Radioactivity

Question Paper 4

Level	IGCSE
Subject	Physics
ExamBoard	CIE
Topic	Atomic Physics
Sub-Topic	Radioactivity
Paper Type	(Extended) Theory Paper
Booklet	Question Paper 4

Time Allowed: **49 minutes**

Score: **/41**

Percentage: **/100**

1 A radioactive source is placed near a radiation detector connected to a counter, as shown in Fig. 11.1.

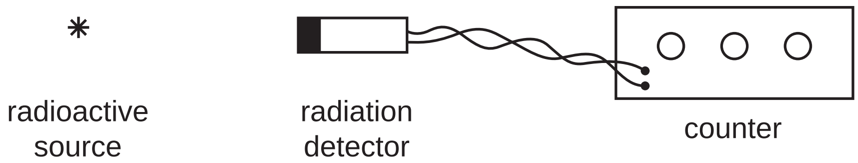

Fig. 11.1

(a) The count rate, measured over three successive minutes, gives values of

720 counts / minute

691 counts / minute

739 counts / minute.

Explain why a variation like this is to be expected in such an experiment.

....

.... [1]

(b) The radiation detector and counter are left untouched. The radioactive source is put in its lead container and returned to the metal security cupboard.

Once this has been done, a further measurement is taken over one minute.

This gives a reading of 33 counts / minute.

(i) State the name used for the radioactivity being detected during this minute.

....

(ii) Suggest two possible sources for this radioactivity.

1. ....

2. .... [3]

[Total: 4]

2 A beam of ionising radiation, containing α-particles, β-particles and γ-rays, is travelling left to right across the page. A magnetic field acts perpendicularly into the page.

(a) In the table below, tick the boxes that describe the deflection of each of the types of radiation as it passes through the magnetic field. One line has been completed, to help you.

	not deflected	**deflected towards top of page**	**deflected towards bottom of page**	**large deflection**	**small deflection**
α-particles		✓			✓
β-particles					
γ-rays					

[3]

(b) An electric field is now applied, in the same region as the magnetic field and at the same time as the magnetic field.

What is the direction of the electric field in order to cancel out the deflection of the α-particles?

.... [2]

[Total: 5]

3 Fig. 11.1 shows the paths of three α-particles moving towards a thin gold foil.

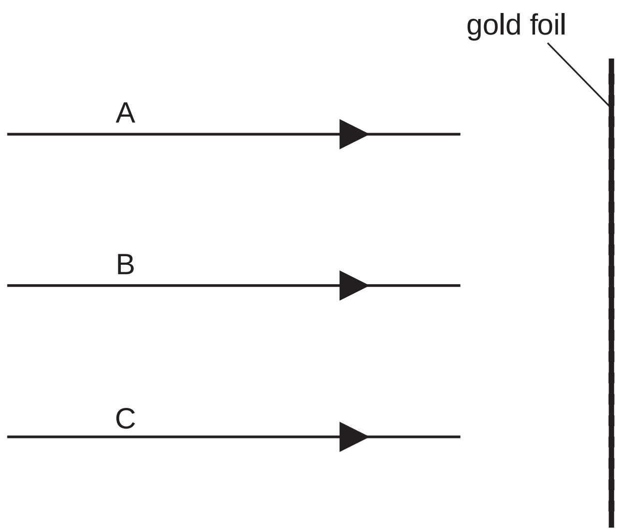

Fig. 11.1

Particle A is moving directly towards a gold nucleus.
Particle B is moving along a line which passes close to a gold nucleus.
Particle C is moving along a line which does not pass close to a gold nucleus.

(a) On Fig. 11.1, complete the paths of the α-particles A, B and C. [3]

(b) State how the results of such an experiment, using large numbers of α-particles, provides evidence for the existence of nuclei in gold atoms.

....

....

....

.... [3]

[Total: 12]

4 Fig. 11.1 shows an experiment to test the absorption of β-particles by thin sheets of aluminium. Ten sheets are available, each 0.5 mm thick.

