6 **(a)** Radioactive decay is both random and spontaneous.

State what is meant by

(i) random.

……

…… [1]

(ii) spontaneous.

……

…… [1]

(b) State one piece of evidence for the random nature of decay.

……

…… [1]

(c) Define half-life of a radioactive isotope.

……

…… [1]

(d) Radioactive isotope X decays to isotope Y. A sample contains only nuclei of X at time $t = 0$. Fig. 6.1 shows the variation with t of the numbers of nuclei of X and of Y as the sample decays.

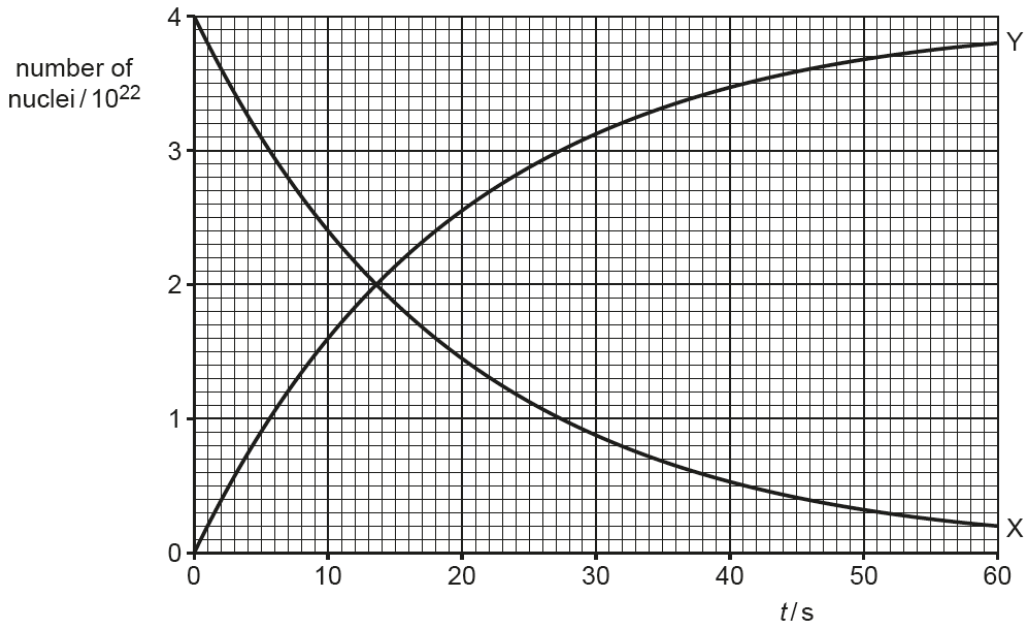

Fig. 6.1

(i) State the name of the quantity represented by the magnitude of the gradient of line X in Fig. 6.1.

……..... [1]

(ii) State three conclusions about X or Y that may be drawn from Fig. 6.1. The conclusions may be qualitative or quantitative. Use the space below for any working that you need.

1. …..…….....

…….....

2. …..…….....

…….....

3. …..…….....

……..... [3]

(e) The mass of radioactive isotope X in the sample in **(d)** is 7.3×10^{-4} kg at time $t = 0$.

Determine the nucleon number of isotope X.

nucleon number = ……. [3]

[Total: 11]