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.

   _____

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   ☐ its length and g

   ☐ the colour of the string

   ☐ the mass of the bob

   ☐ the amplitude only

1. **10 N**

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

2. **4 Hz**

   $f = 1/T = 1/0.25 = 4$ Hz.

3. **0.1 m**

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

4. **1 J**

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

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