

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 constant force
  - ☐ a restoring force proportional to displacement
  - ☐ no force at all
  - ☐ a force that grows with speed
6. For SHM, swinging with a larger amplitude makes the period longer.
  - ☐ True      ☐ False
7. Where is an SHM oscillator moving fastest?
  - ☐ at the extremes (turning points)
  - ☐ at the equilibrium (middle)
  - ☐ everywhere the same
  - ☐ it never moves
8. Where in the swing is all the energy kinetic?
  - ☐ at the extremes
  - ☐ at the middle (equilibrium)
  - ☐ nowhere
  - ☐ everywhere equally
9. In  $F = -kx$ , the minus sign means the force points \_\_\_\_\_ toward equilibrium.  
\_\_\_\_\_

10. The period of a simple pendulum depends on:

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

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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.