4 **(a)** Define *magnetic flux density*.

....

....

.... [1]

(b) A charged particle is initially located at point P on the plane of the page and is moving to the right with speed *v*.

The charged particle moves within the vicinity of a non-uniform magnetic field that is generated by a long, straight wire carrying current I to the right. The wire is located on the same plane of page as the initial position of the charged particle.

As a result, the particle travels along a curved path of non-uniform radius.

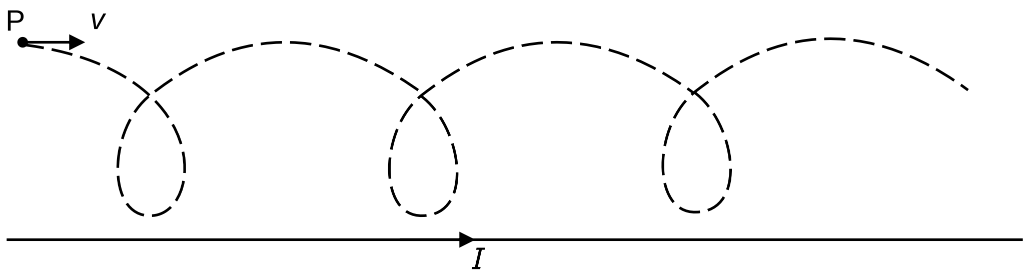

Fig. 4.1

(i) **1.** On Fig. 4.1, sketch a representation of the magnetic field lines on the plane of paper generated by the long straight wire. [2]

2. State the sign of the charged particle.

.... [1]

(ii) Explain, using energy considerations, why the speed of the charged particle remains constant throughout the motion.

....

....

.... [2]

(iii) State an assumption made for the speed of the charged particle to remain constant.

....

.... [1]

(c) Two long parallel wires X and Y are separated by a distance of 5.0 cm and carry currents 7.0 A and 8.0 A respectively. Both the currents are directed out of the plane of paper.

Point Z is located 3.0 cm from wire X and 4.0 cm from wire Y as shown in Fig. 4.2.

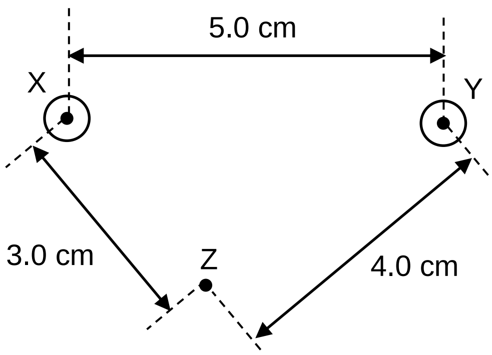

Fig. 4.2 (not to scale)

Determine the magnitude of magnetic flux density at point Z due to wires X and Y.

magnitude of magnetic flux density = ………………………………. T [2]

[Total: 9]