4 **(a)** On Fig. 4.1, complete the two graphs to illustrate what is meant by the amplitude A, the wavelength λ and the period T of a progressive wave.

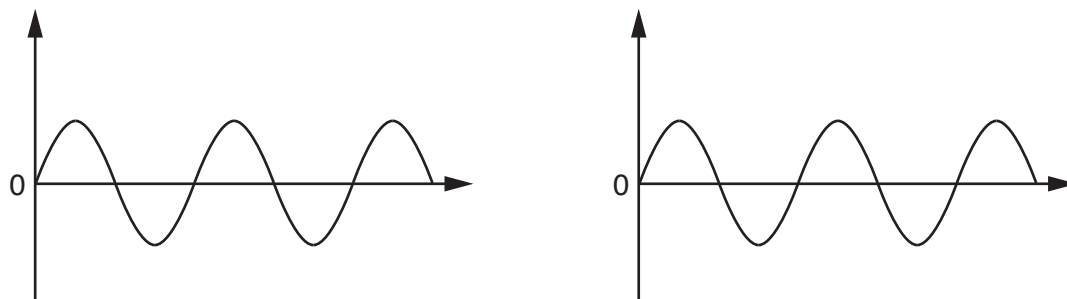Ensure that you label the axes of each graph.

Fig. 4.1

[3]

(b) A horizontal string is stretched between two fixed points X and Y. A vibrator is used to oscillate the string and produce a stationary wave. Fig. 4.2 shows the string at one instant in time.
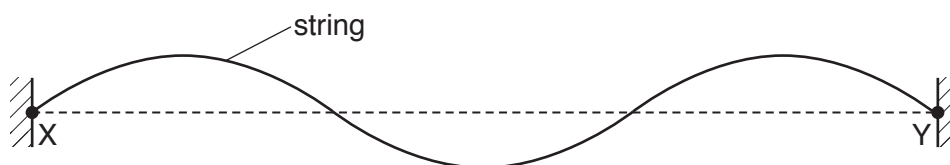

Fig. 4.2

The speed of a progressive wave along the string is $30\,\text{m}\,\text{s}^{-1}$. The stationary wave has a period of 40 ms.

(i) Explain how the stationary wave is formed on the string.

....

....

....

....[2]

(ii) A particle on the string oscillates with an amplitude of 13 mm. At time t, the particle has zero displacement.

Calculate

1. the displacement of the particle at time $(t + 100 \, \text{ms})$,

displacement = ... mm

2. the total distance moved by the particle from time t to time $(t + 100 \, \text{ms})$.

distance = ... mm

[3]

(iii) Determine

1. the frequency of the wave,

frequency = ... Hz [1]

2. the horizontal distance from X to Y.

distance = ... m [3]

[Total: 12]