Solutions

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

2.1

- kinetic energy:
$$K = \tfrac{1}{2}mv^2 = \tfrac{1}{2}(2\text{ kg})(5\text{ m s}^{-1})^2$$
- $K = \mathbf{25}$ J

2.2

- Four times (speed is squared)

2.3

- $K = \frac{1}{2}mv^2$, rearranged for v:
$$v = \sqrt{\frac{2K}{m}} = \sqrt{\frac{2(12\text{ J})}{6\text{ kg}}}$$
- $v = \mathbf{2}$ m s^{-1}

2.4

- No – mass and v^2 are never negative, so $K \geq 0$

3.1 B

- $K = \frac{1}{2}mv^2$

3.2 C

- $K \propto v^2$, so $3^2 = 9$

3.3

(a)

- kinetic energy:
$$K = \tfrac{1}{2}mv^2 = \tfrac{1}{2}(1500\text{ kg})(20\text{ m s}^{-1})^2$$
- $K = \mathbf{3.0 \times 10^5}$ J

(b)

- $K \propto v^2$ and the speed doubles, so K is four times larger:
$$K' = 4 \times (3.0 \times 10^5\text{ J}) = \mathbf{1.2 \times 10^6}\text{ J}$$

3.4

(a)

- $K = \frac{1}{2}mv^2$, rearranged for v:
$$v = \sqrt{\frac{2K}{m}} = \sqrt{\frac{2(10\text{ J})}{0.2\text{ kg}}}$$
- $v = \mathbf{10}$ m s^{-1}

(b)

- No – K is a scalar, independent of direction