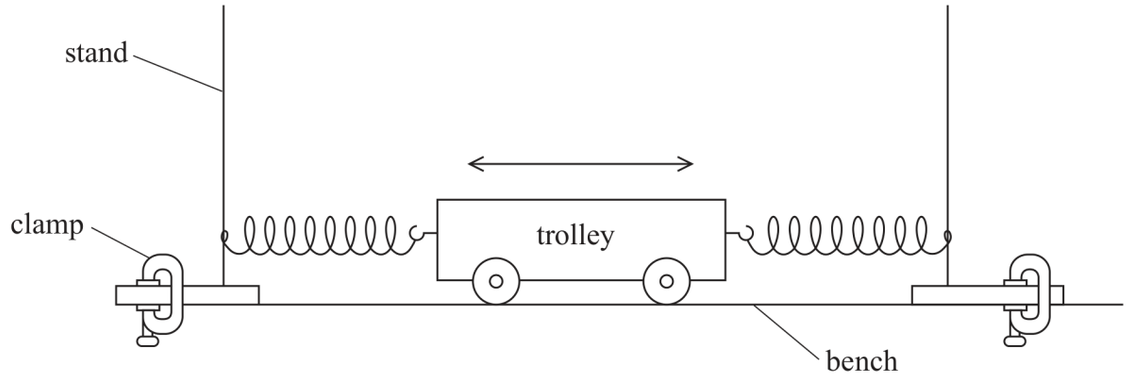
3 A student investigated the horizontal oscillations of a trolley between two springs using the apparatus shown.



(a) The student used a stop clock to time the oscillations.

(i) Describe how he should modify the equipment to make his measurements as accurate as possible.

(2)

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(ii) Describe two techniques he should use to reduce the uncertainty in the value of the time period.

(2)

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(b) The student added masses to the trolley. He measured the total mass M of the trolley and masses. He recorded the following values of the time period T for each value of M.

M/kg	T/s		
0.800	0.78		
1.300	1.01		
1.800	1.18		
2.300	1.34		
2.800	1.49		
3.300	1.60		

(i) Plot a graph of log T against log M on the grid opposite. Use the additional columns in the table to record your processed data.

(6)

(ii) The student predicts that the relationship between T and M is given by

$$T = 2\pi\sqrt{\frac{M}{k}}$$

where k is the spring constant.

Discuss the validity of this prediction.

(5)

(iii) Determine the value of k.

(3)

$k =$ .....

(Total for Question 3 = 18 marks)

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