For Examiner's Use

9 **(a)** **(i)** State what is meant by the *decay constant* of a radioactive isotope.

.....

.....

..... [2]

(ii) Show that the decay constant λ and the half-life $t_{\frac{1}{2}}$ of an isotope are related by the expression

$$\lambda t_{\frac{1}{2}} = 0.693.$$

[3]

(b) In order to determine the half-life of a sample of a radioactive isotope, a student measures the count rate near to the sample, as illustrated in Fig. 9.1.

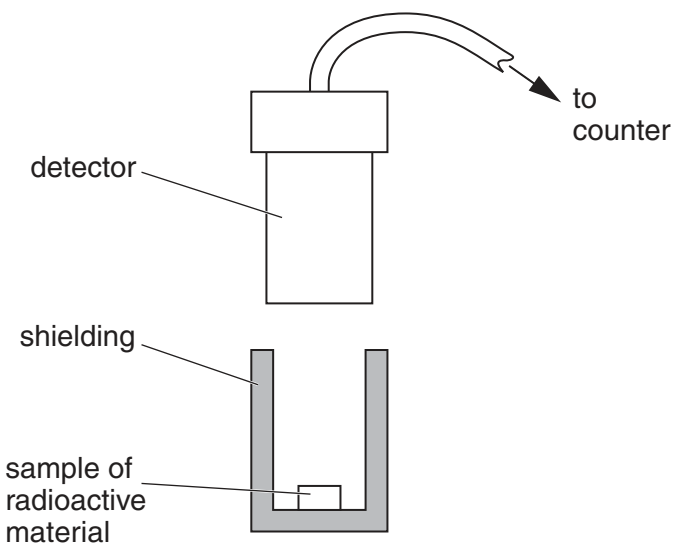

Fig. 9.1

Initially, the measured count rate is 538 per minute. After a time of 8.0 hours, the measured count rate is 228 per minute.

For Examiner's Use

Use these data to estimate the half-life of the isotope.

half-life = ... hours [3]

(c) The accepted value of the half-life of the isotope in **(b)** is 5.8 hours.
The difference between this value for the half-life and that calculated in **(b)** cannot be explained by reference to faulty equipment.

Suggest two possible reasons for this difference.

1. .....

.....

2. .....

.....
[2]