . When the arrangement is stretched by applying forces at two ends, the ratio of the elongation in the thin wire to that in the thick wire is
 (A) 0.25 (B) 0.50
 (C) 2.00 (D) 4.00

Sol.



$$k_1 = \frac{\pi 4R^2 x}{2L}, k_2 = \frac{\pi R^2 y}{L}$$

$$F = k_1 x = k_2 y \Rightarrow \frac{y}{x} = \frac{k_1}{k_2} = 2$$

- * 2. The work done on a particle of mass m by a force $\mathbf{K} \left[\frac{x}{(x^2 + y^2)^{3/2}} \hat{i} + \frac{y}{(x^2 + y^2)^{3/2}} \hat{j} \right]$ (K being a constant of appropriate dimensions, when the particle is taken from the point $(a, 0)$ to the point $(0, a)$ along a circular path of radius a about the origin in the x - y plane is
 (A) $\frac{2K\pi}{a}$ (B) $\frac{K\pi}{a}$
 (C) $\frac{K\pi}{2a}$ (D) 0

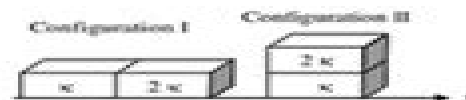
Sol.

$$dw = \vec{F} \cdot d\vec{r} = \vec{F} \cdot (dx\hat{i} + dy\hat{j}) = K \int \frac{x dx}{(x^2 + y^2)^{3/2}} + \frac{y dy}{(x^2 + y^2)^{3/2}}$$

$$x^2 + y^2 = a^2$$

$$w = \frac{K}{a^2} \int_a^0 x dx + \int_0^a y dy = \frac{K}{a^2} \left(\frac{-a^2}{2} + \frac{a^2}{2} \right) = 0.$$

- * 3. Two rectangular blocks, having identical dimensions, can be arranged either in configuration I or in configuration II as shown in the figure. One of the blocks has thermal conductivity κ and the other 2κ . The temperature difference between the ends along the x -axis is the same in both the configurations. It takes 9 s to transport a certain amount of heat from the hot end to the cold end in the configuration I. The time to transport the same amount of heat in the configuration II is
 (A) 2.0 s (B) 3.0 s
 (C) 4.5 s (D) 6.0 s



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