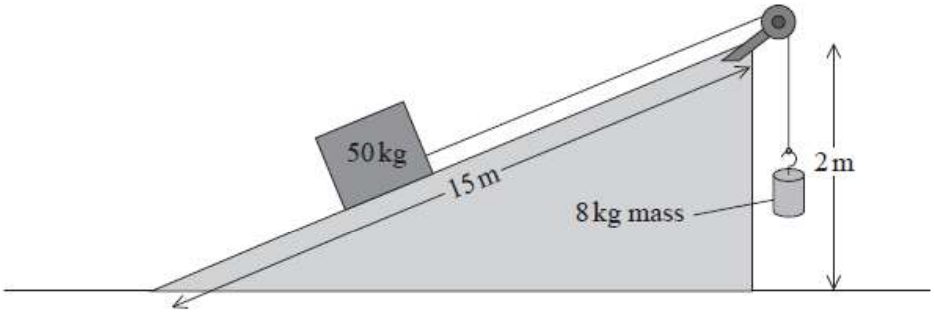
Q1.

Machines make work easier by changing the size or direction of a force. A student designed a simple machine to lift a box of mass 50 kg. The student claimed the efficiency of the machine was greater than 90%.

The machine used a slope of height 2.0 m and length 15 m to move the box. The box was connected to an 8.0 kg mass by a rope over a pulley as shown. As the 8.0 kg mass fell, the box moved up the slope at a steady speed.



Determine whether the maximum efficiency of the machine was greater than 90%.

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(Total for question = 4 marks)

Q2.

Which of the following is equivalent to 1 kilowatt-hour?

☐ **A** 0.28 J

☐ **B** 0.28 W

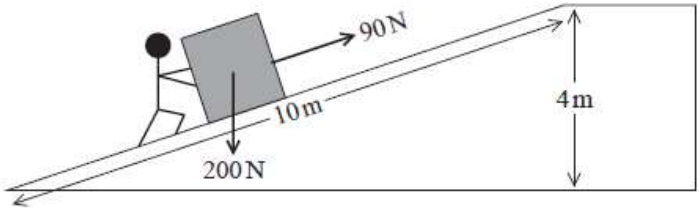
☐ **C** 3.6×10^6J

☐ **D** 3.6×10^6W

(Total for question = 1 mark)

Q3.

A force of 90 N is used to push a box along a ramp of length 10 m, up to a platform. The platform is 4 m above the ground. The weight of the box is 200 N.



Which of the following expressions could be used to determine the efficiency of the ramp?

☐ **A** $\frac{90 \times 10}{200 \times 4}$

☐ **B** $\frac{200 \times 4}{(90 \times 10) + (200 \times 4)}$

☐ **C** $\frac{200 \times 4}{90 \times 10}$

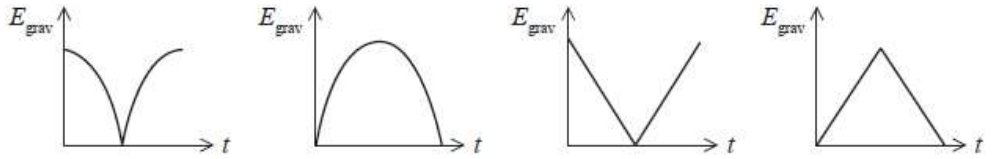
☐ **D** $\frac{90 \times 10}{(90 \times 10) + (200 \times 4)}$

(Total for question = 1 mark)

Q4.

A ball is dropped, bounces once and is then caught.

Which of the following graphs of gravitational potential energy E_{grav} against time t could represent the motion of the ball?



☐ **A** ☐ **B** ☐ **C** ☐ **D**

(Total for question = 1 mark)

Q5.

Answer the question with a cross in the box you think is correct ☒. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.

A water pump causes 200 g of water to be ejected from the nozzle of a garden hose each second at a velocity of 3 m s^{-1}.

Which of the following expressions could be used to determine the minimum output power in watts required from the pump?

