

Exercise walk-through

5.2

Work done and energy transfer (4.5.2)

AQA · GCSE · Physics

Exercises 2.1·2.2

2.1 A box is dragged 8.0 m by a 60 N force along its direction. Calculate the work done. [2]

2.2 A 50 N force does 350 J of work. Calculate the distance moved along its line of action. [2]

Exercises 2.1·2.2

2.1 A box is dragged 8.0 m by a 60 N force along its direction. Calculate the work done.[2]

2.1

$$W = Fs = 60 \times 8.0 = \mathbf{480 \text{ J}}$$

(substitution 1, answer with unit 1)

2.2 A 50 N force does 350 J of work. Calculate the distance moved along its line of action. [2]

2.2 Rearrange first: $s = W/F$ (C1).

$$s = \frac{350}{50} = \mathbf{7.0 \text{ m}}$$

Exercise 2.3

2.3 State what happens to the energy when work is done against friction, and give the units equivalence for one joule. [2]

3 Exam-style questions

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2.3 The object's (and surface's) temperature rises – energy transfers to thermal stores; $1 \text{ J} = 1 \text{ N} \cdot \text{m}$.

Exercise 3.1

3.1 A child pulls a toy car 4.5 m across a carpet with a horizontal force of 2.0 N.

(a) Calculate the work done by the child. [3]

(b) The same pull on a smooth floor moves the car the same distance faster. Explain what changes about the energy transfers. [2]

(c) The child then pushes with 2.0 N at right angles to the car's motion while it coasts 4.5 m. Explain why this force does no work on the car. [2]

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3.1 (a) Force parallel to the motion.

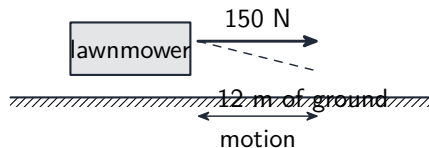
$$W = Fs = 2.0 \times 4.5 = \mathbf{9.0 \text{ J}}$$

(C1 substitution, A1 answer, A1 unit) (b) The same work is done in less time, so the useful energy arrives faster – more power (and on carpet more of it went to friction and thermal stores of the carpet and wheels). (c) The force is at right angles to the displacement, and s must be along the line of action of the force – there is no component of this force along the motion, so no work is done on the car by it.

Exercise 3.2

3.2 A gardener pushes a lawnmower with a force of 150 N at an angle along a 12 m stretch (the force's component along the motion is 120 N).

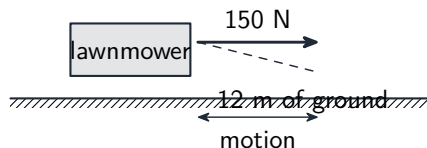
- (a) Explain which distance enters $W = Fs$ here. [1]
- (b) Calculate the work done by the 150 N force along the 12 m stretch. [2]
- (c) Over the 12 m the frictional force totals 100 N opposing the motion. Calculate the work done against friction and the final thermal transfer. [3]



Exercise 3.2

3.2 A gardener pushes a lawnmower with a force of 150 N at an angle along a 12 m stretch (the force's component along the motion is 120 N).

- Explain which distance enters $W = Fs$ here. [1]
- Calculate the work done by the 150 N force along the 12 m stretch. [2]
- Over the 12 m the frictional force totals 100 N opposing the motion. Calculate the work done against friction and the final thermal transfer. [3]



- 3.2** (a) Only the component of the force along the motion counts: use 120 N over 12 m.
 (b)

$$W = F_s s = 120 \times 12 = \mathbf{1440 \text{ J}}$$

(C1, A1) (c) Work against friction = $100 \times 12 = \mathbf{1200 \text{ J}}$ (C1); this energy transfers to the thermal stores of the blade, grass and surroundings – their temperature rises; the remaining 240 J of the input went to other transfers (e.g. kinetic/gravity along uneven ground).