

Radioactive Emissions

Q1.(2018)

Atoms contain electrons. An atom can lose its outer electrons.

What is this process called?

- A Friction
- B Ionisation
- C Radiation
- D Radioactive decay

Your answer

[1]

Q2.(2018)

An element gives out a beta (β) particle.

The table shows how the atomic number and mass number of the element change.

	Atomic number	Mass number
A	Decreases by 2	Decreases by 4
B	Decreases by 4	Decreases by 2
C	Increases by 1	Stays the same
D	Stays the same	Increases by 1

Which row of the table is correct?

Your answer

[1]

Q3.(2018)

This question is about radioactivity.

(a) Two isotopes of nitrogen are shown below.



Explain what is meant by the term **isotopes**.

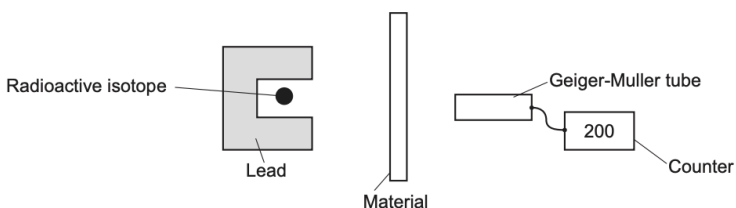
.....
.....
..... [2]

Q4.a(2018)

A teacher shows his class an experiment. The teacher wants to identify the type of radiation given out by a radioactive isotope.

He uses a Geiger-Muller tube connected to a counter to measure the count rate.

He places different materials between the radioactive isotope and the Geiger-Muller tube.



The table shows the count rate for different materials.

Material	Count rate
No material (air)	200
Thick paper	200
Thin aluminium	197
Thick lead	3

Suggest why the teacher places lead around most of the radioactive isotope.

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

Q4.b(2018)

There are three types of radiation, alpha, beta and gamma.

Which type of radiation is given out by the radioactive isotope?

.....

Explain your answer.

Use the data in the table to help.

.....
.....
.....
..... [3]

Q5.(2019)

Which statement is correct?

- A Changes in atoms and nuclei can generate radiations over a wide range of frequencies.
- B Changes in atoms and nuclei can generate radiations over a narrow range of frequencies.
- C Changes in atoms and nuclei do not generate radiations.
- D Changes in atoms and nuclei always generate radio waves.

Your answer

☐

[1]

Q6.(2019)

This question is about radioactive atoms.

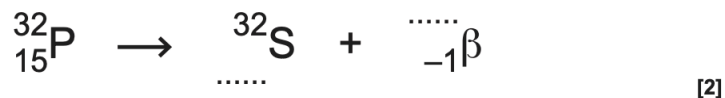
(a) Why are some atoms radioactive?

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

Q7.a(2019)

Phosphorus-32 ($^{32}_{15}\text{P}$) gives out beta particles.

(i) Complete the equation for the beta decay.



Q7.b(2019)

Phosphorus-32 **only** gives out beta particles.

Describe a simple experiment to show how this can be demonstrated in a laboratory.

You may include a diagram in your answer.

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..... [4]

Q7.c(2019)

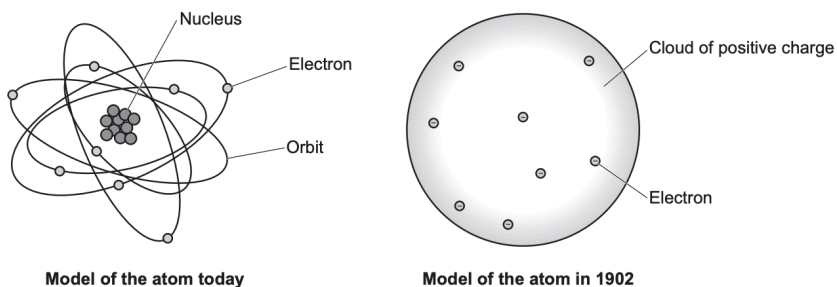
Beta particles are one type of radioactive particle.

Name a **different** particle given out by radioactive atoms.

..... [1]

Q8.a(2019)

- (d) Look at the diagram.
It compares the model of the atom today with a model of the atom in 1902.



- (i) Describe **two** differences between the models in the diagram.

