

Concept Items

9.1 Work, Power, and the Work–Energy Theorem 1.

Is it possible for the sum of kinetic energy and potential energy of an object to change without work having been done on the object? Explain.

- a. No, because the work-energy theorem states that work done on an object is equal to the change in kinetic energy, and change in KE requires a change in velocity. It is assumed that mass is constant.
- b. No, because the work-energy theorem states that work done on an object is equal to the sum of kinetic energy, and the change in KE requires a change in displacement. It is assumed that mass is constant.
- c. Yes, because the work-energy theorem states that work done on an object is equal to the change in kinetic energy, and change in KE requires a change in velocity. It is assumed that mass is constant.
- d. Yes, because the work-energy theorem states that work done on an object is equal to the sum of kinetic energy, and the change in KE requires a change in displacement. It is assumed that mass is constant.

2.

Define work for one-dimensional motion.

- a. Work is defined as the ratio of the force over the distance.
- b. Work is defined as the sum of the force and the distance.
- c. Work is defined as the square of the force over the distance.
- d. Work is defined as the product of the force and the distance.

3.

A book with a mass of 0.30 kg falls 2 m from a shelf to the floor. This event is described by the work–energy theorem:

$$W = fd = \frac{1}{2}mv_2^2 - \frac{1}{2}mv_1^2$$

Explain why this is enough information to calculate the speed with which the book hits the floor.

- a. The mass of the book, m , and distance, d , are stated. F is the weight of the book mg . v_1 is the initial velocity and v_2 is the final velocity. The final velocity is the only unknown quantity.
- b. The mass of the book, m , and distance, d , are stated. F is the weight of the book mg . v_1 is the final velocity and v_2 is the initial velocity. The final velocity is the only unknown quantity.
- c. The mass of the book, m , and distance, d , are stated. F is the weight of the book mg . v_1 is the initial velocity and v_2 is the final velocity. The final velocity and the initial velocities are the only unknown quantities.
- d. The mass of the book, m , and distance, d , are stated. F is the weight of the book mg . v_1 is the final velocity and v_2 is the initial velocity. The final velocity and the initial velocities are the only unknown quantities.

9.2 Mechanical Energy and Conservation of Energy 4.

Describe the changes in KE and PE of a person jumping up and down on a trampoline.

- While going up, the person's KE would change to PE. While coming down, the person's PE would change to KE.
- While going up, the person's PE would change to KE. While coming down, the person's KE would change to PE.
- While going up, the person's KE would not change, but while coming down, the person's PE would change to KE.
- While going up, the person's PE would change to KE, but while coming down, the person's KE would not change.

5.

You know the height from which an object is dropped. Which equation could you use to calculate the velocity as the object hits the ground?

- $v = h$
- $v = \sqrt{2h}$
- $v = gh$
- $v = \sqrt{2gh}$

6.

The starting line of a cross country foot race is at the bottom of a hill. Which form(s) of mechanical energy of the runners will change when the starting gun is fired?

- Kinetic energy only
- Potential energy only
- Both kinetic and potential energy
- Neither kinetic nor potential energy

9.3 Simple Machines 7.

How does a simple machine make work easier?

- It reduces the input force and the output force.
- It reduces the input force and increases the output force.
- It increases the input force and reduces the output force.
- It increases the input force and the output force.

8.

Which type of simple machine is a knife?

- A ramp
- A wedge
- A pulley
- A screw