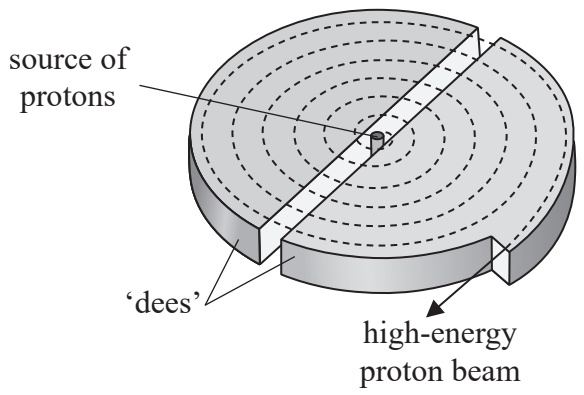
13 Proton beam therapy is being introduced in the UK as a new cancer treatment.

A beam of protons is accelerated by a cyclotron to an energy of 23 MeV and is then focused onto a tumour.

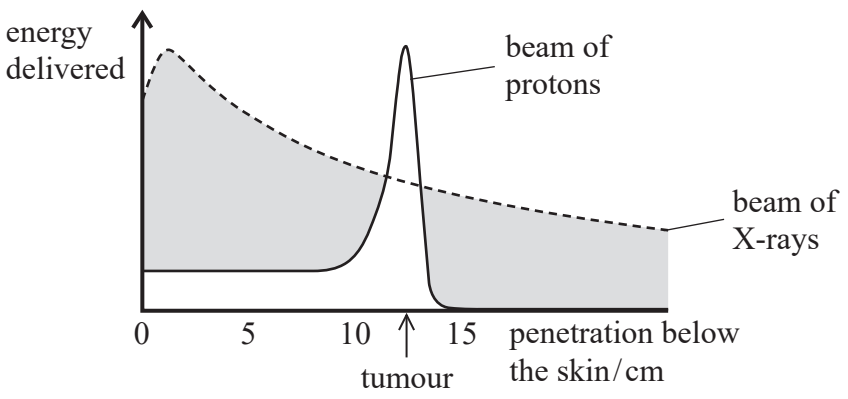


*(a) Explain how the cyclotron produces the high-energy proton beam.

(6)

(b) Conventional treatment may use X-rays to deliver energy to a tumour.

The graph shows the variation of energy delivered with penetration below the skin for a beam of protons and a beam of X-rays.



Deduce why the beam of protons could be a more effective treatment for tumours than a beam of X-rays.

(2)

(c) Developing new cancer treatments is expensive.

Give two possible reasons why money should be provided for the development of this new cancer treatment.

(2)

(Total for Question 13 = 10 marks)