AP PHYSICS 2 • EXERCISE SHEET

15.8 Types of Radioactive Decay

Name: _____ Class: _____ Date: _____ **Total: 10 marks**

Objective

Build the skills to answer exam questions on **types of radioactive decay**.

You must be able to:

- describe **alpha** 阿尔法, **beta** 贝塔, and **gamma** 伽马 decay and what each emits
- write balanced nuclear equations that conserve nucleon number and charge
- compare the penetrating power of the three types

1 Worked examples

Study these first. Each one shows the method for a question type used later.

The three decays

- **Alpha** —emits a helium nucleus ($^4_2$He).
- **Beta** —emits a fast electron.
- **Gamma** —emits a high-energy photon (electromagnetic wave).

Balanced nuclear equations

Both the **nucleon number** (top) and the **charge** (bottom) must balance on each side.

Penetrating power

Alpha is the **least** penetrating (stopped by paper); beta is stopped by aluminium; **gamma is the most** penetrating (needs thick lead).

2 Practice

2.1 State what is emitted in alpha, beta, and gamma decay. [2]

2.2 State which type of radiation is the most penetrating. [1]

2.3 In alpha decay, state how the mass number and the atomic number change. [2]

3 Exam-style questions

3.1 An alpha particle is a [1]

- **A** helium nucleus
- **B** fast-moving electron
- **C** high-energy photon
- **D** single proton

3.2 The most penetrating type of radiation is [1]

- **A** alpha
- **B** beta
- **C** gamma
- **D** all equally penetrating

3.3 A nucleus $^{238}_{92}\mathrm{U}$ emits an alpha particle.

(a) State the mass number of the new nucleus. [1]

(b) State its atomic number. [1]

(c) Name the two quantities that must be conserved in the equation. [1]

4 Go further

- work through the **15.8 Types of Radioactive Decay** lesson on the **Learn** page;
- read the **Modern Physics** section of the AP Physics 2 handout on the **Know** page.

Solutions

2.1 alpha: a helium nucleus; beta: a fast electron; gamma: a high-energy photon.

2.2 gamma.

2.3 the mass number decreases by 4 and the atomic number decreases by 2.

3.1 A.

3.2 C.

3.3 (a) $238 - 4 = 234$. (b) $92 - 2 = 90$. (c) nucleon number and charge.