Radioactivity

Question Paper 1

Level	IGCSE
Subject	Physics (0625/0972)
Exam Board	Cambridge International Examinations (CIE)
Topic	General Physics
Sub-Topic	Radioactivity
Booklet	Question Paper 1

Time allowed: **21 minutes**

Score: **/17**

Percentage: **/100**

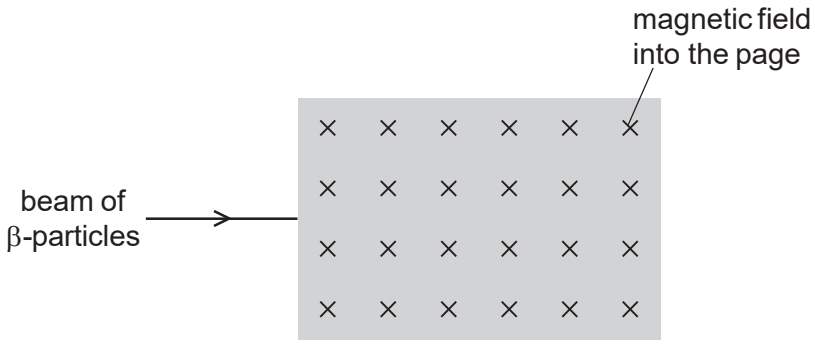
Grade Boundaries:

9	8	7	6	5	4	3	2	1
>85%	75%	68%	60%	55%	50%	43%	35%	<30%

Question 1

The diagram shows a shaded area where the direction of a magnetic field is into the page.

A beam of β-particles enters the field as shown.



In which direction is the beam of β-particles deflected as they enter the magnetic field?

A into the page

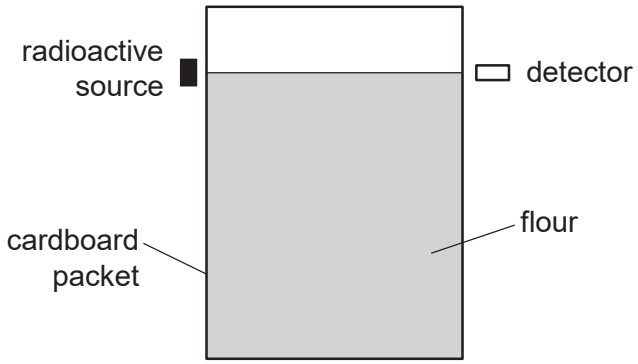
B out of the page

C down the page

D up the page

Question 2

The arrangement shown is used to check whether the flour inside a cardboard packet is above a certain level. If it is above this level, the flour absorbs the radiation from the source so that it doesn't reach the detector.



Which type of radiation is suitable to use?

A. α-particles only

B. β-particles only

C. either α-particles or β-particles

D. γ-rays only

A nucleus of americium $^{243}_{95}Am$ emits an α-particle to form a nucleus of neptunium (Np).

Which equation represents this decay?

A $^{243}_{95}Am \rightarrow {}^{247}_{97}Np + {}^{4}_{2}\alpha$

B $^{243}_{95}Am \rightarrow {}^{243}_{96}Np + {}^{0}_{-1}\alpha$

C $^{243}_{95}Am \rightarrow {}^{243}_{94}Np + {}^{0}_{-1}\alpha$

D $^{243}_{95}Am \rightarrow {}^{239}_{93}Np + {}^{4}_{2}\alpha$

Question 4

A reading is taken every 10 minutes of the number of emissions per second from a radioactive source. The table shows the readings.

time / min	number of emissions per second
0	800
10	560
20	400
30	280
40	200
50	140
60	100

What is the half-life of the source?

A 10 min B 20 min C 40 min D 60 min

A radioactive decay can be represented as shown.

$$^{233}_{91}\text{Pa} \rightarrow {}^{233}_{92}U$$

The equation is incomplete.

In this decay, the nucleus changes by

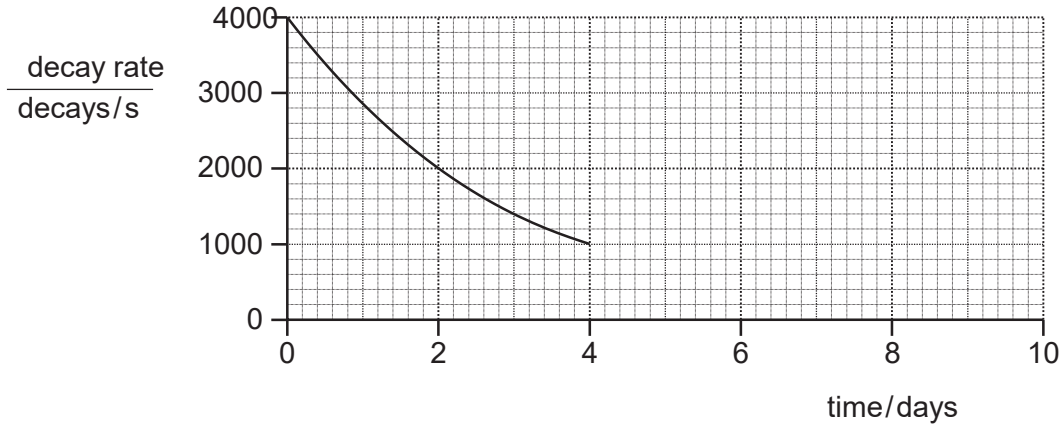
A. absorbing a neutron.

