**8** The isotope thallium-208 ($^{208}_{81}Tl$) is radioactive. It decays by β-decay.

**(a)** Thallium-208 decays to an isotope of lead (Pb).

**(i)** Complete the equation for this decay.

$$^{208}_{81}Tl \longrightarrow {}^{\cdots\cdots}_{\cdots\cdots}Pb + {}^{\cdots\cdots}_{\cdots\cdots}\beta$$

[3]

**(ii)** The β-emission of thallium-208 is accompanied by γ-emission from the nucleus.

Explain why this γ-emission does **not** affect the numbers in the equation in **(a)(i)**.

.....

..... [1]

**(iii)** Suggest **one** reason why a nucleus of thallium-208 is unstable.

.....

..... [1]

**(b)** A sample of thallium-208 is placed in a thick lead container. Fig. 8.1 shows a narrow beam of β-particles and γ-radiation emerging from a small hole in one side of the container.

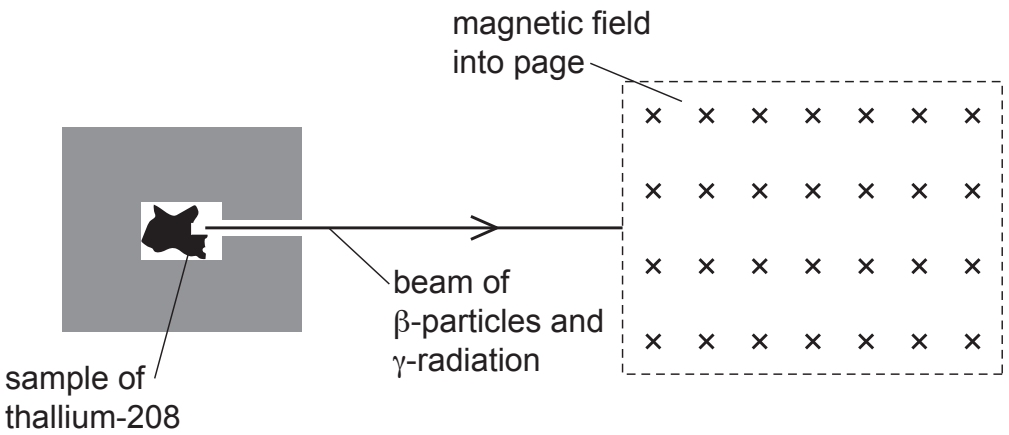


**Fig. 8.1**

The narrow beam enters a region where there is a magnetic field that is directed into the page.

On Fig. 8.1:

- draw a line **labelled β** to indicate the path of the β-particles in the magnetic field
- draw a line **labelled γ** to indicate the path of the γ-radiation in the magnetic field.

[3]

[Total: 8]