MR SULLY UNFOLDS PHYSICS ANSWERS

Nuclear radiation and nuclear equations

AQA 4.4.2.1–4.4.2.2
Atomic structure · Paper 1
Foundation & Higher

Name _____ Class _____ Date _____

Unstable nuclei give out radiation to become more stable. The three main types are alpha, beta and gamma.

KEY FACTS

Radiation	What it is	Ionising	Stopped by
Alpha (α)	2 protons + 2 neutrons	Strongly	Paper / few cm of air
Beta (β)	Fast electron from the nucleus	Moderately	Few mm of aluminium
Gamma (γ)	EM radiation	Weakly	Thick lead / concrete (reduces)

Section A · Recall

Grade 4–5

1 Which type of radiation is the most ionising? [1]

Alpha

2 Which type of radiation is an electromagnetic wave? [1]

Gamma

3 Radioactive decay is random. What does this mean? [1]

You cannot predict when a particular nucleus will decay.

4 Define activity and give its unit. [2]

The rate at which a source of unstable nuclei decays.

Measured in becquerels (Bq).

Section B · Nuclear equations

Grade 5–6

5 Complete each statement. [3]

Alpha decay: mass number decreases by 4; atomic number decreases by 2.

Beta decay: mass number stays the same; atomic number increases by 1.

Gamma emission: no change to mass number or atomic number.

6 Radium-226 (atomic number 88) decays by alpha emission into radon. Give the mass number and atomic number of radon. [2]

Mass number 222, atomic number 86

7 Carbon-14 (atomic number 6) decays by beta emission into nitrogen. Give the mass number and atomic number of nitrogen. [2]

Mass number 14, atomic number 7

Section C · Stretch

Grade 7+

8 Explain what happens inside the nucleus during beta decay. [2]

A neutron turns into a proton,

and a high-speed electron (beta particle) is emitted from the nucleus.

Exam-style question

AQA style

9 A teacher tests an unknown radioactive source with a detector, placing different absorbers between them.

Absorber	Count-rate (counts/min)
No absorber	520
Paper	515
3 mm aluminium	140
5 cm lead	25

a The background count is 25 counts/min. Use the results to identify the radiation(s) emitted. Explain your answer. [4]

Paper hardly changes the count, so there's no alpha.

Aluminium greatly reduces it, so beta is emitted.

Some passes through aluminium but lead brings it down to background,

so gamma is also emitted.

b Suggest one safety precaution the teacher should take. [1]

Use long tongs / keep the source at a distance / minimise exposure time / store in a lead box.

Total: _____ / 19

How confident am I?

	Not yet	Nearly	Got it
I can compare alpha, beta and gamma	☐	☐	☐
I can write and balance nuclear equations	☐	☐	☐
I can use absorber data to identify radiation	☐	☐	☐