1

2

[2]

Q8.b(2019)

Explain why the model of the atom has changed over time.

.....

..... [1]

Q9.a(2019)

This question is about radioactive decay.

A teacher models radioactive decay using 100 dice:

- she shakes a beaker containing 100 dice and empties the dice into a tray
- every time a number "6" lands face up, she removes that dice
- she places the remaining dice in the beaker and repeats the process.

Here are some of the results from this experiment.

Number of throws	Number of dice removed				Number of dice remaining
	Attempt 1	Attempt 2	Attempt 3	Mean	
1	16	18	17	17	83
2	15	14	14	14	69
3	10	12	11	11	58
4	10	9	10	10	48
5	8	9	7	8	40

- (a) Describe the difference between **mean**, **mode** and **median**.

In your answer use data from the second throw in the table (shaded in grey).

.....

.....

.....

.....

..... [3]

Q9.b(2019)

Use the table to estimate the half-life of the dice.

Give your answer to the **nearest whole number**.

Half-life = throws [1]

Q10.(2020)

Atoms contain protons, neutrons and electrons.

Which row in the table describes the **nucleus**?

	Nucleus contains	Charge on the nucleus
A	Electrons and neutrons	Negative
B	Protons and electrons	Neutral
C	Protons and neutrons	Neutral
D	Protons and neutrons	Positive

Your answer

[1]

Q11.a(2020)

A scientist measures the activity of a radioactive isotope. She uses a Geiger-Muller tube connected to a counter.

Table 12.1 shows her results.

Measurement	Activity (Bq)
1	701
2	708
3	704
4	707

Table 12.1

(i) What is the **mean** activity of the isotope?

Mean activity = Bq [1]

Q11.b(2020)

Is there a pattern in the results in **Table 12.1**?

Explain your answer using ideas about radioactivity.

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

Q12.a(2020)

Carbon-12 is a stable isotope. Carbon-14 is an unstable radioactive isotope.

Table 12.2 shows the contents of each nucleus.

	Carbon-12	Carbon-14
Number of protons	6	6
Number of neutrons	6	8

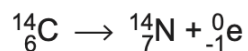
Table 12.2

Explain why carbon-12 and carbon-14 are isotopes.

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

Q12.b(2020)

This is the equation for the radioactive decay of carbon-14:



What happens to the **nuclear mass** (mass number) when carbon-14 decays?

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

Q13.a(2020)

Americium-241 is a radioactive isotope used in smoke alarms.

Table 12.3 shows how the activity of americium-241 changes.

Time (years)	Activity (Bq)
458	36 000
916	18 000
1374	9 000

Table 12.3

- (i) What is meant by the half-life of an isotope?

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

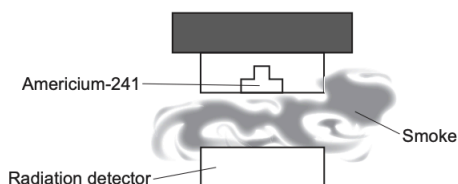
Q13.b(2020)

Use the data in **Table 12.3** to calculate the half-life of americium-241.

Half-life = years [1]

Q13.c(2020)

This is a diagram of a smoke alarm.



Smoke enters the smoke alarm, which blocks the radiation emitted by the americium-241.

A smoke alarm company decides to use a different isotope.

Table 12.4 shows the three choices of isotope.

Isotope	Radiation emitted	Half-life (years)
A	Alpha	2
B	Beta	400
C	Alpha	350

Table 12.4

Which isotope, **A**, **B** or **C**, is the best to use in a smoke alarm?

Tick (✓) **one** box.

A ☐

B ☐

C ☐

Explain your answer using the information in Table 12.4.

.....

.....

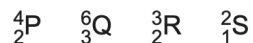
.....

.....

..... [3]

Q14.(2021)

P, Q, R and S are isotopes.



Which **two** atoms are isotopes of the **same** element?

A ${}^4_2\text{P}$ and ${}^3_2\text{R}$

B ${}^6_3\text{Q}$ and ${}^3_2\text{R}$

C ${}^3_2\text{R}$ and ${}^2_1\text{S}$

D ${}^4_2\text{P}$ and ${}^2_1\text{S}$

Your answer ☐

[1]

Q15.a(2021)

This question is about two radioactive isotopes, **X** and **Y**.

