

- 4 A device containing a microwave emitter and receiver is placed in front of a large metal sheet in a vacuum as shown in Fig. 4.1.

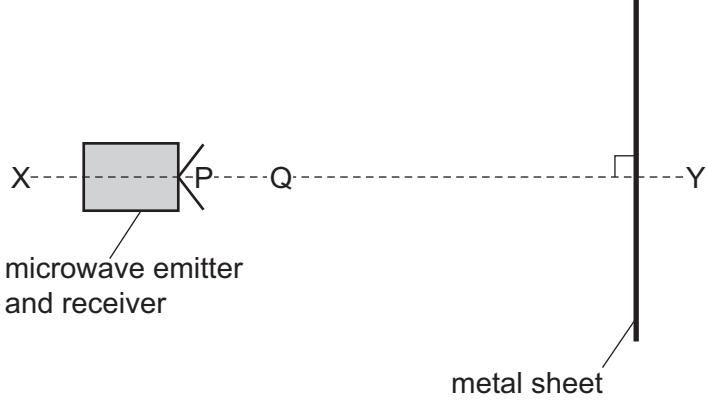


Fig. 4.1 (not to scale)

The line XY is perpendicular to the metal sheet. The device emits microwaves of frequency 6.3 GHz.

- (a) When the device is at position P, a stationary wave is formed between the device and the sheet.

Explain how the stationary wave, including the nodes and the antinodes, is formed.

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[4]

- (b) (i) Calculate the wavelength of the microwaves.

$$\text{wavelength} = \dots \text{m} \quad [2]$$





- (ii) At point P the receiver detects a maximum amplitude of the stationary wave.

The device is moved slowly from point P along the line XY and the receiver detects a series of minimum and maximum amplitudes. The first time a minimum amplitude is detected by the receiver is when the device is at point Q.

Determine the distance between P and Q.

$$\text{distance} = \dots \text{m} [1]$$

- (iii) The intensity of the microwaves emitted by the device is increased. The frequency of the microwaves is unchanged. The device is moved slowly along the line XY from point Q until the next maximum amplitude is detected at point R.

State and explain whether the distance QR is greater than, less than or the same as distance PQ.

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[1]

[Total: 8]