

CHAPTER 5.8 | WORK, ENERGY AND POWER

The Conservation of Mechanical Energy

Proving energy constancy under conservative forces for NEET/JEE.

[Physics]

[Class 11]

[Important Concept]

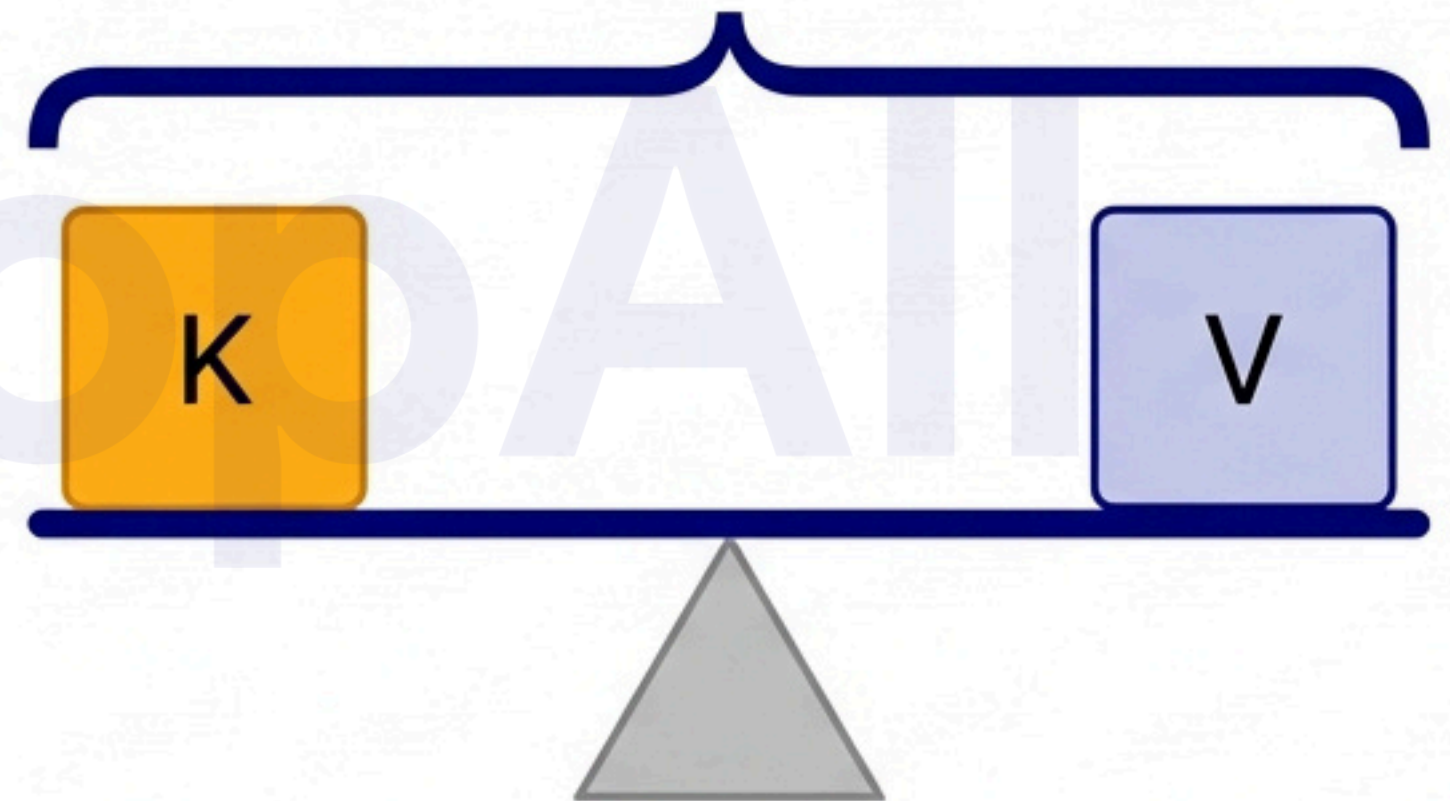
The Fundamental Principle

When only conservative forces (like gravity or ideal spring forces) act on a body, **the sum of its kinetic and potential energies remains constant.**