(a) Draw lines to connect each **part of the atom** with its correct **description**.

Part of the atom

Description

Electrons

Usually found in the nucleus.

Neutrons

Unstable in radioactive isotopes.

Nucleus

Arranged in shells around the nucleus.

Protons

[3]

Q15.b(2021)

Isotope **X** gives out gamma rays.

(i) The charge on the nucleus of isotope **X** stays the same.

What happens to the mass number of the nucleus?

..... [1]

Q15.c(2021)

Isotope **X** is stored safely in a container.

Suggest a material for the container.

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

Q15.d(2021)

Describe how an object can be **irradiated** using isotope **X**.

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

Q15.e(2021)

Equal amounts of isotope Y are placed in a plastic box and in a cardboard box.

Table 11.1 gives information about both boxes.

	Plastic box	Cardboard box
Waterproof	yes	no
Material breaks easily	no	yes
Secure lid	yes	no

Table 11.1

(i) Which box is best for storing isotope Y?

Give **one** reason for your answer using the information in Table 11.1.

.....

 [1]

Q15.f(2021)

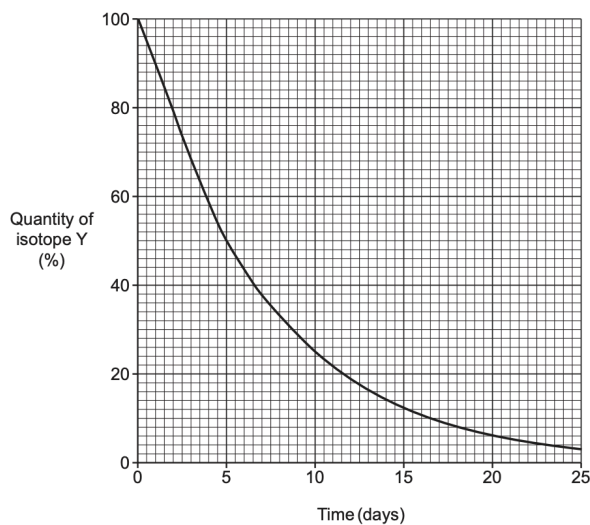
The plastic box does not let any of the radiation emitted by isotope Y pass through it.

Which type of radiation does isotope Y emit?

..... [1]

Q15.g(2021)

The graph shows how the quantity of isotope Y changes with time.



(i) Complete Table 11.2 using the graph to help you.

Time (days)	Quantity of isotope Y (%)
5	
10	

Table 11.2

[1]

Q15.h(2021)

Explain why the half-life of isotope Y is 5 days.

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

Q16.(2022)

Some radioactive elements give out beta radiation.

What is beta radiation stopped by?

- A Aluminium
- B Thin cardboard
- C Thin paper
- D Skin

Your answer ☐

[1]

Q17.(2022)

Uranium-238 is a radioactive isotope.

When uranium decays, it gives out an alpha particle forming thorium-234.

Complete the radioactive decay equation using the symbols below:



You must write **one** symbol in **each** box.



[2]

Q18.(2022)

OCR [Physics] | Foundation
Topic [2]: [Radioactivity]

Atoms can give out different types of electromagnetic radiation.

Draw lines to connect each **question** with its correct **answer**.

Question	Answer
Which radiation is given out by atoms?	Radiation with a large range of frequencies
	Radiation with a small range of frequencies
	Only gamma radiation
Which radiation is detected by our eyes?	Only infra-red radiation

[2]

Q19.(2022)

This question is about radioactivity.

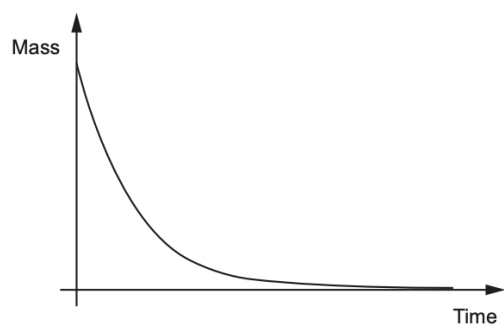
- (a) Which statements about the nucleus of an atom are correct?
Tick (✓) **two** boxes.

