

GCSE Combined Science: Trilogy

Worksheet: Work done and energy transfer

TIME 35 min	TOTAL 31 marks	CALCULATOR Allowed	DIFFICULTY Easy, Medium
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Topics: Work done and energy transfer

NAME	CLASS	DATE
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- Use black ink or black ball-point pen. Pencil should only be used for drawing.
- Answer all questions in the spaces provided.
- In all calculations, show clearly how you work out your answer.
- The marks for questions are shown in brackets.

01

01.1

A removal worker pushes a box 6.0 m along a corridor with a horizontal force of 150 N.

Calculate the work done by the worker.

Use the equation:

work done = force × distance

Work done = J

[2 marks]

01.2

Which unit is equivalent to the joule?

Tick (✓) **one** box.

N/m	☐
N m	☐
N/m ²	☐
kg m/s	☐

[1 mark]

0 1 . 3

Friction acts between the box and the floor.
What happens to the temperature of the box and the floor as the box is pushed?

.....

.....

.....

.....

[1 mark]

0 1 . 4

Complete the sentence.
When a force causes an object to move through a distance, is done on the object.

.....

.....

.....

.....

[1 mark]

0 2

0 2 . 1

Which of these is the correct unit for work done?

Tick (✓) **one** box.

Newton

Joule

Watt

Pascal

☐

☐

☐

☐

[1 mark]

0 2 . 2

A force acts on an object. In which **two** of these situations does the force do no work on the object?

Tick (✓) **two** boxes.

The object does not move

☐

The object moves in the same direction as the force

☐

The object moves at right angles to the direction of the force

☐

The object moves in the opposite direction to the force

☐

[2 marks]

0 2 . 3

Write down the equation that links distance moved along the line of action of the force (s), force (F) and work done (W).

.....

.....

[1 mark]

0 3

A shopper pushes a shopping trolley 28 m across a level car park, using a constant horizontal force of 60 N.

0 3 . 1

Calculate the work done by the shopper.

Use the equation:

work done = force $\times$ distance

.....

.....

.....

.....

Work done = J

[2 marks]

0 4

A cyclist does 72 kJ of work to travel 1.6 km along a level road at a steady speed.

0 4 . 1

Write down the equation that links distance (s), force (F) and work done (W).

.....

.....

[1 mark]

0 4 . 2

Calculate the average driving force.

.....

.....

.....

.....

.....

Force = N

[3 marks]

0 4 . 3

Give the work done by the cyclist in newton-metres.

.....

.....

.....

Work done = N m

[1 mark]

0 4 . 4

The driving force is equal to the resistive forces acting on the bicycle.

Explain what happens to the energy transferred by the work done against the resistive forces.

[2 marks]

0 5

A student of mass 90 kg climbs a flight of stairs of vertical height 11 m at a steady speed.
gravitational field strength = 9.8 N/kg

0 5 . 1

Calculate the work done by the student against gravity.

Work done = J

[3 marks]

0 6

A weightlifter lifts a barbell of mass 140 kg from the floor to a height of 2.1 m above the floor.
gravitational field strength = 9.8 N/kg

0 6 . 1

Calculate the work done on the barbell.

.....

.....

.....

.....

.....

Work done = J

[3 marks]

0 6 . 2

The weightlifter then holds the barbell stationary above their head for 3.0 s.
How much work is done on the barbell during this time? Give a reason for your answer.

.....

.....

.....

.....

[2 marks]

0 6 . 3

The lift took 1.4 s.
Calculate the average useful power output of the weightlifter during the lift.

.....

.....

.....

.....

