

Exercise walk-through

Emission and Absorption Spectra ■ 15.3

eXercise

You must be able to

- explain how discrete energy levels produce line **emission** 发射 and **absorption** 吸收 spectra
- relate each spectral line to a specific electron transition
- describe how spectra identify the elements in a gas or a star

Method — Line spectra

Because energy levels are **discrete**, an atom emits or absorbs only certain photon energies — giving sharp **lines**, not a continuous band.

Method — Emission vs absorption

- **Emission** — bright lines from photons **released** as electrons drop down.
- **Absorption** — dark lines where photons are **absorbed** to lift electrons up.

Method — A fingerprint

Each element has a unique set of lines, so spectra identify the elements in a gas or star.

Practice 2.1 ■ 2 marks

Explain why atoms produce line spectra rather than continuous ones.

Solution 2.1

Method: Line spectra

Worked steps

the energy levels are discrete **B1**, so only certain photon energies (and wavelengths) can be emitted or absorbed **B1**.

Practice 2.2 ■ 2 marks

State the difference between an emission and an absorption spectrum.

Solution 2.2

Method: Emission vs absorption

Worked steps

an emission spectrum is bright lines from emitted photons; an absorption spectrum is dark lines where photons are absorbed **B1** **B1**.

Practice 2.3 ■ 1 mark

State how a spectrum can identify an element.

Solution 2.3

Method: A fingerprint

Worked steps

each element has a unique pattern of lines **B1**.

Exam-style 3.1 ■ 1 mark

Line spectra are evidence that atomic energy levels are

A continuous

B quantized

C all zero

D random

Solution 3.1

Method: Line spectra

A continuous

B quantized 

C all zero

D random

Worked steps

B.

Exam-style 3.2 ■ 1 mark

A spectrum of dark lines on a bright background is produced by

A emission

B absorption

C reflection

D diffraction

Solution 3.2

Method: Emission vs absorption

A emission

B absorption



C reflection

D diffraction

Worked steps

B.

Exam-style 3.3 ■ 1 mark

The light from a star shows dark lines that match those of hydrogen.

- (a) Name this type of spectrum.
- (b) State what it tells us about the star.

Solution 3.3

Worked steps

(a) an absorption spectrum **B1**. (b) hydrogen is present in the star's outer layers, absorbing those wavelengths **B1 B1**.