In radioactive atoms, the nucleus is stable.	☐
Most of the nucleus contains empty space.	☐
Scientists can say exactly when a nucleus will emit radiation.	☐
The diameter of a nucleus is approximately 1 nm.	☐
The mass of a nucleus is much less than the mass of an atom.	☐
The nucleus contains protons and electrons.	☐
The nucleus contains protons and neutrons.	☐
The nucleus has a positive charge.	☐

[2]

Q20.(2022)

The graph shows how the mass of a radioactive element changes with time.



Describe the trend shown by the graph.

.....

.....

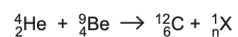
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..... [2]

Q21.(2023)

When an alpha particle hits a beryllium nucleus, a particle 'X' is emitted.

What is the missing number, labelled **n** in the equation?



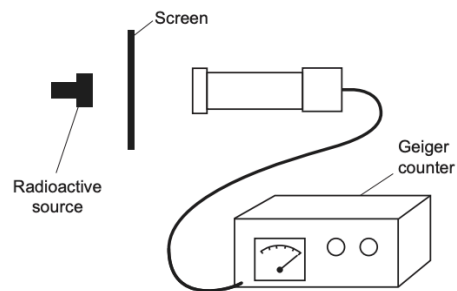
- A** -1
- B** 0
- C** 1
- D** 2

Your answer

[1]

Q22.(2023)

The diagram shows the teacher's experiment.



Type of screen	Source	Count rate (counts per minute)
none	no	20
none	yes	2010
paper	yes	2000
4 mm thick aluminium sheet	yes	18
1 cm thick lead sheet	yes	21

[6]

- A** They form a neutron.
- B** They form a new element.
- C** They move from a high energy level to a lower energy level.
- D** They move from a low energy level to a higher energy level.

7

[1]

Q24.(2024)

Some students design a practical to model radioactive decay.

Which model is correct?

- A Throw a coin in the air 100 times and count the number of heads or tails.
- B Throw 10 dice in a tray 10 times and add up the scores.
- C Throw 100 dice in a tray and remove the ones with a 6 facing up.
- D Throw 100 identical wooden blocks in a tray.

Your answer

[1]

Q25.a(2024)

This question is about radioactivity.

Some atoms and isotopes of elements are shown.



Which statements are correct for these atoms and isotopes?
Tick (✓) **three** boxes.

${}^7_3\text{Li}$ and ${}^3_1\text{H}$ are isotopes.

☐

${}^7_3\text{Li}$ contains 3 protons and 4 neutrons.

☐

${}^{14}_7\text{N}$ and ${}^{15}_7\text{N}$ are isotopes.

☐

The atomic number of hydrogen is 3.

☐

The atomic number of nitrogen is 7.

☐

The mass number of lithium is 4.

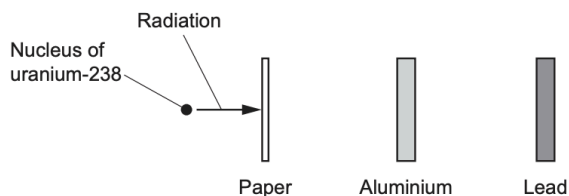
☐

[3]

Q25.b(2024)

A nuclear scientist investigates the radiation emitted when a nucleus of uranium-238 decays.

The diagram shows the experiment.



Which type of radiation is emitted by uranium-238?

Put a ring around the correct answer.

alpha particles

beta particles

gamma rays

[1]

Q25.c(2024)

Thorium-234 decays by emitting beta radiation.

What happens to the mass number and charge of a nucleus of thorium-234 when it decays?

Draw **one** line from **each** quantity to what happens.

Quantity	What happens
Mass number	decreases by 4
	decreases by 1
Charge	increases by 1
	stays the same

[2]

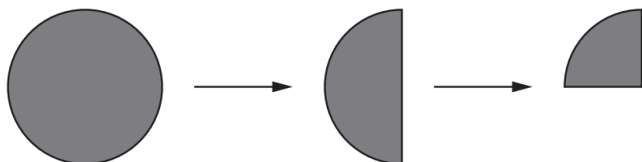
Q25.d(2024)

Why do some atoms emit nuclear radiation?

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

Q25.e(2024)

The diagram shows how the amount of a radioactive element changes over a total of 30 days.



Calculate the half-life of this radioactive element.

Half-life = days [2]