

Forces, Work, Energy, Power

Name

1. A cyclist accelerates from a set of traffic lights.

The driving force of the cyclist is 250 N forwards.

(a) How much work is done by this force when the cyclist travels 5 metres?
(Show your working.)

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Answer joules (J)

(2)

(b) What happens to the energy transferred by this force?

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(2)

(c) It takes the cyclist 6 seconds to travel the 5 metres. Calculate the power of the cyclist.

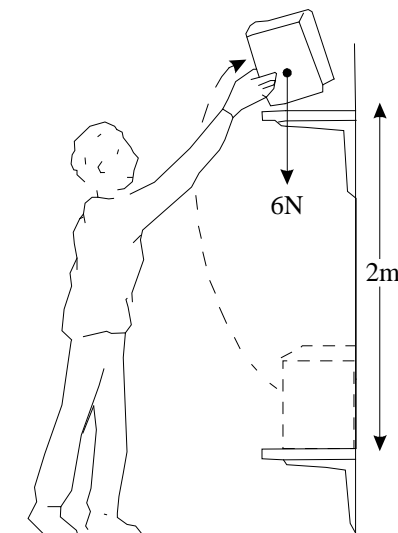
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(2)

(Total 6 marks)

2. A book weighs 6 newtons.

A librarian picks up the book from one shelf and puts it on a shelf 2 metres higher.



(a) Calculate the work done on the book. [Show your working].

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(3)

(b) A robot lifts another book of the same weight. The robot has a power output of 5W. How long does it take for the robot to lift the book 2m?

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(2)

(c) The next person to take the book from the shelf accidentally drops it.

The book accelerates at 9.8m/s^2 .

Use this information to calculate the mass of the book. [Show your working].

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Answer kg.

(3)

(d) If the book was dropped from an aeroplane high in the sky, it would accelerate to begin with. Eventually it would fall at a steady speed.

Explain in detail why this happens.

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(3)

(Total 11 marks)

3. A car is stationary at red traffic lights on a long straight road. The lights turn green and the car accelerates. The car then travels at a constant speed of 30mph, then slows down and stops at another red traffic light.

(a) Sketch a speed-time graph for the motion described above.

(3)

(b) What does the area under the graph represent?

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(1)

(c) During the motion described above, the car transfers a total of 600kJ of chemical energy by burning petrol. At the end of the motion, when the car is stationary at the second set of traffic lights, where has all this energy gone?

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(2)

(d) The car drives along a motorway, and the engine's power output is 40kW. If the fuel tank has 432MJ of energy in it, how long can the car drive for before it runs out of fuel?

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(3)

(Total 9 marks)

4. A crane lifts a pallet of mass 800 kg at a constant speed.

a) Calculate the force from the crane needed to lift the pallet at a constant speed. Use $g = 9.81 \text{ N/kg}$.

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(1)

b) The pallet is lifted 54 m. Calculate how much work is done by the crane.

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(1)

c) The crane has a power output of 6,000 W. Calculate how long it would take to lift the pallet 54 m.

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(2)

5. A car of mass 1200 kg accelerates from rest to 30 m/s over a distance of 150 m.

The driving force from the engine is 4800N.

a) Calculate how much work is done by the driving force.

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(2)

b) Calculate how much kinetic energy has been gained by the car.

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(2)

c) Explain any difference between a) and b).

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(2)

d) Calculate the engine's power output.

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(2)