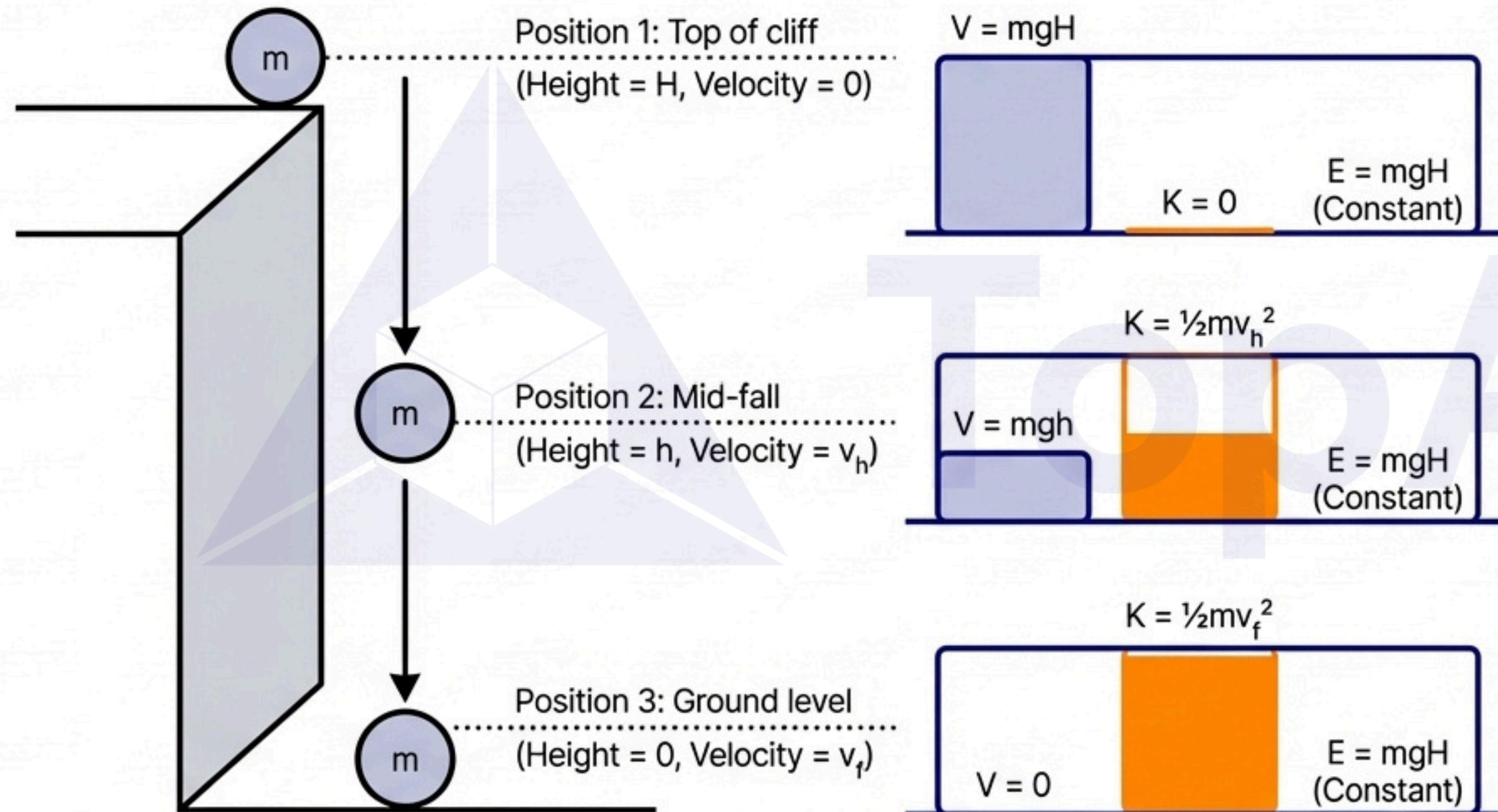
$$\Delta K + \Delta V = 0 \Rightarrow \Delta(K + V) = 0$$

