

15.6 Compton Scattering

Name: _____ Class: _____ Date: _____

Total: 9 marks

KEY WORDS compton scattering 康普顿散射 • momentum 动量

Objective

Build the skills to answer exam questions on **Compton scattering**.

You must be able to:

- describe **Compton scattering** 康普顿散射 as a photon colliding with an electron
- explain that the scattered photon has a longer wavelength (lower energy)
- state that Compton scattering conserves both energy and **momentum** 动量

1 Worked examples

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

■ Compton scattering

A photon collides with an electron much like two particles — clear evidence of the **particle** nature of light.

■ Wavelength shift

The photon gives some energy to the electron, so the **scattered photon has less energy** and therefore a **longer wavelength**.

■ Conservation

Both **energy** and **momentum** are conserved in the collision.

2 Practice

2.1 State what Compton scattering involves. [1]

2.2 State what happens to the photon's wavelength after scattering. [1]

2.3 State the two quantities conserved in Compton scattering. [2]

3 Exam-style questions

3.1 In Compton scattering, the scattered photon has a [1]

- **A** shorter wavelength
 - **B** longer wavelength
 - **C** higher frequency
 - **D** unchanged energy
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3.2 Compton scattering treats light as a [1]

- **A** wave
 - **B** particle
 - **C** field
 - **D** fluid
-

3.3 A photon scatters off a stationary electron.

(a) State what happens to the photon's energy. [1]

(b) Explain your answer using conservation of energy. [2]

Solutions

2.1 a photon colliding with an electron.

2.2 it increases (the wavelength gets longer).

2.3 energy and momentum.

3.1 B.

3.2 B.

3.3 (a) it decreases. (b) the photon transfers some energy to the electron; by conservation of energy the photon is left with less, so its frequency falls and wavelength grows.