

## Power

Name & Set

**Work = Force x distance**

**Power = Work/time**

1 (a) How much work is done in lifting an object that weighs 250 N to a height of 4 m?

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[2]

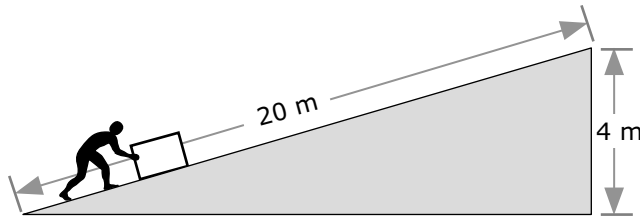
(b) At what rate is work done if the 250 N object is lifted to a height of 4 m in 4 s?

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[2]

2 A block of stone weighs 500 newtons. It is 20 m pushed up a slope as shown in the diagram.



(a) Neglecting friction, how much force is needed to push it up the incline at constant velocity?

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[1]

(b) (i) How much work is done to push it up the incline?

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[2]

(ii) how much work is done in lifting the block vertically 4 m?

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[2]

(ii) Which method for raising the stone is best if no machinery is available? Explain your answer.

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[3]

3 What is the power output of an engine that does 60 000 J of work in 10 s?

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[2]

4 Someone takes 11 minutes to walk up a hill 120 metres high. His weight is 550 N.

(a) How much work does he do in climbing the hill?

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[2]

(b) How many seconds does he take to climb the hill?

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[1]

(c) What power is developed by his muscles as he climbs?

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[2]

(d) If he runs up the hill his muscles can develop 500 Watts. How long will it take him to get to the top of the hill?

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[2]

5 An model electric motor is supplied with 3 joules of electrical energy. It raises a weight of 2 N through a distance of 0.6 metres in 5 seconds.

(a) How much work does the motor do on the weight in raising it through 0.6 m?

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[2]

(b) What is the efficiency of the motor?

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[2]

(c) What is the power output of the motor?

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[2]

(d) Explain why the amount of energy supplied to the motor is greater than the work done on the weight.

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[2]

6 An electric motor is 75 % efficient. It is used to raise a weight of 1000 N a vertical distance of 5 metres in 10 seconds.

(a) How much work must the motor do in raising the weight?

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(b) What is the power developed by the motor as it raises the weight?

\_\_\_\_\_ [2]

(c) Given its efficiency, at what rate must power be supplied to the motor.

\_\_\_\_\_ [2]

(d) What happens to the energy used to raise the weight?

\_\_\_\_\_ [2]

(e) What happens to the energy that is not used to raise the weight?

\_\_\_\_\_ [2]

7 The escalator at Highgate underground station transports people up and down a vertical height of 30 m in one minute.

(a) How much work does the motor of the escalator do in taking someone of weight 750 N from the bottom to the top?

\_\_\_\_\_ [2]

(b) Calculate the power developed by the motor in raising each traveller.

\_\_\_\_\_ [2]

At busy times the escalator moves more than 120 people up the stairs every minute.

(c) What is the minimum amount of power required from the electric motors that drive the escalators (assume that the passengers each have an average weight of 750 N)

\_\_\_\_\_ [2]

The rowing exercise machines at Emanuel School measure the power output of a young sculler to be 200 W on an average day.

(d) How many scullers would be needed at Highgate escalator to move the crowd during rush hour?

\_\_\_\_\_ [2]