

# Radioactivity

## Question Paper 5

Level	IGCSE
Subject	Physics
ExamBoard	CIE
Topic	Atomic Physics
Sub-Topic	Radioactivity
Paper Type	(Extended) Theory Paper
Booklet	Question Paper 5

**Time Allowed:** 44 minutes

**Score:** /36

**Percentage:** /100

1 A radioactive source emits only  $\beta^-$  particles.

(a) A scientist wishes to investigate the deflection of  $\beta^-$ -particles by an electric field. Draw a labelled diagram to suggest a suitable experimental arrangement.

[3]

(b) State how the apparatus would be used to show the deflection of the  $\beta^-$ -particles by the electric field.

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

(c) State how the results would show the deflection of the  $\beta^-$ -particles.

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

(d) Explain the direction of the deflection obtained.

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

- 2 (a) The decay of a nucleus of radium  ${}^{226}_{88}\text{Ra}$  leads to the emission of an  $\alpha$ -particle and leaves behind a nucleus of radon (Rn).  
In the space below, write an equation to show this decay. [2]

- (b) In an experiment to find the range of  $\alpha$ -particles in air, the apparatus in Fig. 11.1 was used.

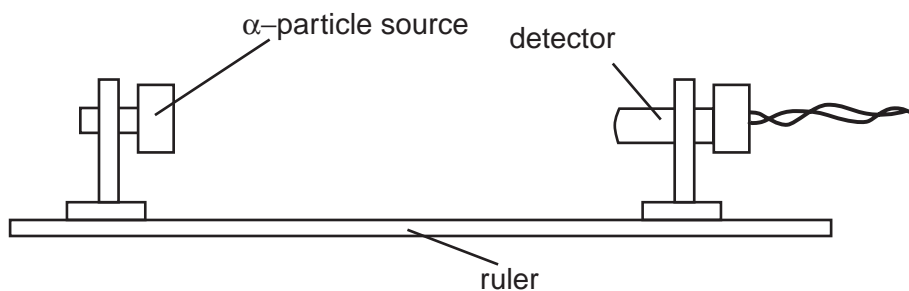


Fig. 11.1

The results of this experiment are shown below.

count rate / (counts/minute)	681	562	441	382	317	20	19	21	19
distance from source to detector/cm	1	2	3	4	5	6	7	8	9

- (i) State what causes the count rate 9 cm from the source.  
.....
- (ii) Estimate the count rate that is due to the source at a distance of 2 cm.  
.....
- (iii) Suggest a value for the maximum distance that  $\alpha$ -particles can travel from the source.  
.....
- (iv) Justify your answer to (iii).  
.....  
.....

[4]

3 (a) A radioactive isotope emits only  $\alpha$ -particles.

(i) In the space below, draw a labelled diagram of the apparatus you would use to prove that no  $\beta$ -particles or  $\gamma$ -radiation are emitted from the isotope.

(ii) Describe the test you would carry out.

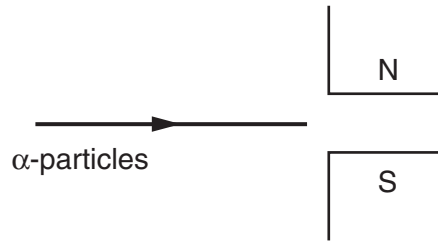
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(iii) Explain how your results would show that only  $\alpha$ -particles are emitted.

.....  
.....  
.....

[6]

- (b) Fig. 11.1 shows a stream of  $\alpha$ -particles about to enter the space between the poles of a very strong magnet.



**Fig. 11.1**

Describe the path of the  $\alpha$ -particles in the space between the magnetic poles.

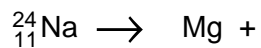
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.....[3]

[Total : 9]

- 4 (a) A sodium nucleus decays by the emission of a  $\beta$ -particle to form magnesium.  
(i) Complete the decay equation below.



- (ii) Fig. 11.1 shows  $\beta$ -particles from sodium nuclei moving into the space between the poles of a magnet.

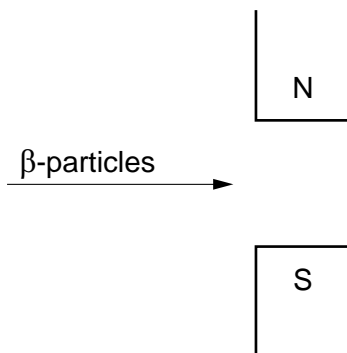


Fig. 11.1

Describe the path of the  $\beta$ -particles between the magnetic poles.

.....

.....

.....

[5]

**(b)** Very small quantities of a radioactive isotope are used to check the circulation of blood by injecting the isotope into the bloodstream.

**(i)** Describe how the results are obtained.

.....  
.....  
.....  
.....

**(ii)** Explain why a  $\gamma$ -emitting isotope is used for this purpose rather than one that emits either  $\alpha$ -particles or  $\beta$ -particles.

.....  
.....  
.....

[4]

[Total : 9]

5 Fig. 10.1 is part of the decay curve for a sample of a  $\beta$ -emitting isotope.

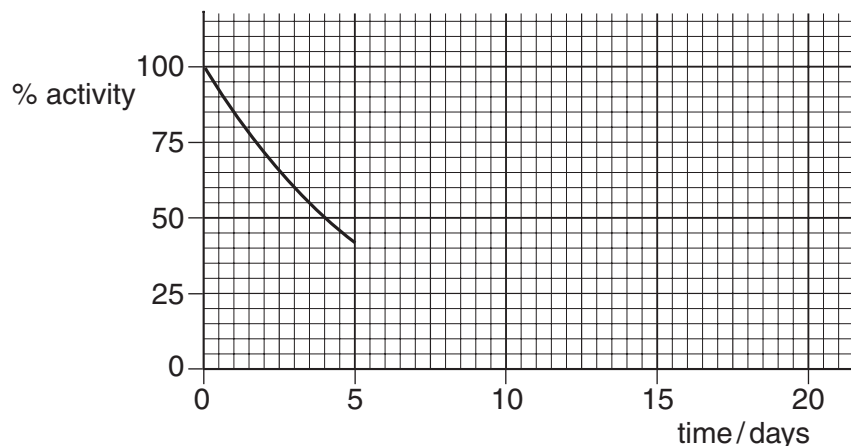


Fig. 10.1

(a) Use Fig. 10.1 to find the half-life of the isotope.

half-life = ..... [1]

(b) Complete Fig. 10.1 as far as time = 20 days, by working out the values of a number of points and plotting them. Show your working. [2]

(c) The decay product of the  $\beta$ -emitting isotope is not radioactive. Explain why the sample of the radioactive isotope will be safer after 20 days than after 1 day. Support your answer by reference to the graph.

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

(d) The isotope used for this decay curve may be represented by the symbol  ${}^A_ZX$ . Write down an equation, by filling in the gaps below, to show the  $\beta$ -decay of this isotope to a decay product that has the symbol Y.