☐ **A** $\frac{200 \times 3^2}{2}$

☐ **B** $\frac{0.2 \times 3^2}{2}$

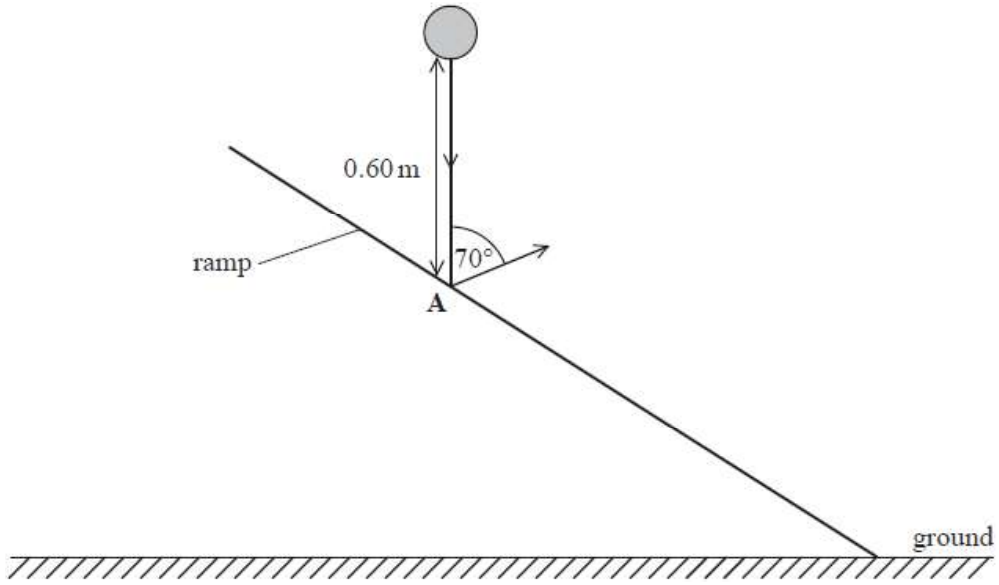
☐ **C** $\frac{200 \times 3}{2}$

☐ **D** $\frac{0.2 \times 3}{2}$

(Total for question = 1 mark)

Q6.

A ball falls through a vertical height of 0.60 m before bouncing at point A on a ramp, as shown.



(a) Show that the velocity of the ball immediately before the bounce is about 3 m s^{-1}.

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(b) Kinetic energy is conserved as the ball bounces off the ramp. The ball bounces at an angle of 70° to the vertical.

State expressions for the horizontal and vertical components of velocity of the ball immediately after the bounce.

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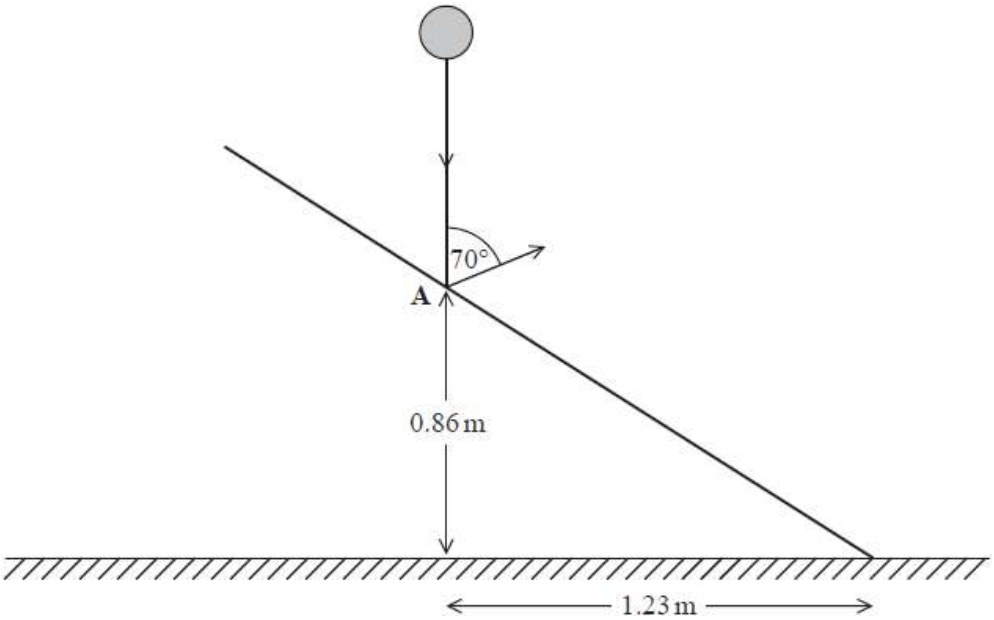
Horizontal component = ...

Vertical component = ...

(c) Point A is 0.86 m vertically above the ground and 1.23 m horizontally from the end of the ramp as shown.



Deduce whether the ball will bounce a second time on the ramp.

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(Total for question = 8 marks)

Q7.

A motor with an efficiency of 68% is used to raise a load of 350 N through a height of 25 m.

Which of the following expressions gives the energy supplied to the motor?

☐ **A** $\frac{68}{350 \times 25}$

☐ **B** $\frac{0.68}{350 \times 25}$

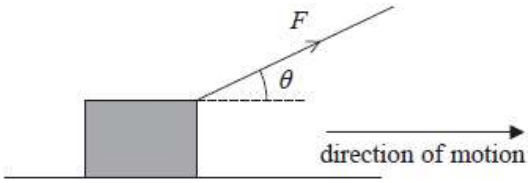
☐ **C** $\frac{350 \times 25}{68}$

☐ **D** $\frac{350 \times 25}{0.68}$

(Total for question = 1 mark)

Q8.

A rope is used to pull a box a fixed distance s along a horizontal surface. The rope is at an angle θ to the horizontal and a constant force F is applied to the rope as shown.



Explain how the work done on the box by F varies as θ varies.

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(Total for question = 3 marks)