Total Mechanical Energy (E) =
 $K + V(x) = \text{Constant}$

E (Total Constant Energy)



The Falling Body Model



Model Constraints:

- Mass = m
- Upward direction is defined as positive.
- The only force acting is gravity (a conservative force).



**You've Learned the Theory.
Let's Test Them Now.**

$$E=mc^2$$



Turn theory into marks with **unlimited MCQs, smart analysis, and focused revision.**

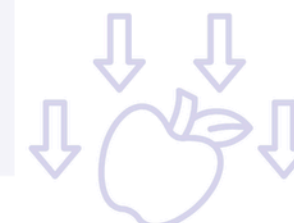
Practice Now



At prep.topall.app

Key Highlights

- » Free Study Material, Videos & Infographics
- » Push Your Limits with Level-Based Challenges
- » Climb the Leaderboard Among Fellow Aspirants
- » Practice Unlimited MCQs for NEET & JEE
- » Get Clear Explanations, Not Just Marks
- » Track Your Performance Smarter



Mathematical Proof of Conservation

Position 1: At Height H

Pure Potential

$$E_H = mgH + 0$$

Position 2: At Height h

Mixed Energy

$$E_h = mgh + \frac{1}{2}mv_h^2$$

Position 3: At Ground 0

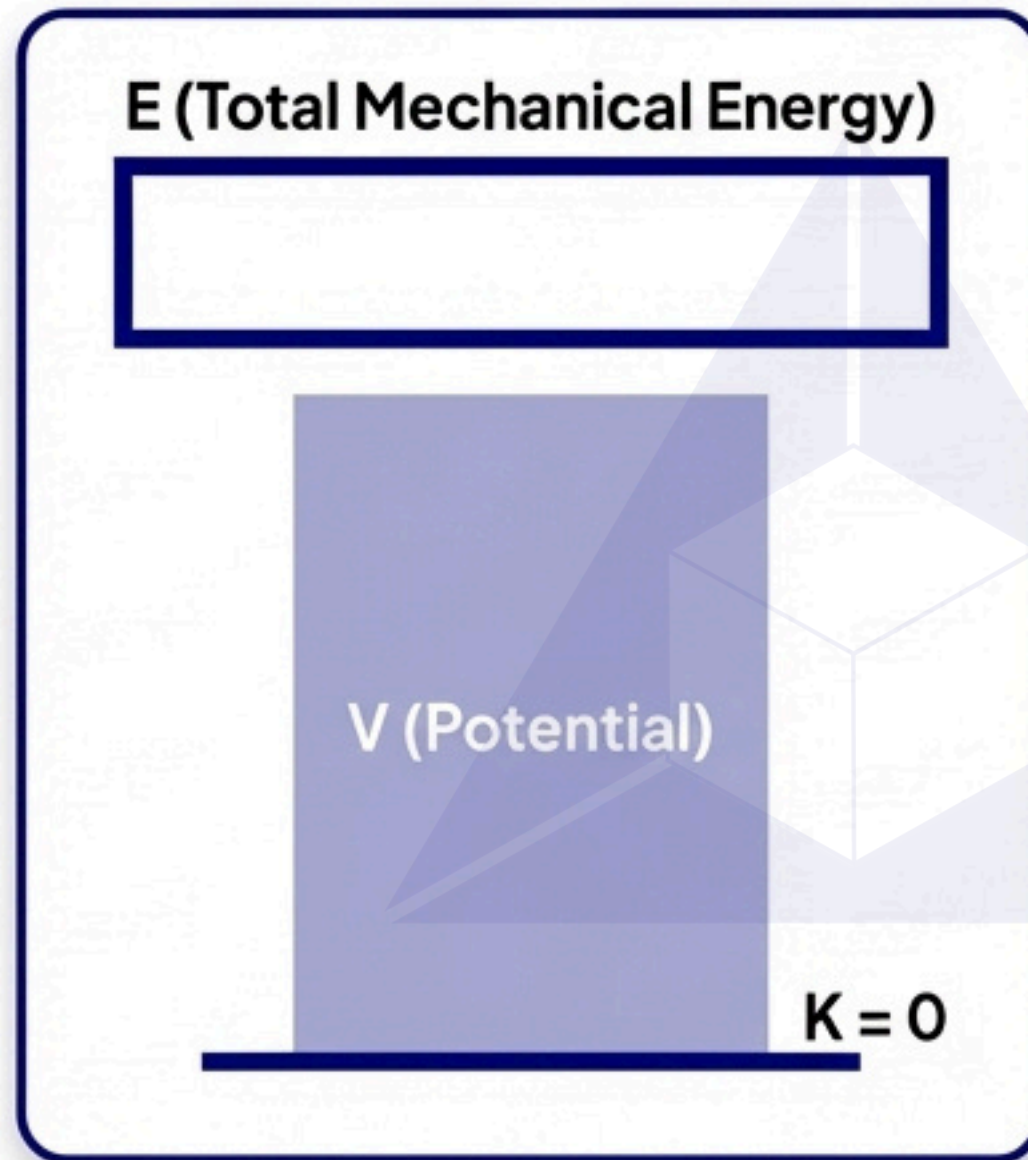
Pure Kinetic

$$E_0 = 0 + \frac{1}{2}mv_f^2$$

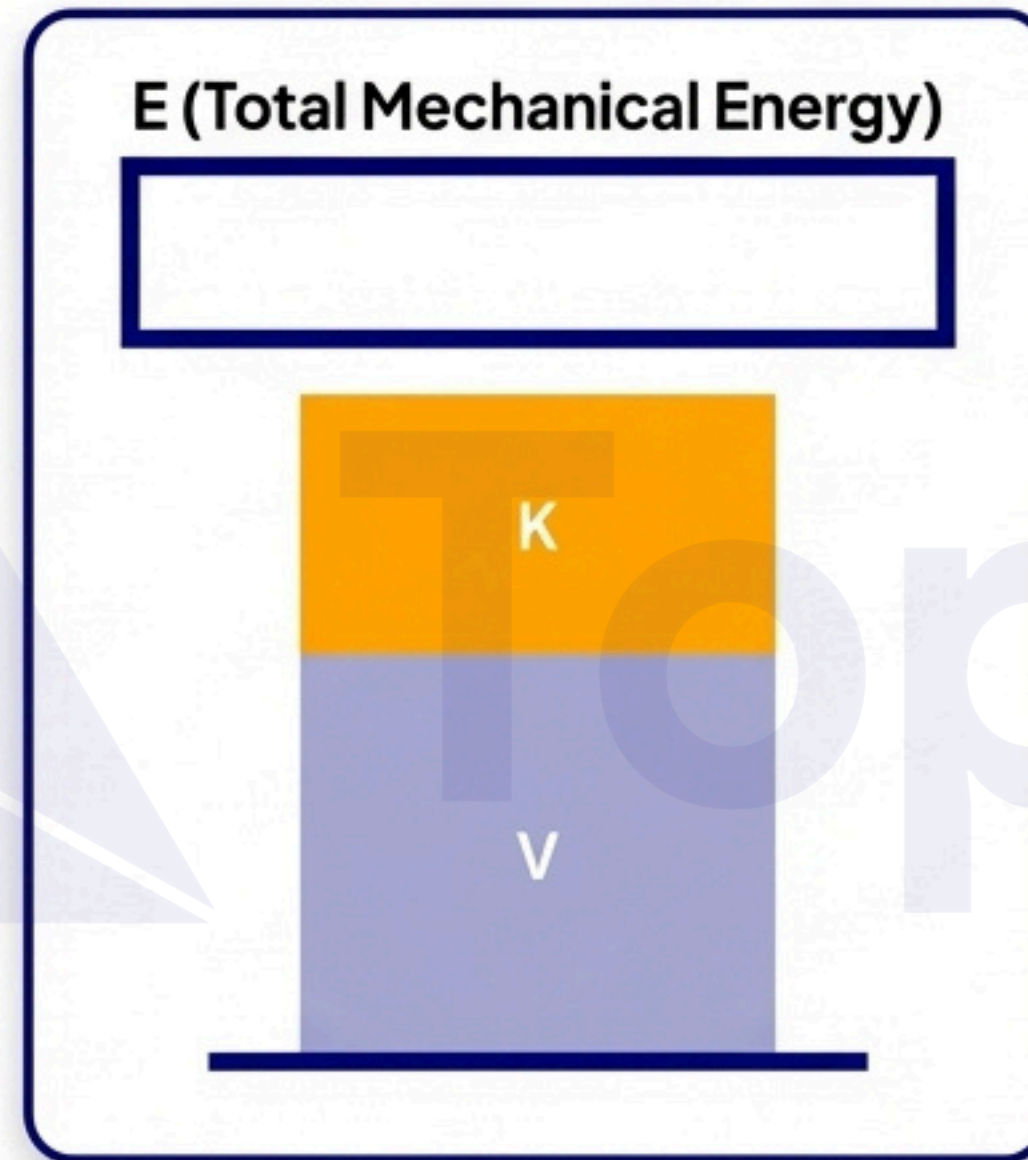
Because gravity is a constant conservative force, the total energy is conserved: $E_H = E_h = E_0$

