

Q1

A cord is wound round the circumference of wheel of radius r . The axis of the wheel is horizontal and moment of inertia about it is I . A weight mg is attached to the end of the cord and falls from the rest. After falling through a distance h , the angular velocity of the wheel will be

- (a) $\sqrt{\frac{2gh}{I+mr^2}}$ (b) $\left[\frac{2mgh}{I+mr^2}\right]^{1/2}$
 (c) $\left[\frac{2mgh}{I+2mr^2}\right]^{1/2}$ (d) $\sqrt{2gh}$

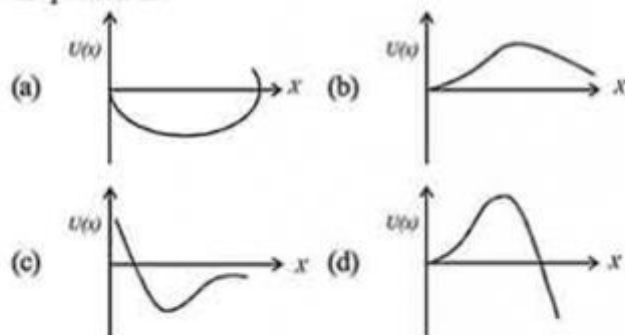
Q2

The Young's modulus of steel is twice that of brass. Two wires of same length and of same area of cross section, one of steel and another of brass are suspended from the same roof. If we want the lower ends of the wires to be at the same level, then the weights added to the steel and brass wires must be in the ratio of:

- (a) 2 : 1 (b) 4 : 1 (c) 1 : 1 (d) 1 : 2

Q3

A particle, which is constrained to move along the x -axis, is subjected to a force in the same direction which varies with the distance x of the particle from the origin as $F(x) = -kx + ax^3$. Here k and a are positive constants. For $x \geq 0$, the functional form of the potential energy $U(x)$ of the particle is



Q4

A solid spherical conductor of radius R has a spherical cavity of radius a ($a < R$) at its centre. A charge $+Q$ is kept at the centre. The charge at the inner surface, outer and at a position r ($a < r < R$) are respectively

- (a) $+Q, -Q, 0$ (b) $-Q, +Q, 0$
 (c) $0, -Q, 0$ (d) $+Q, 0, 0$

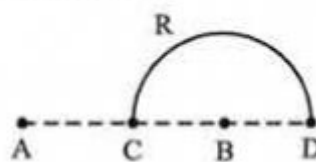
Q5

Two straight horizontal parallel wires are carrying the same current in the same direction, d is the distance between the wires. You are provided with a small freely suspended magnetic needle. At which of the following positions will the orientation of the needle be independent of the magnitude of the current in the wires?

- (a) At a distance $d/2$ from any of the wires
 (b) At a distance $d/2$ from any of the wires in the horizontal plane
 (c) Anywhere on the circumference of a vertical circle of radius d and centre halfway between the wires
 (d) At points halfway between the wires in the horizontal plane

Q6

Charges $+q$ and $-q$ are placed at points A and B respectively which are a distance $2L$ apart, C is the midpoint between A and B. The work done in moving a charge $+Q$ from C to D along the semicircle CRD is



- (a) $\frac{qQ}{2\pi\epsilon_0 L}$ (b) $\frac{qQ}{6\pi\epsilon_0 L}$ (c) $-\frac{qQ}{6\pi\epsilon_0 L}$ (d) $\frac{qQ}{4\pi\epsilon_0 L}$

Q7

The density of a cube is measured by measuring its mass and length of its sides. If the maximum error in the measurement of mass and length are 4% and 3% respectively, the maximum error in the measurement of density will be

- (a) 7% (b) 9% (c) 12% (d) 13%