

15.3 Emission and Absorption Spectra

Name: _____ Class: _____ Date: _____

Total: 10 marks

Objective

Build the skills to answer exam questions on **emission and absorption spectra**.

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

1 Worked examples

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

■ Line spectra

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

■ Emission vs absorption

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

■ A fingerprint

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

2 Practice

2.1 Explain why atoms produce line spectra rather than continuous ones. [2]

2.2 State the difference between an emission and an absorption spectrum. [2]

2.3 State how a spectrum can identify an element. [1]

3 Exam-style questions

3.1 Line spectra are evidence that atomic energy levels are [1]

- **A** continuous
- **B** quantized
- **C** all zero
- **D** random

3.2 A spectrum of dark lines on a bright background is produced by [1]

- **A** emission
- **B** absorption
- **C** reflection
- **D** diffraction

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

(a) Name this type of spectrum. [1]

(b) State what it tells us about the star. [2]

4 Go further

- work through the **15.3 Emission and Absorption Spectra** lesson on the **Learn** page;

- read the **Modern Physics** section of the AP Physics 2 handout on the **Know** page.

Solutions

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

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

2.3 each element has a unique pattern of lines.

3.1 B.

3.2 B.

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