B. absorbing a proton.

C. emitting an α-particle.

D. emitting a β-particle.

The graph shows how the decay rate of a radioactive source changes with time.



What will be the decay rate at 8 days?

A. 0 decays/s

B. 125 decays/s

C. 250 decays/s

D. 500 decays/s

Sodium-24 decays to magnesium-24 according to the following equation.

$$^{24}_{11}\text{Na} \rightarrow {}^{24}_{12}\text{Mg} + \text{emitted particle}$$

What is the emitted particle?

A α-particle

B β-particle

C neutron

D proton

The reading on a detector placed near a radioactive material is 536 counts per second.

The background count rate is 44 counts per second.

The half-life of the radioactive material is 34 hours.

What is the reading on the detector after 68 hours?

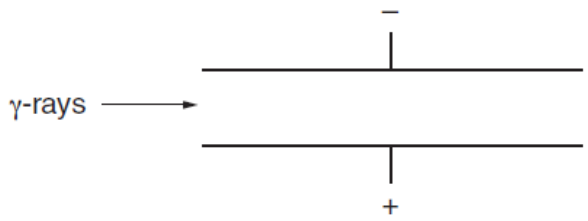
A 44 counts per second

B 123 counts per second

C 134 counts per second

D 167 counts per second

A beam of γ-rays passes between two charged metal plates as shown in the diagram.



How do the γ-rays pass between the two charged plates?

A. The rays are deflected in a direction perpendicular to the page

B. The rays are deflected towards the negative plate.

C. The rays are deflected towards the positive plate.

D. The rays will continue in the same direction.

A powder contains 400 mg of a radioactive isotope that emits α-particles.

The half-life of the isotope is 5 days.

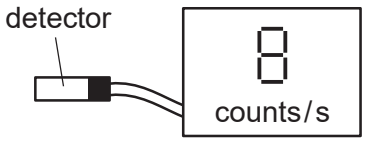
What mass of this isotope remains after 10 days?

A 0 mg B 40 mg C 100 mg D 200 mg

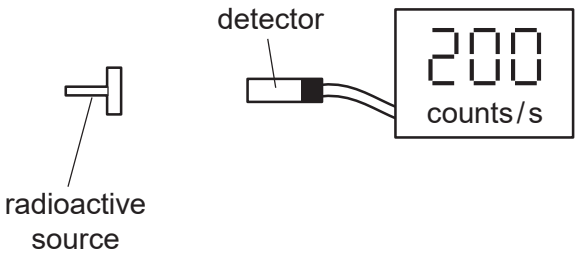
Which row gives the properties of the radiation from radioactive materials?

	most penetrating radiation	most highly ionising radiation
A	α	β
B	β	γ
C	γ	α
D	γ	γ

In a laboratory, a detector of ionising radiation records an average background count rate of 8 counts per second.



A radioactive source is now placed close to the detector. The count rate on the detector rises to 200 counts per second.



What is the count rate due to radiation from the radioactive source?

A 25 counts / s

B 192 counts/s

C 200 counts/s

D 208 counts/s

Which statement about α-radiation is correct?

A. It is a stream of fast-moving electrons.

B. It is a form of electromagnetic radiation.

C. It is more highly ionising than γ-radiation.

D. It is more penetrating than β-radiation.

Question 14

A radioactive source produces a count rate on a detector of 1600 counts/s.

After 32 hours the count rate has fallen to 100 counts/s.

Both count rates have been corrected for background radiation.

What is the half-life of the source?

A 2.0 hours B 6.4 hours C 8.0 hours D 16 hours

α, β and γ-radiations are emitted by radioactive substances.

Which statement is correct?

A. α-radiation consists of charged particles and is the most highly ionising radiation.

B. β-radiation consists of charged particles and is the most penetrating radiation.

C. β-radiation consists of uncharged particles and is the least highly ionising radiation.

D. γ-radiation consists of uncharged particles and is the least penetrating radiation.

A student investigates how the radiation from a radioactive source changes with time.

The table shows the results from the detector used by the student.

time / minutes	Count rate / counts per minute
0	340
2.0	180
4.0	100
6.0	60
8.0	40

The experiment is repeated by many other students, who also measure the count rate every two minutes.

The half-life of the source is known to be exactly 2.0 minutes.

Why is the measured count rate **always greater** than half the previous value?

A. Radioactive emissions occur randomly with time.

B. The detector used is very close to the source.

C. There is background radiation present.

D. The radioactive source is decaying.

Which row shows the relative ionising effects and penetrating abilities of α-particles and β-particles?

	ionising effect	penetrating ability
A	α greater than β	α greater than β
B	α greater than β	α less than β
C	α less than β	α greater than β
D	α less than β	α less than β