



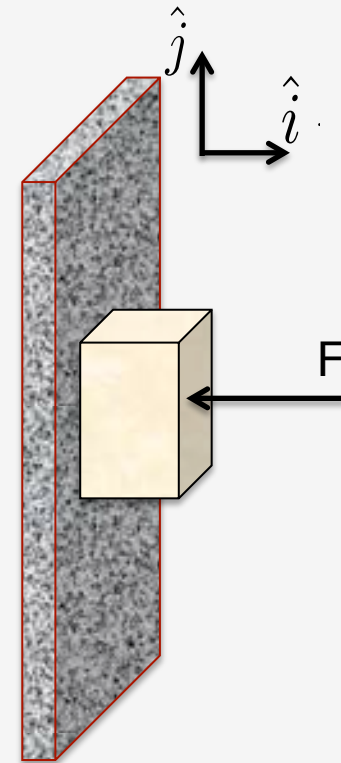
Kinetic Energy And Work

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Clicker Question 1 (30 s)



- A block is held pressed against a wall with a force of $F = 40 \text{ N}$ applied perpendicular to the wall
- Mass of the block is $m = 2 \text{ kg}$
- Assume $g = 10 \text{ m/s}^2$
- What is the co-efficient of static friction μ_s ?
- $N = F = 40 \text{ N}$
- $F_{\text{fr}} = mg = 20 \text{ N}$
- $\mu_s = F_{\text{fr}}/N = 20/40 = 0.5$



Clicker Question 2 (30 s)

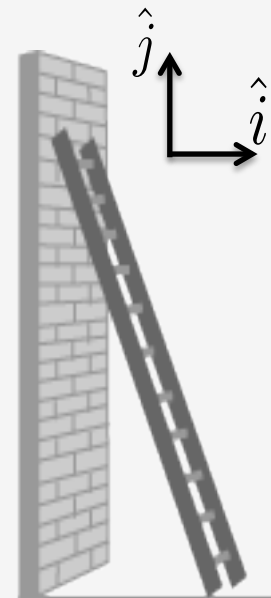


- What is the direction of frictional force between the sprinter's foot and the track?
 - A. Horizontally to the right
 - B. Horizontally to the left
 - C. Cannot be determined
 - D. No friction between the two surfaces

Clicker Question 3 (30 s)



- A ladder rests against a wall and the floor as shown. The unit vectors are also shown.
- What is the direction of normal force on the ladder due to the wall?



a) + \hat{i}

b) - \hat{j}

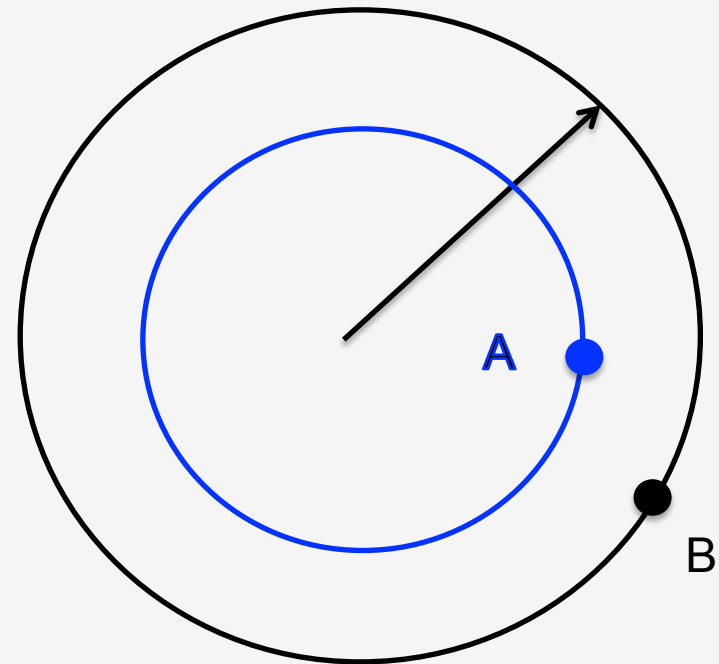
c) + \hat{j}

d) - \hat{i}

Clicker Question 4 (30 s)



- Objects A and B are moving in concentric circles. They complete one full rotation at the same time.
 - A. A is moving faster
 - B. B is moving faster
 - C. Both move at the same speed
 - D. Cannot be compared



Energy

- Energy is the ability to do work
- It's a scalar physical quantity that describes the state of a system
- A system can be composed of one or more “objects”.
 - Mass / Spring system
- Energy can be transformed from one type to another
 -
 - types of energy kinetic energy, potential energy, thermal energy etc.
- Total Energy of an isolated system is conserved
- Kinetic energy is the energy possessed by an object by the virtue of its motion.

Kinetic Energy

- Energy associated with the state of motion
- If an object with mass “m” is moving and it’s instantaneous velocity is “v”, kinetic energy is:

$$KE = \frac{1}{2}mv^2$$

- Units: 1 kg (m/s)² = 1 Joule
- Note1: If velocity is zero, KE = 0
- Note2: KE is positive quantity $m > 0$, $v \geq 0$, $KE \geq 0$
- Velocity of object is assumed to be small compared to speed of light

Work

- Work is the amount of energy transferred to (or from) a body to its surroundings by means of forces acting on it.
 - Work can be positive or negative
 - Energy transferred from surroundings to the object is positive
 - Energy transferred from the object to its surroundings is negative

$$W = \vec{F} \cdot \vec{d}$$

- Work is a scalar quantity. It's the dot product of force and the displacement vectors
- Units: $1 \text{ N m} = 1 \text{ kg m}^2/\text{s}^2 = 1 \text{ Joule}$