

Forces and energy

1. The diagram shows a high jumper.



In order to jump over the bar, the high jumper must raise his mass by 1.25m. The high jumper has a mass of 65kg. The gravitational field strength is 10N/kg.

(a) The high jumper just clears the bar.

Use the following equations to calculate the gain in his gravitational potential energy.

weight	=	mass	×	gravitational field strength
(newton, N)		(kilogram, kg)		(newton/kilogram, N/kg)

change in gravitational potential energy	=	weight	×	change in vertical height
(joule, J)		(newton, N)		(metre, m)

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Gain in gravitational potential energy J

(4)

Unit P2, P2.2.1

- (b) Use the following equation to calculate the minimum speed the high jumper must reach for take-off in order to jump over the bar.

$$\text{kinetic energy} = \frac{1}{2} \times \text{mass} \times [\text{speed}]^2$$

(joule, J) (kilogram, kg) [(metre/se cond)², (m/s)²]

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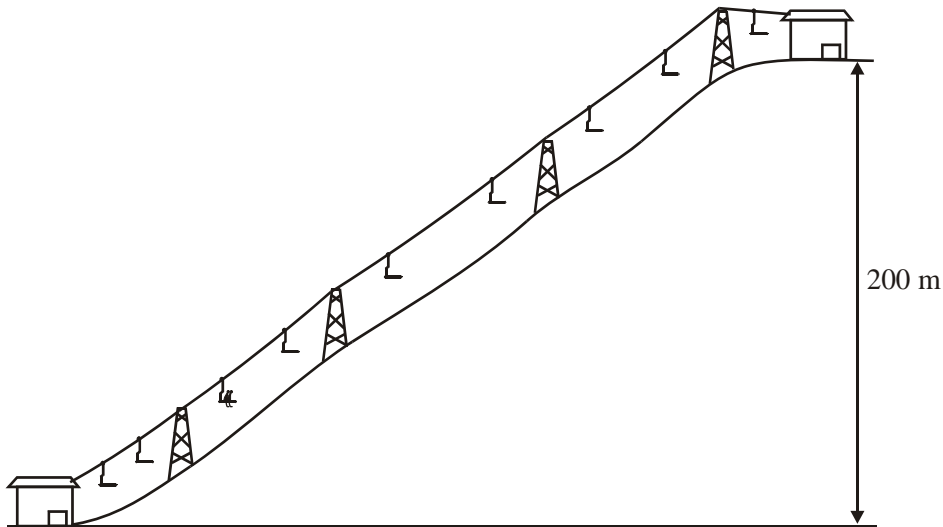
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Speed m/s

(3)
(Total 7 marks)

2. (a) A chair lift carries two skiers, Greg and Jill, to the top of a ski slope. Greg weighs 700 N and Jill weighs 500 N.



- (i) Write down the equation that links distance moved, force applied and work done.

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(1)

- (ii) Calculate the work done to lift Greg and Jill through a vertical height of 200 m. Show clearly how you work out your answer and give the unit.

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work done =

(3)

Unit P2, P2.2.1

- (b) The chair takes 5 minutes to move from the bottom to the top of the ski slope.
Use the following equation to calculate the power required to lift Greg and Jill to the top of the ski slope. Show clearly how you work out your answer.

$$\text{power} = \frac{\text{work done}}{\text{time taken}}$$

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power = watts

(2)

- (c) The chair lift is driven by an electric motor.
(i) Why would the power output of the electric motor need to be larger than your answer to part (b)?

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(1)

- (ii) Complete the following sentence.
When the ski lift is working energy supplied to the motor
is usefully transferred as gravitational energy.

(1)

(Total 8 marks)