

Solutions

Each answer shows the steps, then the **result**.

2.1

- Hooke's law (size of the force):

$$|F| = kx = (20 \text{ N m}^{-1})(0.15 \text{ m})$$

- $|F| = \mathbf{3 \text{ N}}$

2.2

- The force opposes the displacement (points back to equilibrium)

2.3

- in SHM, $a = -\omega^2 x$:

$$|a| = \omega^2 x = (25 \text{ s}^{-2})(0.2 \text{ m})$$

- $|a| = \mathbf{5 \text{ m s}^{-2}}$

2.4

- At the extremes (largest x)

3.1 B

- proportional to displacement and opposite in direction

3.2 B

- at equilibrium, $x = 0$ so $a = 0$

3.3

(a)

- Hooke's law, taking the pull direction as positive:

$$F = -kx = -(8 \text{ N m}^{-1})(0.1 \text{ m})$$

- $F = -0.8 \text{ N}$: size **0.8 N**, back towards equilibrium

(b)

- Newton's second law with the restoring force:

$$a = \frac{F}{m} = \frac{-0.8 \text{ N}}{0.5 \text{ kg}}$$

- $a = -1.6 \text{ m s}^{-2}$: size **1.6 m s⁻²**, towards equilibrium

3.4

(a)

- Yes (approximately)

(b)

- Small angles (roughly under 15°)