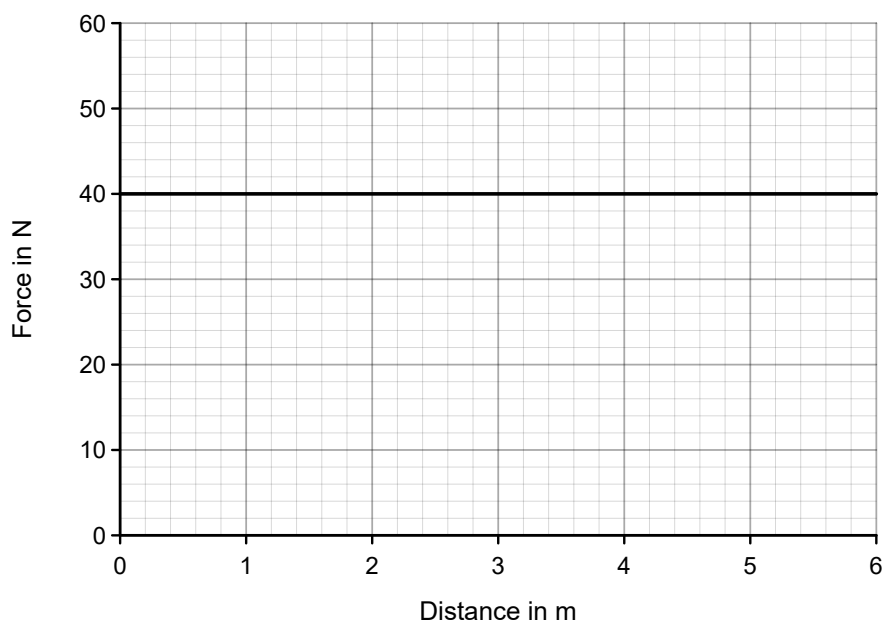
Power = W

[2 marks]

0 7

A student pushes a shopping trolley along a level floor. Figure 1 shows the horizontal force exerted by the student against the distance the trolley moves.

Figure 1



0 7 . 1

Use Figure 1 to determine the work done in pushing the trolley 6.0 m.

.....

.....

.....

.....

Work done = J

[2 marks]

0 7 . 2

Explain why the area under a force–distance graph represents the work done.

.....

.....

[1 mark]

END OF QUESTIONS

Original practice questions written to match the specification. Not produced by, affiliated with or endorsed by AQA.

Mark scheme

GCSE Combined Science: Trilogy · Worksheet: Work done and energy transfer · 31 marks

Question 1 (5 marks)

01.1 [2 marks]

Answer: 900 J

- $W = 150 \times 6.0$ (1)
 - 900 (J) (1)
-

01.2 [1 mark]

Correct: N m

01.3 [1 mark]

Answer: It increases.

- it increases / they get warmer (1)
-

01.4 [1 mark]

Answer: work

- work (1)
-

Question 2 (4 marks)

02.1 [1 mark]

Correct: Joule

02.2 [2 marks]

Correct: The object does not move; The object moves at right angles to the direction of the force

02.3 [1 mark]

Answer: $W = F s$

- $W = F s$ (1)

Notes: Allow work done = force $\times$ distance, or any correct rearrangement.

Question 3 (2 marks)

03.1 [2 marks]

Answer: 1680 J

- $W = 60 \times 28$ (1)
 - 1680 (J) (1)
-

Question 4 (7 marks)

04.1 [1 mark]

Answer: $W = F s$

- $W = F s$ / work done = force $\times$ distance (1)
-

04.2 [3 marks]

Answer: 45 N

- 72 kJ = 72 000 J and 1.6 km = 1600 m (1)
 - $72\,000 = F \times 1600$ (1)
 - $F = 45$ (N) (1)
-

Notes: An answer of 45 scores 3 marks. An answer of 0.045 or 45 000 scores 2 marks.

04.3 [1 mark]

Answer: 72 000 N m

- 72 000 (N m) (1)
-

04.4 [2 marks]

Answer: It is dissipated to the thermal energy stores of the surroundings, which warm up slightly.

- it is transferred to the thermal energy store / internal energy of the surroundings (the air, the tyres and the road) (1)
 - the energy is dissipated / wasted, causing a small rise in temperature (1)
-

Question 5 (3 marks)

05.1 [3 marks]

Answer: 9702 J

- weight = $90 \times 9.8 = 882$ (N) (1)
 - $W = 882 \times 11$ (1)
 - 9702 (J) (1)
-

Question 6 (7 marks)

06.1 [3 marks]

Answer: 2900 J (2881 J)

- $\text{weight} = 140 \times 9.8 = 1372 \text{ (N)}$ (1)
- $W = 1372 \times 2.1$ (1)
- 2881 (J) (1)

Notes: Allow 2880 J or 2900 J.

06.2 [2 marks]

Answer: No work, because the barbell does not move.

- zero / no work (is done on the barbell) (1)
 - the barbell does not move / there is no distance moved in the direction of the force (1)
-

06.3 [2 marks]

Answer: 2100 W (2058 W)

- $P = 2881 \div 1.4$ (1)
- 2058 (W) (1)

Notes: Allow ECF from the first part. Allow 2060 W or 2100 W.

Question 7 (3 marks)

07.1 [2 marks]

Answer: 240 J

- $\text{area under the graph} = 40 \times 6.0$ (1)
 - 240 (J) (1)
-

07.2 [1 mark]

Answer: $\text{Area} = \text{height} \times \text{width} = \text{force} \times \text{distance} = \text{work done}$.

- $\text{work done} = \text{force} \times \text{distance}$, which is the same calculation as finding the area of a rectangle ($\text{height} \times \text{width}$) under the graph (1)
-