

What is the Work-Energy Theorem?

Worksheet

The work-energy theorem states that the net work done on an object equals its change in kinetic energy: $W_{\text{net}} = \Delta KE = \frac{1}{2}mv_f^2 - \frac{1}{2}mv_i^2$.

$$W = \frac{1}{2}m(v^2 - v_0^2)$$

Questions

1. A 5 kg object speeds up from 0 to 4 m/s. What is the net work done?
A) 20 J
B) 40 J
C) 10 J
D) 80 J
2. The work-energy theorem relates net work to...
A) Momentum change
B) Kinetic energy change
C) Potential energy change
D) Force change
3. If net work done on an object is negative, the object...
A) Speeds up
B) Slows down
C) Stays at constant speed
D) Reverses mass
4. A 2 kg object moving at 10 m/s comes to rest. How much work was done on it?
A) 100 J
B) 100 J
C) 200 J
D) 200 J
5. A 10 kg object starts at rest and reaches 6 m/s. Find the net work done on it.
6. A 2 kg ball moving at 8 m/s slows to 3 m/s. Find the work done by friction.
7. A constant net force of 20 N pushes a 4 kg crate 5 m, starting from rest. Use $W = Fd$ to verify with the work-energy theorem.
8. Define: What does the work-energy theorem state?
9. Define: Formula for the work-energy theorem?
10. Define: When is work negative?

Answer Key

1. B) $40 \text{ J} - W = 54 \text{ J} - 14 \text{ J} = 40 \text{ J}$.
2. B) Kinetic energy change - $W_{\text{net}} = \Delta KE$ by definition of the theorem.
3. B) Slows down - Negative work removes kinetic energy, so the object slows down.
4. B) $100 \text{ J} - W = 0 \text{ J} - 100 \text{ J} = -100 \text{ J}$ (work done against motion).
5. $W = \frac{1}{2}mv_f^2 - \frac{1}{2}mv_i^2 = 106 \text{ J} - 10 \text{ J} = 96 \text{ J}$
6. $W = \frac{1}{2}mv_f^2 - \frac{1}{2}mv_i^2 = 23 \text{ J} - 68 \text{ J} = -45 \text{ J}$ (friction removes 45 J)
7. $W = Fd = 205 \text{ N} \cdot 0.5 \text{ m} = 102.5 \text{ J}$ $KE = \frac{1}{2}mv_f^2 = 100 \text{ J} = \frac{1}{2} \cdot 4 \text{ kg} \cdot v_f^2 = 2 \text{ kg} \cdot v_f^2 = 100 \text{ J}$ $v_f = 7.07 \text{ m/s}$
8. Net work done on an object equals its change in kinetic energy: $W = \Delta KE$.
9. $W_{\text{net}} = \frac{1}{2}mv_f^2 - \frac{1}{2}mv_i^2$.
10. When the force (like friction) opposes motion, removing kinetic energy.

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