

Atomic structure – GCSE CS Physics1. **No.1****0 1**

A scientist investigated the radiation emitted by different radioactive isotopes.

The scientist had a sample of polonium-210.

The radiation emitted by polonium-210 can be represented by the symbol ${}^4_2\text{He}$.**0 1****. 1** Which type of radiation can be represented by the symbol ${}^4_2\text{He}$?**[1 mark]**Tick (✓) **one** box.

Alpha

☐

Beta

☐

Gamma

☐**0 1****. 2** How many protons are there in a particle of radiation represented by ${}^4_2\text{He}$?**[1 mark]**Tick (✓) **one** box.

2

☐

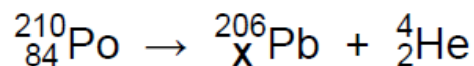
4

☐

6

☐

8

☐**0 1****. 3** A polonium-210 (Po) nucleus changes into a lead (Pb) nucleus by emitting a ${}^4_2\text{He}$ particle. This is shown by the following nuclear equation.

What is the value of X?

[1 mark]Tick (✓) **one** box.

80

☐

82

☐

84

☐

86

☐

0 1 . 4

The sample of polonium-210 had an activity of 100 Bq.

Complete the sentence.

Choose the answer from the box.

[1 mark]

25	50	100	200
----	----	-----	-----

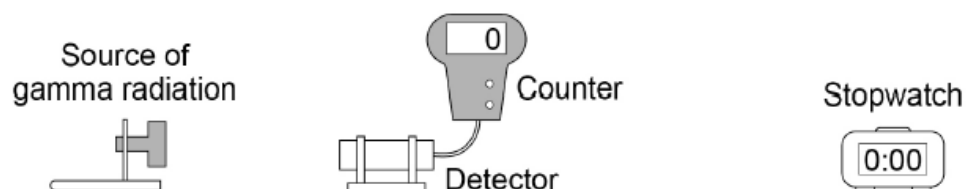
After one half-life, the activity of polonium-210 in the sample

was _____ Bq.

The scientist investigated another radioactive isotope that is a source of gamma radiation.

Figure 1 shows the equipment used.

Figure 1



0 1 . 5

The count-rate is the number of counts detected each second.

In 30 seconds the number of counts detected was 1500.

Calculate the count-rate.

[2 marks]

Count-rate = _____ counts per second

The scientist placed a thick sheet of lead between the source of gamma radiation and the detector.

0 1 . 6

What was the effect of the sheet of lead on the count-rate?

Give a reason for your answer.

[2 marks]

Effect _____

Reason _____

0 1 . 7

The lead was irradiated by the gamma radiation.

What happened to the lead when it was irradiated by the gamma radiation?

[1 mark]

Tick (✓) **one** box.

The lead atoms became radioactive.

☐

The lead gained atoms from the radioactive source.

☐

The lead was exposed to gamma radiation.

☐

0 1 . 8

Gamma radiation is emitted from the nucleus of an atom.

Complete the sentence.

Choose the answer from the box.

[1 mark]

electromagnetic waves

high speed electrons

neutrons

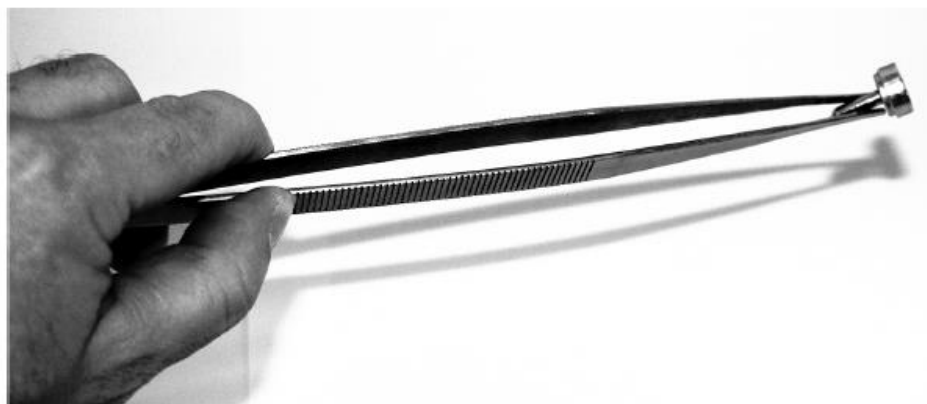
positively charged ions

Gamma radiation consists of _____.

0 1 . 9

Figure 2 shows the scientist holding the radioactive source using tongs.

Figure 2



Suggest **one** reason why using long tongs rather than short tongs was safer for the scientist.

[1 mark]

2. No.4

0 4

A scientist investigated a sample of a radioactive material to determine if it would be suitable for medical use.

0 4 . 1

The method, results and conclusions of the scientist will need to be checked by other scientists before the results of the investigation are published.

What name is given to this checking process?

[1 mark]

0 4 . 2

There is an increased risk of cancer if the scientist is irradiated by nuclear radiation.

What property of nuclear radiation causes the increased risk of cancer?

[1 mark]

0 4 . 3

The activity of a radioactive source is the rate at which the nuclei of the source decay.

What is the unit for the activity of a radioactive source?

[1 mark]

0 4 . 4

The scientist placed a radiation detector near the sample and measured the count-rate.

Explain why the count-rate is less than the activity of the sample.

[2 marks]

0 4 . 5

The scientist recorded the count-rate from the sample with the radiation detector at different distances from the sample.

Table 2 shows the results.

Table 2

Distance between the sample and the detector in centimetres	Count-rate in counts/second
2.0	300
5.0	24
10.0	0

Explain which type of radiation was emitted by the sample.

[2 marks]

0 4 . 6 The scientist moved the detector closer to the sample and started a stopwatch.

The scientist measured the count-rate from the sample at different times.

Table 3 shows some of the results.

Table 3

Time in minutes	Count-rate in counts/second
0	1568
30	X
60	98

The scientist realised that 30 minutes is a whole number of half-lives.

Calculate the value of **X** in **Table 3**.

[3 marks]

X = _____ counts/second

0 4 . 7

The scientist had a second sample of the radioactive material.

The scientist made appropriate measurements, then calculated the half-life of each sample.

Why was the half-life calculated from the second sample slightly different from the half-life calculated from the first sample?

[1 mark]

Tick (✓) one box.

Radioactive decay is a random process.

☐

The count-rate from a radioactive sample is predictable.

☐

The samples were at different temperatures.

☐

The size of each sample was different.

☐