

10 (a) Radioactive decay is a spontaneous process.

State the meaning, in this context, of the term spontaneous.

.....  
 ..... [1]

(b) Two radioactive isotopes X and Y each decay to form a stable isotope. A sample initially contains only atoms of isotope X. At this time, its activity is  $4A$ . Another sample initially contains only atoms of Y. At this time, its activity is  $A$ .

Fig. 10.1 shows the variation of the activity of each sample with time  $t$  between  $t = 0$  and  $t = 6T$ .

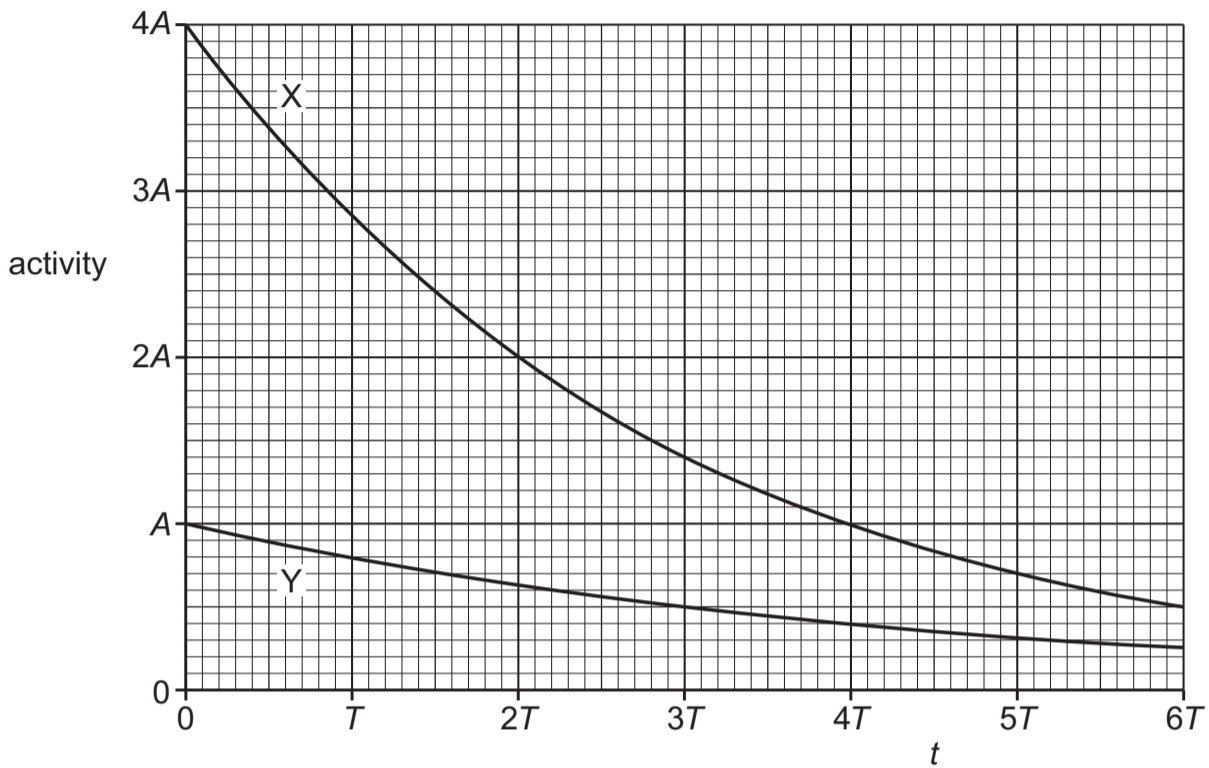


Fig. 10.1

(i) Complete Table 10.1 to give expressions, in terms of either or both of  $A$  and  $T$ , for the quantities indicated for each of the samples.

Table 10.1

sample	half-life	decay constant	initial activity	initial number of nuclei
X			$4A$	
Y			$A$	

[3]

(ii) Determine, in terms of  $T$ , the time at which the two samples will have equal activities.

time = .....  $T$  [3]

(c) A radiation detector is placed near to one of the samples in (b).

Explain why the count rate measured by the detector is less than the activity of the sample.

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 .....  
 ..... [2]

[Total: 9]