

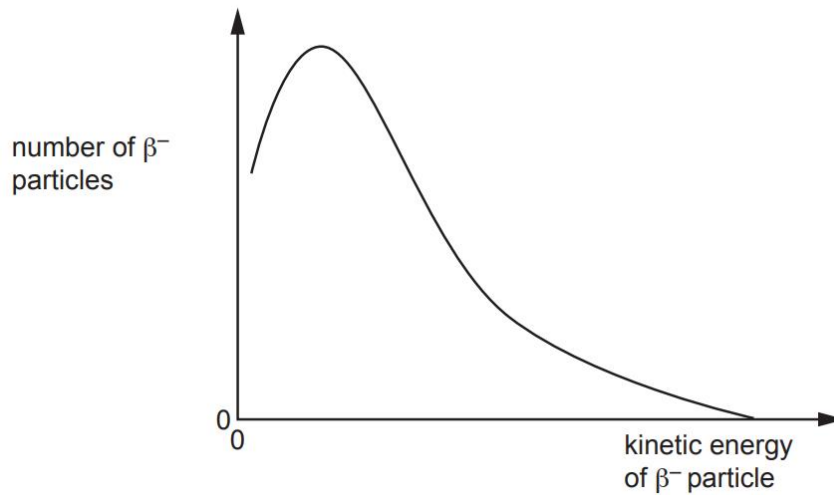
- 5**     **(a)**     Radioactive decay is both random and spontaneous.
- (i)**     State what is meant by random.
- .....  
                 .....[1]
- (ii)**    State what is meant by spontaneous.
- .....  
                 .....[1]
- (iii)**   State **one** piece of evidence for the random nature of decay.
- .....  
                 .....[1]
- (b)**     **(i)**     Describe the differences between nuclear fission and nuclear fusion.
- .....  
                 .....  
                 .....  
                 .....  
                 ..... [3]
- (ii)**    Explain, with reference to the variation of binding energy per nucleon with nucleon number, why the processes of nuclear fission and nuclear fusion both result in a release of energy.
- .....  
                 .....  
                 .....[2]

- (c) Nuclei of an isotope of copper (Cu) each have 29 protons and 37 neutrons. This isotope is a  $\beta^-$  emitter.

(i) State the nuclide notation in the form  ${}^A_Z\text{X}$  for this nucleus of copper.

.....[1]

- (ii) The energy spectrum of the  $\beta^-$  radiation emitted by a sample of this isotope is shown in Fig. 5.1.



**Fig. 5.1**

Use Fig. 5.1 to explain why other particles apart from the  $\beta^-$  particles must be emitted during this decay.

.....  
 .....  
 .....  
 .....  
 ..... [3]

- (iii) In Fig. 5.1, sketch how the energy spectrum will look like if the beta decay were a two-body process. [1]