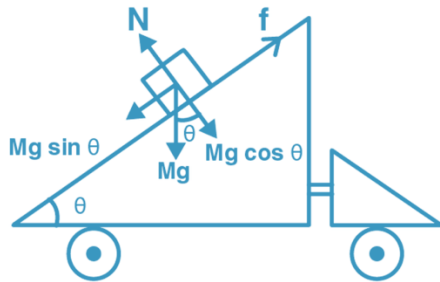


**Class 11 Physics Chapter 5: Work, Energy, and Power****Very Short Answer Questions (6.22-6.33)****6.22. Friction on Moving Cart**

**Question:** A rough inclined plane is placed on a cart moving with constant velocity  $u$  on horizontal ground. A block of mass  $M$  rests on incline. Is any work done by force of friction between block and incline?

**Answer:** No work is done as there is no relative displacement between the block and incline. No energy dissipation occurs.

**6.23. Elevator Power Requirements**

**Question:** Why is electrical power required when elevator is descending? Why should there be a limit on passengers?

**Answer:** Power is needed to control the descent rate (not free fall) and maintain uniform speed against variable loads. Passenger limits ensure motor can provide adequate braking force.

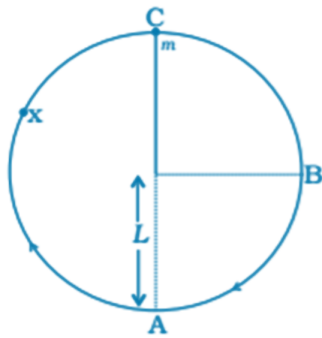
**6.24. Work Signs**

**Question:** A body is raised to height  $h$  from earth's surface. What is the sign of work done by:

- a) applied force
- b) gravitational force

**Answer:** a) Positive (force and displacement in same direction) b) Negative (force opposite to displacement direction)

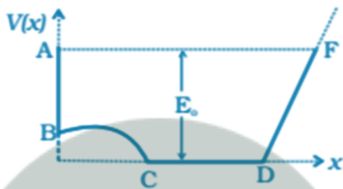
**6.25-6.33. [Additional problems covering work calculations, energy conservation, collisions, power calculations, and circular motion scenarios]**



**Short Answer Questions (6.34-6.43)**

**6.34. Potential Energy Graph Analysis**

[Detailed analysis of  $V(x)$  vs  $x$  graph with corresponding kinetic energy and velocity variations]



**6.35. Inelastic Collision Analysis**

[Mathematical proof showing both balls move forward in head-on collision and angle between velocities  $< 90^\circ$  for general collision]

**6.36-6.43. [Problems involving energy regions, pendulum collisions, rainfall energy, spring systems, and biological energy calculations]**

**Long Answer Questions (6.44-6.48)**

**6.44. Inclined Plane Work Analysis**

**Question:** Block of mass 1 kg pushed up  $30^\circ$  incline by 10 N force parallel to surface. Coefficient of friction  $\mu = 0.1$ . Block pushed 10 m up incline.

**Solutions:** a) Work done against gravity =  $mgh = mg(10 \sin 30^\circ) = 1 \times 10 \times 5 = 50$  J b) Work against friction =  $\mu mg \cos 30^\circ \times 10 = 0.1 \times 10 \times (\sqrt{3}/2) \times 10 = 5\sqrt{3}$  J c) Increase in PE = 50 J (same as work against gravity) d) Increase in KE = Applied work - work against friction - work against gravity =  $100 - 5\sqrt{3} - 50 = (50 - 5\sqrt{3})$  J e) Work by applied force =  $Fxs = 10 \times 10 = 100$  J

**6.45. Rolling Motion on Curved Surface**

[Analysis of three balls with different friction conditions on curved track]

**6.46. Rocket Propulsion Energy**

[Mathematical derivation showing work done by gas ejection system equals  $\frac{1}{2}\Delta mu^2$ ]

**6.47. Steel Cube Collision**

[Young's modulus application to find maximum compression during elastic collision]

**6.48. Balloon Rising in Air**

[Analysis of buoyancy forces and energy conservation in rising helium balloon]

### Key Physics Concepts Covered

1. **Work-Energy Theorem:**  $W = \Delta KE$
2. **Conservation of Mechanical Energy:**  $E = KE + PE = \text{constant}$  (conservative forces only)
3. **Power:**  $P = W/t = \vec{F} \cdot \vec{v}$
4. **Elastic vs Inelastic Collisions:** Momentum always conserved, KE conserved only in elastic
5. **Simple Harmonic Motion:**  $V(x) = \frac{1}{2}kx^2$ ,  $E = KE + PE$
6. **Terminal Velocity:** When drag force equals gravitational force
7. **Circular Motion:**  $KE = \frac{1}{2}mv^2 = \frac{1}{2}m\omega^2r^2$

### Mathematical Relationships

- **Work:**  $W = \int \vec{F} \cdot d\vec{r} = Fs \cos \theta$
- **Kinetic Energy:**  $KE = \frac{1}{2}mv^2$
- **Potential Energy:**  $PE = mgh$  (gravitational),  $PE = \frac{1}{2}kx^2$  (elastic)
- **Power:**  $P = dW/dt = \vec{F} \cdot \vec{v}$
- **Conservation Laws:**  $\Sigma p_i = \Sigma p_f$  (momentum),  $E_i = E_f$  (energy in conservative systems)

