

Work and Energy Example Problems

Lesson Notes

Learning Outcomes

- How do you use the work-energy relationship to solve problems involving speed, height, and distance?

Physics Formulae:

Kinetic Energy

$$KE = \frac{1}{2} \cdot m \cdot v^2$$

Gravitational Potential Energy

$$PE_{\text{grav}} = m \cdot g \cdot h$$

Work (by non-conservative forces)

$$W_{\text{nc}} = F \cdot d \cdot \cos\theta$$

Work-Energy Relation (external energy transfer)

$$KE_i + PE_i + W_{\text{nc}} = KE_f + PE_f$$

Work-Energy Relation (no external energy transfer)

$$KE_i + PE_i = KE_f + PE_f$$

Problem-Solving Strategy

- Read the problem carefully. Diagram it.
- State the known and unknown values.
- Simplify the work-energy equation based on terms like “starts from rest”, “comes to a stop”, “finishes on the ground”, “moves on a level surface”, “moves with constant speed”.
- Substitute known values into equation.
- Perform necessary algebraic steps to solve for the unknown value.

Use the suggested strategy and formulas to solve the following problems. For best results, watch the video ... then solve the problem independently. Refer to the video only as needed.

Example 1 - How Far?

Vera Side is traveling down a level roadway with a speed of 8.00 m/s. She slams on the brakes and encounters a coefficient of friction of 0.816. What distance does her 925-kg car skid before stopping?

Example 2 - How Fast?

A 54-kg ski jumper starts from rest on top of a 153-m high slope. She experiences 5920 J of negative work due to friction and air resistance on her descent down the *in-run*. How fast is she going when she reaches the 62-m high take-off point?

Example 3 - How Far?

Near the end of a roller coaster ride, a 7210-N force acts upon a 328-kg car to decelerate it from 22.6 m/s to 3.8 m/s along a level section of track. Over what distance does this force act?

Example 4 - How Fast?

A 0.250-kg ball is thrown horizontally off a 23.5-m high cliff with a speed of 32.8 m/s. How fast will it be moving when it hits the ground? Assume negligible air resistance.

Example 5 - How High?

A 0.582-kg ball is thrown upward with a speed of 24.5 m/s. How high will the ball rise above the throwing location? Assume negligible air resistance.

Example 6 - How High?

A bicyclist is coasting (not pedaling) along a country road at 6.5 m/s atop one hill. After coasting into a valley and up a second hill, she is moving at 8.2 m/s. How much higher is the first hill than the second hill? Assume negligible resistance forces.