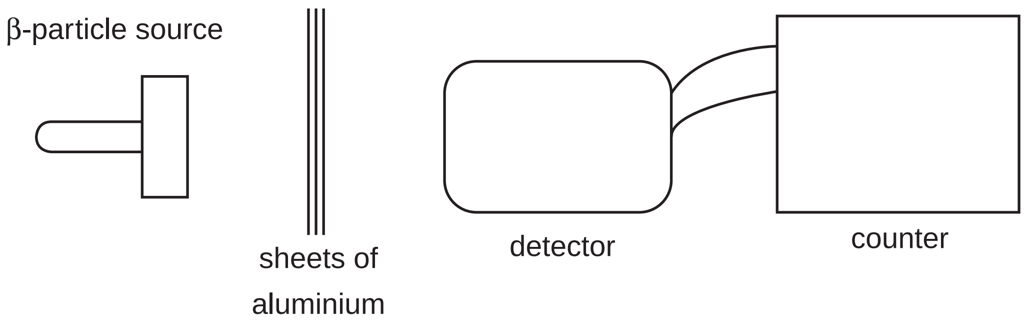

Fig. 11.1

(a) Describe how the experiment is carried out, stating the readings that should be taken.

....

....

....

....

.... [4]

(b) State the results that you would expect to obtain.

....

....

....

.... [2]

[Total: 6]

5 Fig. 11.1 shows a beam of radiation that contains α-particles, β-particles and γ-rays. The beam enters a very strong magnetic field shown in symbol form by N and S poles.

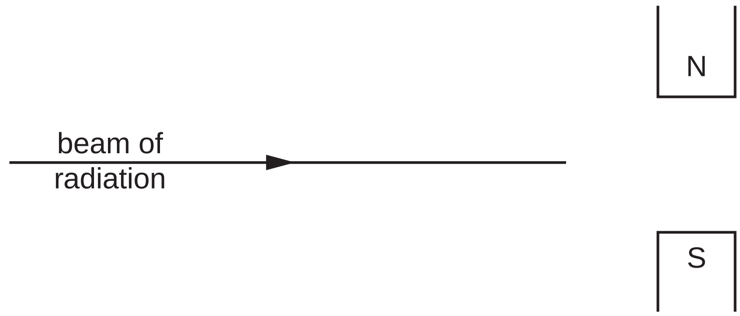

Fig. 11.1

Complete the table below.

radiation	direction of deflection, if any	charge carried by radiation, if any
α-particles		
β-particles		
γ-rays		

[6]

[Total : 6]

6 (a) α-particles, β-particles and γ-rays are known as ionising radiations.

(i) Describe what happens when gases are ionised by ionising radiations.

....

....

....

(ii) Suggest why α-particles are considered better ionisers of gas than β-particles.

....

....
[3]

(b) (i) Suggest two practical applications of radioactive isotopes.

1. ....

2. ....

(ii) For one of the applications that you have suggested, describe how it works, or draw a labelled diagram to illustrate it in use.

....

....

....

[4]

7 (a) Fig. 10.1 is the decay curve for a radioactive isotope that emits only β- particles.

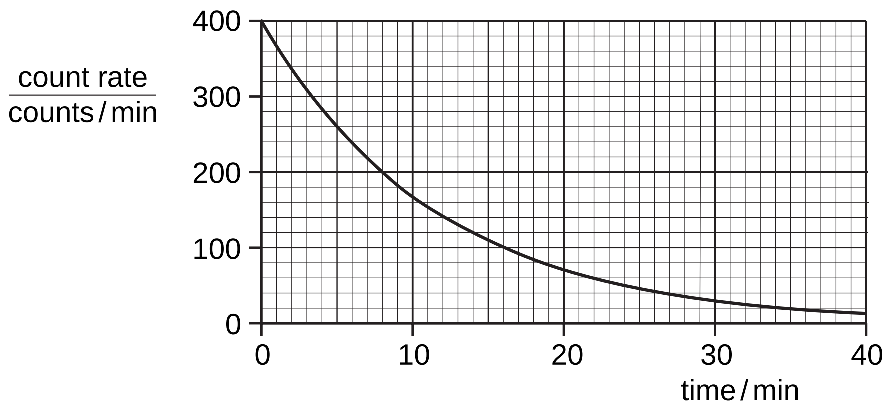

Fig. 10.1

Use the graph to find the value of the half-life of the isotope.

Indicate, on the graph, how you arrived at your value.

half-life ………………………… [2]

(b) A student determines the percentage of β-particles absorbed by a thick aluminium sheet. He uses a source that is emitting only β-particles and that has a long half-life.

(i) In the space below, draw a labelled diagram of the apparatus required, set up to make the determination.

[2]

(ii) List the readings that the student needs to take.

....

....

....

.... [3]

[Total : 7]