5 (a) An object travels in a circle at constant speed.

State the names of **two** quantities that vary during the motion of the object.

1 ....

2 ....

[2]

(b) A charged particle of mass m and with charge q enters a region of uniform magnetic field, perpendicular to the field lines. The magnetic flux density is B.

The particle travels in a circle with period T and radius r.

(i) By considering the magnetic force acting on the particle, show that

$$B = \frac{2\pi m}{qT}.$$

[3]

(ii) The particle is an alpha particle. The period of the circular motion is $2.5\,\mu$s.

Calculate B.

$B =$ ....T [2]

(iii) A second alpha particle is in the same uniform field. It travels in a circle of radius $2r$.

State and explain how the periods of the motion of the two particles compare.

....

....

.... [1]

(iv) The speed of the alpha particle in **(b)(ii)** is $1.1 \times 10^6\,\text{m s}^{-1}$. An electric field is applied so that this particle now moves with constant velocity.

Use your answer in **(b)(ii)** to calculate the electric field strength E. Give the unit with your answer.

E = ... unit .... [2]