

- 6 (a) Define *magnetic field*.

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..... [1]

- (b) A positive ion with speed  $v$  is moving un-deviated, through a region of magnetic field of flux density  $B$  and electric field strength  $E$ , in a velocity selector, as shown in Fig. 6.1. The magnetic field is acting into the page.

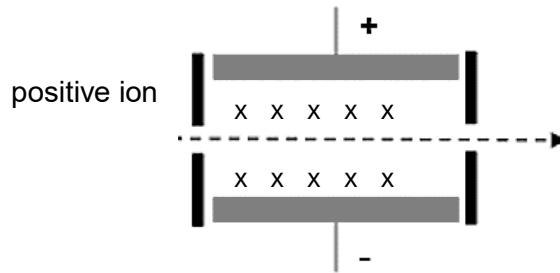


Fig. 6.1

- (i) Explain how the combination of magnetic and electric fields allows the positive ion of only one speed  $v$  to pass through un-deviated.

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[3]

- (ii) A mass spectrometer is able to separate charged particles of different masses. Ions of different masses emerge from the velocity selector and enters a region of uniform magnetic flux density  $B'$ , as shown in Fig. 6.2.

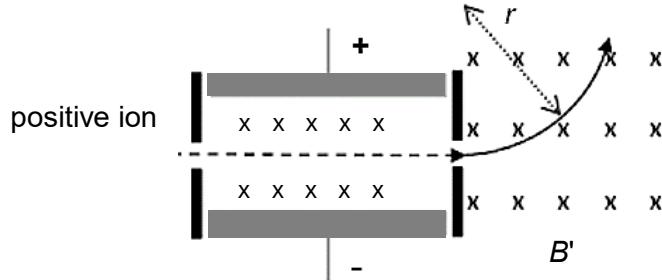


Fig. 6.2

In one experiment, carbon ions of atomic mass 12.0 u are found to be mixed with ions of an unknown element of the same charge. The carbon ions transverse a path of radius 22.4 cm and the ions of an unknown element transverse a path of radius 26.2 cm.

1. Explain why the ions will move in a circular path of radius  $r$ , after emerging from the velocity selector.

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[1]

2. Determine the mass of the ions of an unknown element, in terms of u.

mass of unknown element = ..... u [2]

[Total: 7]

