



ANSWER BOOK

Work, energy and power

Mechanics · Year 12

AQA 3.4.1.7 · CIE 5.1 · OCR A 3.3.1, 3.3.3

10 questions · 29 marks

NAVY EDITION

SECTION A · Warm-up

- A1** $W = Fs = 20 \times 3.0 = 60 \text{ J}$. [2]
- A2** Power is the rate of doing work (or transferring energy): $P = \text{work done} / \text{time taken}$. [2]
Unit: the watt (W), equal to one joule per second.
- A3** Kinetic energy = $\frac{1}{2}mv^2$; change in gravitational potential energy = $mg\Delta h$. [2]

SECTION B · Standard

- B1** $W = Fs \cos\theta = 50 \times 4.0 \times \cos 30^\circ = 173.2 \text{ J}$. [3]
- B2** (a) $KE = \frac{1}{2} \times 2.0 \times 6.0^2 = 36 \text{ J}$. (b) Work done against the force removes this energy: $s = KE/F = 36/12 = 3.0 \text{ m}$. [4]
- B3** $P = mg\Delta h/t = (20 \times 9.81 \times 5.0)/4.0 = 245.25 \text{ W}$. [3]
- B4** Efficiency = useful output / input = $600/800 = 0.75$, or 75%. [2]

SECTION C · Stretch

- C1** $P = Fv$, so $F = P/v = 40000/25 = 1600 \text{ N}$. [3]
- C2** Height gained = $4.0 \sin 30^\circ = 2.0 \text{ m}$. (a) $\Delta GPE = mg\Delta h = 10 \times 9.81 \times 2.0 = 196.2 \text{ J}$. (b) $W_{\text{friction}} = 15 \times 4.0 = 60 \text{ J}$. (c) Total work = 256.2 J over 4.0 m , so $F = 256.2/4.0 = 64.05 \text{ N}$. [5]
- C3** Some input energy is always transferred to unwanted forms, mainly heat from friction and air resistance, and sound. This energy is dissipated to the surroundings, so the useful output is always less than the input. [3]