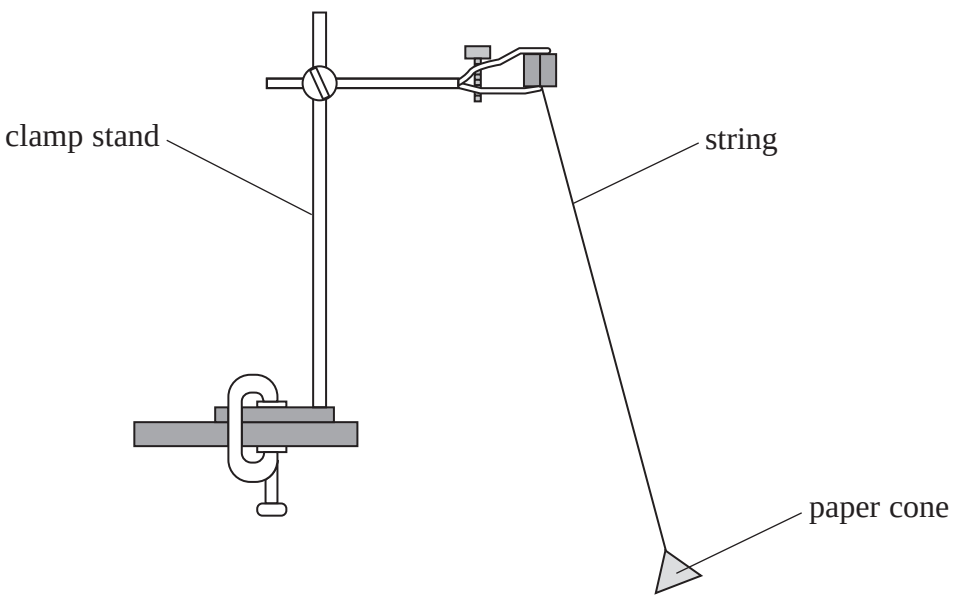
10 A student made a simple pendulum by connecting a paper cone to a piece of string. She attached the pendulum to a clamp as shown.



(a) (i) The student displaced the pendulum through a small angle so that it oscillated. She determined the time period T as 2.50 s.

Calculate the length of the pendulum.

(2)

Length of pendulum = ...

(ii) Explain why the amplitude of oscillation of the pendulum did not stay constant.

(3)

(b) The student recorded how the amplitude of oscillation varied over time.

(i) It is suggested that the relationship between amplitude A and time t is

$$A = A_0 e^{-\frac{kt}{T}}$$

where A_0 is the initial amplitude of the oscillation and k is a constant.

Explain why a graph of $\ln A$ against t would give a straight line.

(2)

(ii) The table shows the student's data.

t / s	A / cm	
2.5	17.6	
5.0	14.3	
7.5	11.6	
10.0	9.4	
12.5	7.6	

Plot a graph of $\ln A$ against t on the grid opposite. Use the additional column to show your processed data.

(5)

(iii) Determine values for A_0 and k.

(4)

A_0 = ...

(Total for Question 10 = 16 marks)