

3. Work, Energy, and Power

Starter Quiz · 课前小测

AP Physics 1

Name: _____ Score: _____

1. What is the kinetic energy of a 2 kg ball moving at $3 \frac{\text{m}}{\text{s}}$, in joules?
_____ J
2. A rope pulls a sled 5 m with 20 N at 60° ($\cos 60^\circ = 0.5$). How much work is done, in joules?
_____ J
3. Lift a 2 kg book to a 1.5 m shelf ($g = 9.8 \frac{\text{N}}{\text{kg}}$). How much gravitational PE is stored, in joules?
_____ J
4. A ball is dropped from rest at 5 m ($g = 10 \frac{\text{m}}{\text{s}^2}$, no air resistance). What is its speed at the bottom, in $\frac{\text{m}}{\text{s}}$?
_____ m/s
5. A motor does 600 J of work in 3 s. What is its power, in watts?
_____ W
6. If a car doubles its speed, its kinetic energy becomes:
☐ twice as large
☐ four times as large
☐ the same
☐ half as large
7. A force acts at 90° to an object's motion. How much work does it do?
☐ the maximum possible
☐ half the force times distance
☐ zero
☐ a negative amount
8. Gravitational potential energy mgh increases when you increase which of these?
☐ the mass m
☐ the height h
☐ the gravitational field strength g
☐ the object's colour

Tick every correct option.

9. Mechanical energy is the sum of kinetic energy and _____ energy.

10. What is the SI unit of power?

- ☐ joule
☐ newton
☐ watt
☐ pascal

AP Physics 1

1. **9 J**

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

2. **50 J**

$$W = Fd \cos \theta = 20 \times 5 \times 0.5 = 50 \text{ J}.$$

3. **29.4 J**

$$E_p = mgh = 2 \times 9.8 \times 1.5 = 29.4 \text{ J}.$$

4. **10 m/s**

$$mgh = \frac{1}{2}mv^2 \Rightarrow v = \sqrt{2gh} = \sqrt{2 \times 10 \times 5} = 10 \frac{\text{m}}{\text{s}}.$$

5. **200 W**

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

6. **four times as large**

$$E_k \propto v^2, \text{ so doubling } v \text{ gives } 2^2 = 4 \text{ times the kinetic energy.}$$

7. **zero**

$$\cos 90^\circ = 0, \text{ so } W = Fd \cos 90^\circ = 0. \text{ A perpendicular force does no work.}$$

8. **the mass m ; the height h ; the gravitational field strength g**

$$E_p = mgh \text{ grows with mass, height and } g. \text{ Colour is irrelevant.}$$

9. **potential**

$$\text{Mechanical energy} = E_k + E_p \text{ — kinetic plus } \mathbf{potential}.$$

10. **watt**

$$\text{Power is measured in } \mathbf{watts}, \text{ where } 1 \text{ W} = 1 \frac{\text{J}}{\text{s}}.$$