

Exercise walk-through

Compton Scattering ■ 15.6

eXercise

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

Method — Compton scattering

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

Method — Wavelength shift

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

Method — Conservation

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

Practice 2.1 ■ 1 mark

State what Compton scattering involves.

Solution 2.1

Method: Compton scattering

Worked steps

a photon colliding with an electron **B1**.

Practice 2.2 ■ 1 mark

State what happens to the photon's wavelength after scattering.

Solution 2.2

Worked steps

it increases (the wavelength gets longer) **B1**.

Practice 2.3 ■ 2 marks

State the two quantities conserved in Compton scattering.

Solution 2.3

Method: Compton scattering

Worked steps

energy and momentum **B1** **B1**.

Exam-style 3.1 ■ 1 mark

In Compton scattering, the scattered photon has a

A shorter wavelength

B longer wavelength

C higher frequency

D unchanged energy

Solution 3.1

Method: Compton scattering

A shorter wavelength

B longer wavelength 

C higher frequency

D unchanged energy

Worked steps

B.

Exam-style 3.2 ■ 1 mark

Compton scattering treats light as a

A wave

B particle

C field

D fluid

Solution 3.2

Method: Compton scattering

A wave

B particle



C field

D fluid

Worked steps

B.

Exam-style 3.3 ■ 1 mark

A photon scatters off a stationary electron.

- (a) State what happens to the photon's energy.
- (b) Explain your answer using conservation of energy.

Solution 3.3

Method: Wavelength shift

Worked steps

(a) it decreases **B1**. (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 **B1 B1**.