Energy Transformation in Action

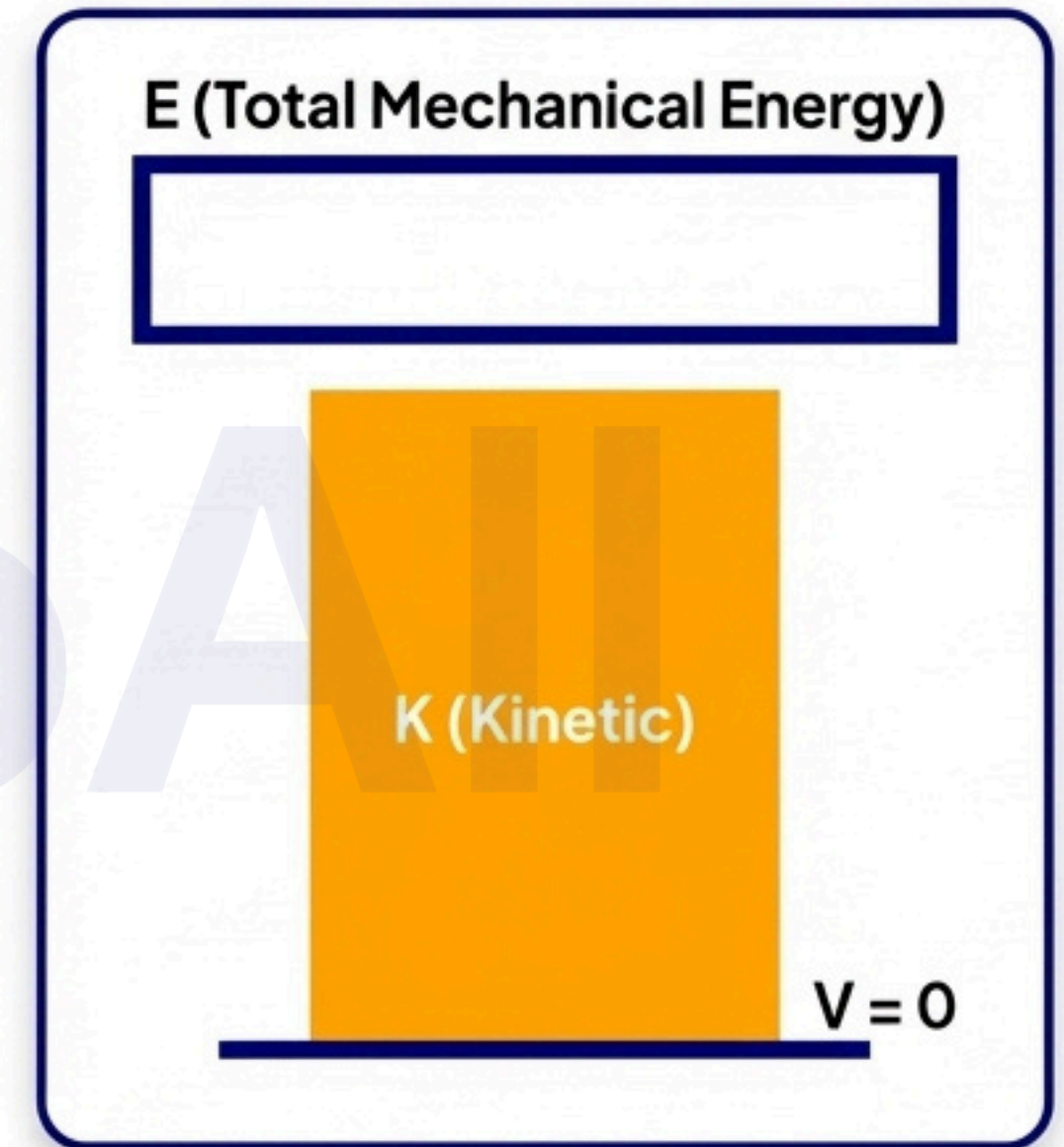
Position 1: Top of Cliff (H)



Position 2: Mid-fall (h)



Position 3: Ground Level (0)



As the ball falls, potential energy is perfectly converted into kinetic energy. The bounding box (E) never changes size.

Key Takeaways for Exams

- ✓ **Constant Total Energy:** $K + V = \text{Constant}$ holds true only if non-conservative forces (like friction or air resistance) are strictly zero.
- ✓ **Path Independence:** The work done by gravity depends only on the initial and final heights, not the trajectory or path taken.
- ✓ **Velocity at Ground:** Equating the top and bottom states ($E_H = E_0$) yields the frequently tested kinematic shortcut: $v_f = \sqrt{2gH}$.
- ✓ **Variable Transformation:** Kinetic energy increases at the exact mathematical rate that potential energy decreases ($\Delta K = -\Delta V$).



You've Learned the Theory.

Now Let's Test It.

Reading notes gets you knowledge.

Practicing MCQs gets you marks.

That's exactly what TopAll Pro is built for.

Try TopAll Pro Now

What TopAll Pro Does Differently

-  **Stuck? Snap it. Solve it. — Doubts AI**
Photo → step-by-step solution in seconds, 24/7
-  **Your AI Coach finds your blind spots**
Concept-level weakness detection — not just chapter-level
-  **4.5 Lakh+ questions. Never run out.**
13× more content than any other prep app in India
-  **Build your own test in 60 seconds**
Pick a chapter, set difficulty — AI does the rest instantly.
-  **AI Recommendation that helps you improve**
AI Recommendation Analysis your Tests and tell you where you need to improve.



Practice the moment you finish studying
Jump in while the concept is still fresh in your head

4.5L+
MCQs

1.5L+
Students

AI Powered
In-Depth Analysis