6 **(a)** Explain how an electric field and a magnetic field may be used for the velocity selection of charged particles. You may draw a diagram if you wish.

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……..[3]

(b) An ion of charge Q and mass m is moving with speed v normal to a magnetic field of magnetic flux density B. The ion will move in a circular path of radius r.

Derive an expression for r in terms of Q, m, v and B. [2]

(c) The isotopes strontium-87 ($^{87}_{38}Sr$) and strontium-86 ($^{86}_{38}Sr$) are found in samples of Moon rock. Particles of a sample of Moon rock are vaporised, releasing strontium isotopes that are sent into the velocity selector of a mass spectrometer as shown in Fig. 6.1. The positive ions of strontium isotopes then pass through a uniform magnetic field which makes them follow separate circular paths.

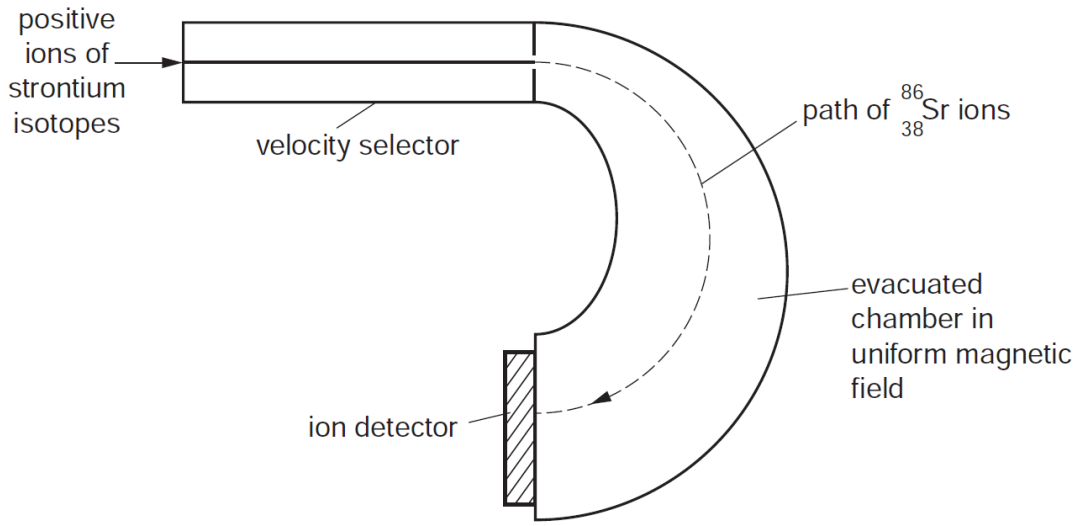

Fig. 6.1

(i) On Fig. 6.1, sketch a possible path for the strontium-87 ($^{87}_{38}Sr$) ions. [1]

(ii) The velocity selector allows strontium ions of speed 7.6×10^5 m s^{-1} to enter the evacuated chamber in uniform magnetic field of magnetic flux density 680 mT.

Determine the change in the magnetic flux density needed to make the strontium-87 ($^{87}_{38}Sr$) ions follow the same path taken initially by the strontium-86 ions.

change in magnetic flux density = ... T [2]