3 **(a)** State the *principle of superposition*.

.....

.....

..... [2]

(b) Two coherent microwave sources X and Y of frequency 2.5×10^{10} Hz are a distance of 0.18 m apart in a vacuum, as shown in Fig. 3.1.

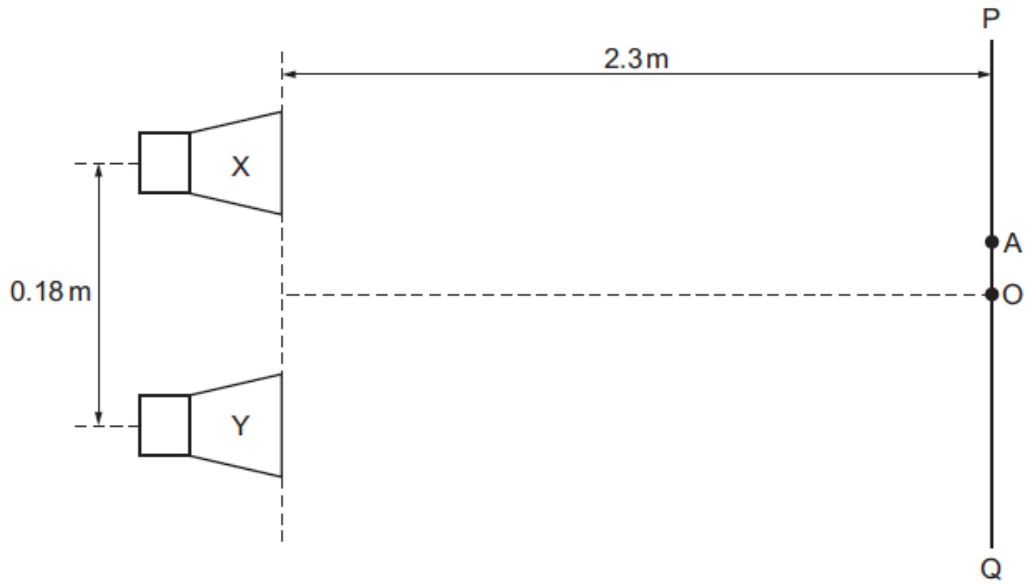

Fig. 3.1 (not to scale)

There is a phase difference of 180° between the waves emitted by the two sources.

A microwave detector moves along line PQ, which is parallel to the line joining the two sources and 2.3 m away from it.

Point O is along line PQ at a position that is equidistant from the two sources.
Point A is the first maximum intensity detected when the detector moves from O to A.

(i) Show that the wavelength of the microwaves is 0.012 m.

[1]

(ii) **1.** Explain why zero intensity is detected at point O.

……

……

……

……
[2]

2. Determine the difference in the distances travelled by the microwaves from X to A and from Y to A.

difference = …… m [1]

(iii) Use the formula for the double-slit interference of light to calculate the distance between adjacent intensity maxima on line PQ.

distance = …… m [2]

(iv) On Fig. 3.1, draw a cross (×) to show the position of a point along line PQ closest to point O where the waves meet with a phase difference of 90°. Label this point B. [1]

[Total: 9]