

AP Physics 1

Name: _____ Score: _____

1. A spring has $k = 50 \frac{\text{N}}{\text{m}}$. What is the size of the restoring force at a displacement of 0.2 m, in N?
_____ N
2. An oscillator has a period of 0.25 s. What is its frequency, in Hz?
_____ Hz
3. An oscillator is $x(t) = 0.1 \cos(4t)$ (metres). What is its position at $t = 0$, in metres?
_____ m
4. A spring with $k = 200 \frac{\text{N}}{\text{m}}$ oscillates with amplitude 0.1 m. What is the total energy, in joules?
_____ J
5. What defines simple harmonic motion?
 - ☐ a restoring force proportional to displacement
 - ☐ a force that grows with speed
 - ☐ no force at all
 - ☐ a constant force
6. For SHM, swinging with a larger amplitude makes the period longer.
 - ☐ True ☐ False
7. Where is an SHM oscillator moving fastest?
 - ☐ at the equilibrium (middle)
 - ☐ everywhere the same
 - ☐ it never moves
 - ☐ at the extremes (turning points)
8. Where in the swing is all the energy kinetic?
 - ☐ everywhere equally
 - ☐ at the extremes
 - ☐ at the middle (equilibrium)
 - ☐ nowhere
9. In $F = -kx$, the minus sign means the force points _____ toward equilibrium.

10. The period of a simple pendulum depends on:

- ☐ its length and g
- ☐ the amplitude only
- ☐ the colour of the string
- ☐ the mass of the bob

AP Physics 11. **10 N**

$|F| = kx = 50 \times 0.2 = 10 \text{ N}$, pointing back toward equilibrium.

2. **4 Hz**

$f = 1/T = 1/0.25 = 4 \text{ Hz}$.

3. **0.1 m**

$x(0) = 0.1 \cos 0 = 0.1 \text{ m}$ – the maximum displacement (amplitude).

4. **1 J**

$E = \frac{1}{2}kA^2 = \frac{1}{2}(200)(0.01) = 1 \text{ J}$.

5. **a restoring force proportional to displacement**

SHM needs $F = -kx$: a restoring force proportional to displacement, pointing back to equilibrium.

6. **False**

The period of SHM is independent of amplitude – a wider swing is also faster, so the time is unchanged.

7. **at the equilibrium (middle)**

Speed is greatest at the middle, where the acceleration (and force) is zero.

8. **at the middle (equilibrium)**

At the middle the speed is greatest and $x = 0$, so all the energy is kinetic.

9. **back**

The force always opposes the displacement – it points **back** toward the middle.

10. **its length and g**

$T = 2\pi\sqrt{L/g}$ – only length and gravity, not the bob's mass.