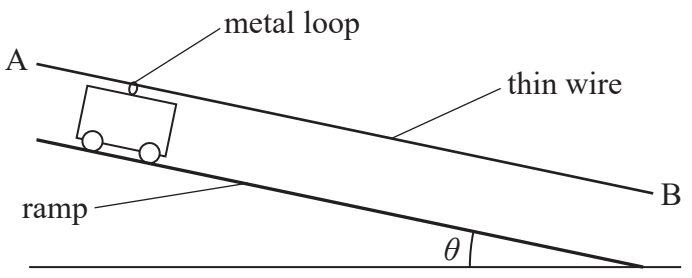
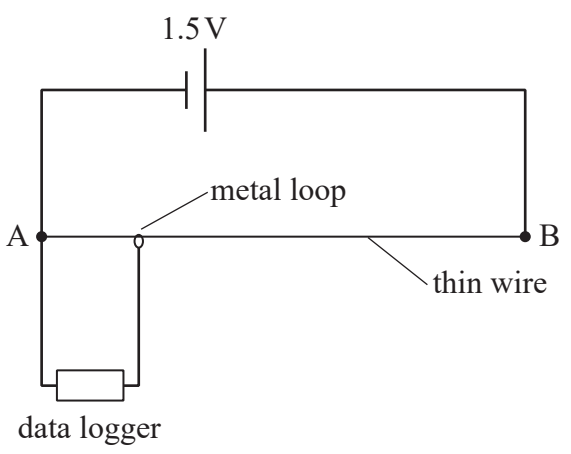
17 A student investigates the motion of a friction-free trolley down a ramp. On the top of the trolley there is a metal loop which makes contact with a length of thin resistance wire, AB, fixed above the ramp. The resistance wire has a uniform diameter.

The trolley accelerates down the ramp and the metal loop stays in contact with the wire along the full length of the ramp.



The student uses a protractor to measure the angle θ between the ramp and the horizontal and records a value of 4° with an uncertainty of ±1°.

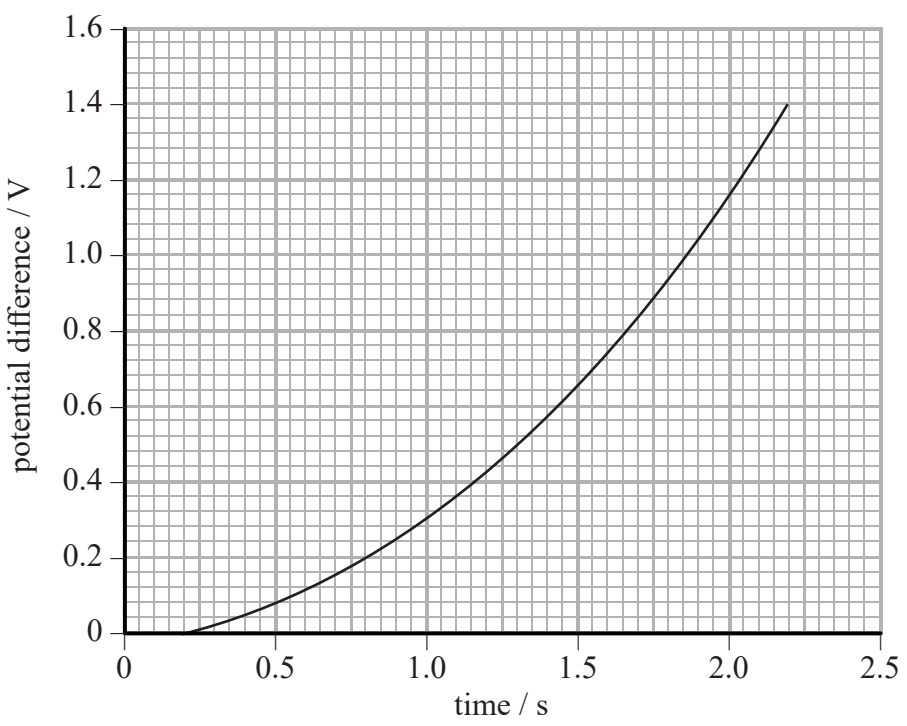
(a) The two ends of the wire are connected to a 1.5 V cell. A data logger, set to measure potential difference, is connected to the metal loop and to the negative terminal of the cell.



Explain how the potential difference recorded by the data logger will vary as the loop moves along the length of the wire AB.

(3)

(b) The graph shows the data obtained from the data logger.



Determine the velocity of the trolley at 1.5 s.

1.5 V represents a distance of 2.00 m.

(4)

Velocity = ...

(c) The student calculated the velocity of the trolley at 2.0 s to be 1.5 m s^{-1}.

By considering the acceleration of the trolley, determine whether the student's measurement of θ was within the uncertainty quoted.

(4)

(Total for Question 17 = 11 marks)