

Solutions

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

2.1

- gravitational potential energy:

$$U = mgh = (5 \text{ kg})(10 \text{ m s}^{-2})(4 \text{ m})$$

- $U = \mathbf{200 \text{ J}}$

2.2

- elastic potential energy:

$$U = \frac{1}{2}kx^2 = \frac{1}{2}(200 \text{ N m}^{-1})(0.2 \text{ m})^2$$

- $U = \mathbf{4 \text{ J}}$

2.3

- Gravitational potential energy

2.4

- the change depends only on the rise in height:

$$\Delta U = mg(h_2 - h_1) = (3 \text{ kg})(10 \text{ m s}^{-2})(4 \text{ m} - 1 \text{ m})$$

- $\Delta U = \mathbf{90 \text{ J}}$

3.1 B

- $U = mgh$

3.2 B

- $U \propto x^2$, so doubling gives $2^2 = 4$

3.3

(a)

- elastic potential energy:

$$U = \frac{1}{2}kx^2 = \frac{1}{2}(500 \text{ N m}^{-1})(0.06 \text{ m})^2$$

- $U = \mathbf{0.9 \text{ J}}$

(b)

- It converts into the block's kinetic energy

3.4

(a)

- gravitational potential energy gained:

$$\Delta U = mg\Delta h = (10 \text{ kg})(9.8 \text{ m s}^{-2})(2.5 \text{ m})$$

- $\Delta U = \mathbf{245 \text{ J}}$

(b)

- lifting at steady speed, the work done equals the gain in PE: **245 J**