9 Carbon-11 is radioactive and decays by β^+ emission to form boron-11. Carbon-11 has a half-life of 20 minutes. Boron-11 is stable.

(a) Define half-life.

.....

..... [1]

(b) A sample contains N_0 nuclei of carbon-11 and no other nuclei at time $t = 0$.

On Fig. 9.1, sketch the variation with t of the number of nuclei of **boron-11** in the sample.

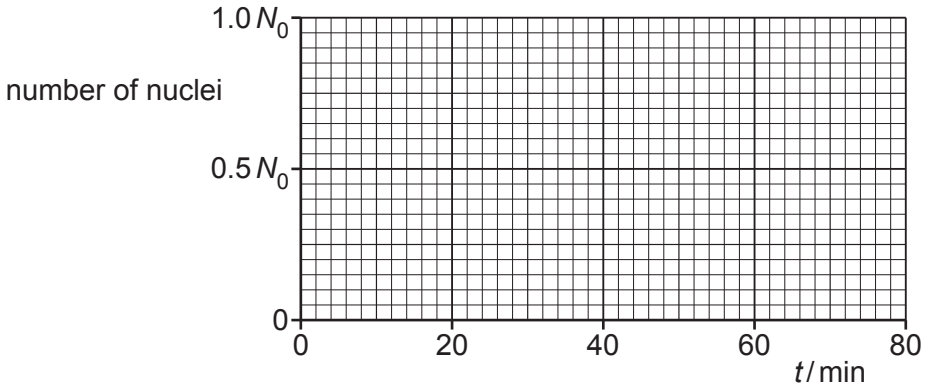

Fig. 9.1

[3]

(c) **(i)** Explain, with reference to the random nature of radioactive decay, why the activity of the carbon-11 sample in **(b)** decreases with time.

.....

.....

..... [2]

(ii) State, with reasons, whether a radiation detector placed near to the sample of carbon-11 indicates a measured count rate from the sample that is less than, the same as or greater than the activity of the sample.

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.....

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..... [3]

[Total: 9]