

Solutions

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

2.1

- $T = \frac{30 \times 0.2}{1} = 6 \text{ N}$

2.2

- $E = \frac{30 \times 0.2^2}{2 \times 1} = 0.6 \text{ J}$

3.1 B

- $E \propto x^2$, so doubling x multiplies E by 4

3.2

(a)

- equilibrium $T = mg = 20 \text{ N}$; $\frac{60x}{1.5} = 20 \Rightarrow 40x = 20 \Rightarrow x = 0.5 \text{ m}$

(b)

- $E = \frac{60 \times 0.5^2}{2 \times 1.5} = \frac{15}{3} = 5 \text{ J}$

3.3

- the particle falls $2 + 0.5 = 2.5 \text{ m}$ to reach extension 0.5 m ; energy: $mg(2.5) = \frac{1}{2}mv^2 + \frac{\lambda x^2}{2L}$; $0.5(10)(2.5) = \frac{1}{2}(0.5)v^2 + \frac{40(0.25)}{2(2)}$; $12.5 = 0.25v^2 + 2.5 \Rightarrow v^2 = 40$; $v = 6.32 \text{ m s}^{-1}$