
AP Physics C: Mechanics

Name: _____ Score: _____

1. A 4 kg object moves at $3 \frac{\text{m}}{\text{s}}$. What is its kinetic energy (in J)?
_____ J
2. A 10 N force pushes a box 4 m in the same direction. How much work is done (in J)?
_____ J
3. Lift a 2 kg book 1.5 m ($g = 9.8$). How much gravitational potential energy is stored (in J)?
_____ J
4. A ball is dropped from 2 m (no air resistance, $g = 10$). Its speed at the bottom (in m/s)?
_____ m/s
5. A machine does 600 J of work in 3 s. What is its average power (in W)?
_____ W
6. If a car's speed doubles, its kinetic energy becomes...
 - ☐ four times
 - ☐ the same
 - ☐ double
 - ☐ half
7. You carry a bag horizontally across a room. The work gravity does on the bag is...
 - ☐ large and negative
 - ☐ large and positive
 - ☐ equal to the bag's weight
 - ☐ zero
8. Friction has an associated potential energy, just like gravity.
 - ☐ True ☐ False
9. When friction acts, the mechanical energy $K + U$ stays constant.
 - ☐ True ☐ False
10. A more powerful motor always does more total work than a weaker one.
 - ☐ True ☐ False

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1. **18 J**

$$K = \frac{1}{2}mv^2 = \frac{1}{2}(4)(9) = 18 \text{ J.}$$

2. **40 J**

$$\text{With } \theta = 0, W = Fd \cos 0 = 10 \times 4 \times 1 = 40 \text{ J.}$$

3. **29.4 J**

$$U_g = mgy = 2 \times 9.8 \times 1.5 = 29.4 \text{ J.}$$

4. **6.32 m/s**

$$mgh = \frac{1}{2}mv^2, \text{ so } v = \sqrt{2gh} = \sqrt{2 \times 10 \times 2} = \sqrt{40} \approx 6.32 \frac{\text{m}}{\text{s}}.$$

5. **200 W**

$$P = W/t = 600/3 = 200 \text{ W.}$$

6. **four times**

$$K \propto v^2, \text{ so doubling } v \text{ multiplies } K \text{ by } 2^2 = 4.$$

7. **zero**

Gravity points down, motion is horizontal – perpendicular, so $\cos 90^\circ = 0$ and the work is zero.

8. **False**

Only conservative forces have potential energy. Friction dissipates energy as heat – it cannot be stored.

9. **False**

Friction is nonconservative – it drains mechanical energy into heat, so $K + U$ decreases.

10. **False**

Power is a *rate*. Two motors can do identical total work; the more powerful one just finishes faster.