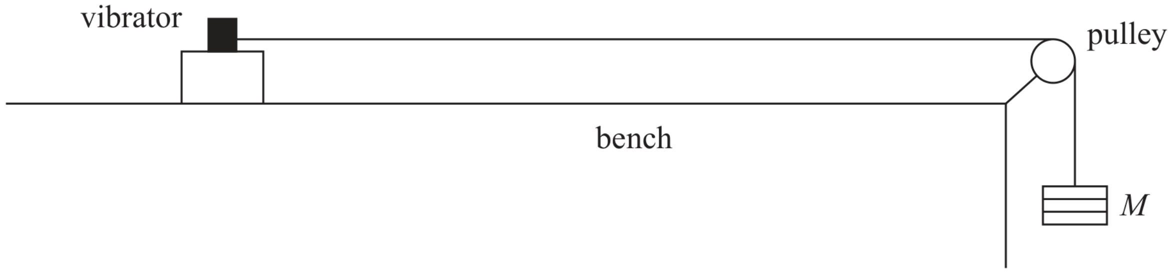
16 A student investigated stationary waves on a stretched string. The string was attached to a vibrator and a mass M, as shown.



(a) Explain how a stationary wave forms on the string.

(3)

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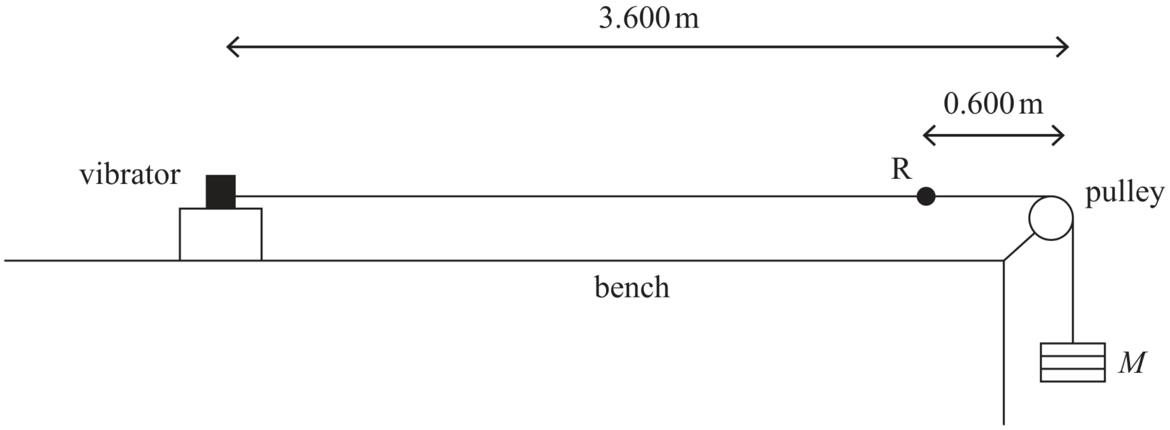
(b) The frequency of the stationary wave was 30.0 Hz. The distance between the vibrator and the pulley was 3.600 m. Point R is 0.600 m from the pulley, as shown.

Diagram **NOT** to scale

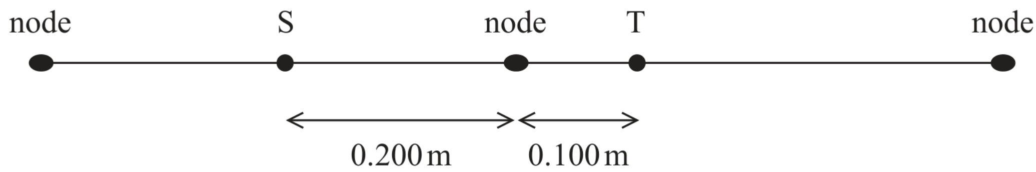


Determine whether there was a node at point R.

$M = 0.300\,\text{kg}$
mass per unit length of string = $2.27 \times 10^{-3}\,\text{kg}\,\text{m}^{-1}$

(5)

(c) The mass M was changed and the frequency of the vibrator was adjusted, so that a different stationary wave formed on the string. Adjacent nodes were separated by 0.400 m. The diagram shows two points, S and T, on the string at an instant when the string was straight.



(i) Explain the phase relationship between points S and T.

(2)

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(ii) Explain how the amplitude of vibration of the string at point S compares with the amplitude of vibration of the string at point T.

(2)

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(Total for Question 16 = 12 marks)