

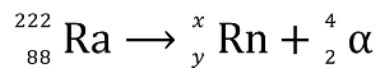
0 1 . 1

Complete the below table which describes the properties of three types of nuclear radiation.

Type of radiation	Description	Typical range in air	Stopped by
Alpha	Helium nucleus	5 – 10 cm	Paper
Beta	Fast-moving electron	10 cm – several metres	Thin sheet of aluminium
Gamma	Electromagnetic radiation	Very long	Thick sheet of lead/concrete

0 1 . 2

An incomplete nuclear equation for the alpha decay of radium-222 is as follows:



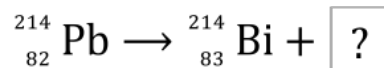
Calculate the values of the constants x and y .

$$x = 218$$

$$y = 86$$

0 1 . 3

Another unstable isotope, lead-214, decays by a different process to form bismuth-214:



Determine the particle which lead-214 must emit to allow this decay to take place.

$$\text{Mass number, (A)} = 214 - 214 = 0$$

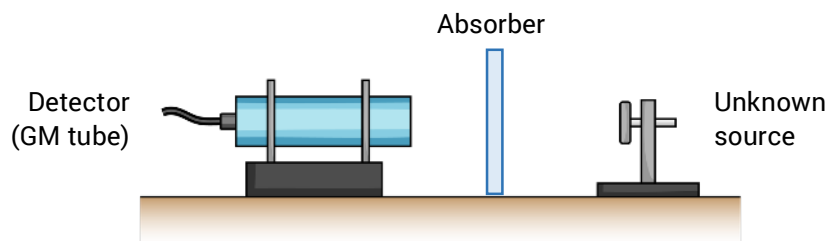
$$\text{Atomic number (Z)} = 82 - 83 = -1$$

Particle: Electron / beta (minus) particle

0 2

A radioactive waste adviser is asked to identify the type (or types) of nuclear radiation which are emitted by an unknown source.

She uses the following setup to investigate the source:



From her investigation, she obtains the following results:

Absorber used	None	Sheet of paper	Aluminium sheet	Thick piece of lead
Count rate in counts per second	210	90	90	27

0 2 . 1

State the type (or types) of radiation which are emitted by the source.

Alpha and gamma [1]

0 2 . 2

Explain your previous answer.

When paper is used as an absorber, the count rate fell (from 210 to 90 per second), so the source must be emitting alpha particles (as alpha particles are absorbed by paper) [1]. When aluminium sheet is used, the count rate did not fall, so the source is NOT emitting beta particles (beta particles are stopped by aluminium sheet) [1]. When thick lead was used as the absorber, the count rate fell (from 90 to 27), so the source must be emitting gamma rays (as gamma rays are stopped by lead) [1].

0 2 . 3

When the source is removed from the room, the GM tube still registers approximately 25 counts per second. Explain why.

These counts are due to the background radiation which is always present in the environment.