6 **(a)** **(i)** Explain what is meant by *nuclear binding energy*.

.....

..... [1]

(ii) Calculate the nuclear binding energy in MeV of the gold nuclide $^{197}_{79}Au$, using the following data:

mass of proton = 1.672648×10^{-27} kg

mass of neutron = 1.674954×10^{-27} kg

mass of gold nuclide = 3.269645×10^{-25} kg

binding energy = ... MeV [3]

(b) Another gold isotope $^{198}_{79}Au$ is unstable and undergoes beta decay to mercury (Hg) with a half-life of 2.7 days.

(i) Write down the equation representing the beta decay of this gold nuclide.

[1]

(ii) Define *half-life.*

.....

.....

..... [1]

(iii) Determine the time taken for the activity of a sample of gold−198 to decrease by 85%.

time taken = ... days [2]

(iv) The beta particles emitted in the decay have a range of kinetic energies up to a maximum value of 0.83 MeV.

In Fig. 6.1 below, sketch the variation with kinetic energy of the number of beta particles emitted. Label the maximum kinetic energy of 0.83 MeV on your graph.

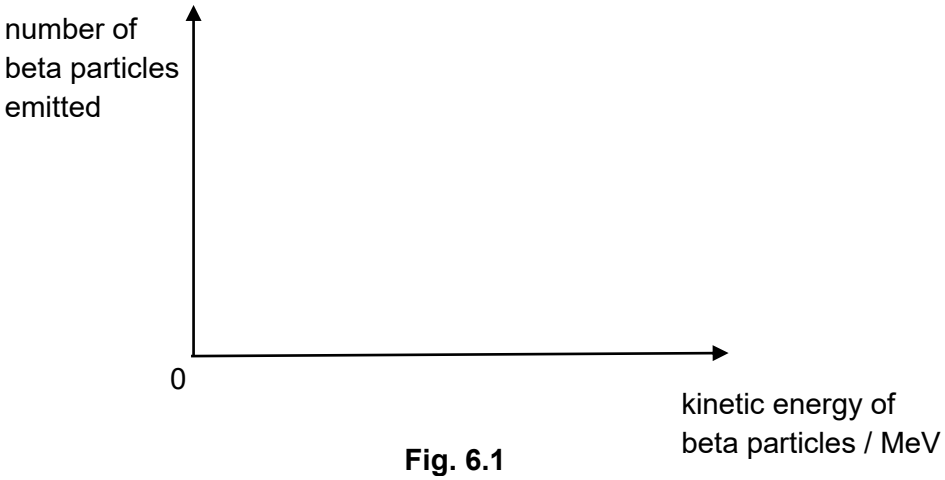

Fig. 6.1

[2]