

Exercise walk-through

The Bohr Model of Atomic Structure ■ 15.2

eXercise

You must be able to

- describe the **Bohr model 玻尔模型** with electrons in discrete, quantized **energy levels 能级**
- explain that an electron absorbs or emits a photon when it changes level
- relate the photon energy to the difference between levels, $E = hf = E_i - E_f$

Method — The Bohr model

Electrons occupy only certain **discrete** energy levels — their energy is **quantized**, not continuous.

Method — Photons and level changes

An electron **absorbs** a photon to jump up a level and **emits** a photon when it drops down.

Method — Photon energy

$E = hf = E_i - E_f$ — the photon carries exactly the energy difference between the two levels.

Practice 2.1 ■ 1 mark

State what is meant by quantized energy levels.

Solution 2.1

Method: The Bohr model

Worked steps

the electron can only have certain allowed energy values, not any value in between **B1**.

Practice 2.2 ■ 1 mark

State what happens when an electron drops to a lower energy level.

Solution 2.2

Method: Photons and level changes

Worked steps

it emits a photon carrying the energy difference **B1**.

Practice 2.3 ■ 2 marks

An electron falls from a level at -1.5 eV to one at -3.4 eV . Find the energy of the emitted photon.

Solution 2.3

Method: Photons and level changes

Worked steps

$$E = E_i - E_f = (-1.5) - (-3.4) = 1.9 \text{ eV} \quad \text{M1} \quad \text{A1}.$$

Exam-style 3.1 ■ 1 mark

In the Bohr model, the electron energy levels are

A continuous

B quantized

C all zero

D infinite

Solution 3.1

Method: The Bohr model

A continuous

B quantized



C all zero

D infinite

Worked steps

B.

Exam-style 3.2 ■ 1 mark

An electron emits a photon when it

- A** stays in a level
- B** moves to a higher level
- C** moves to a lower level
- D** leaves the atom

Solution 3.2

Method: Photons and level changes

- A stays in a level
- B moves to a higher level
- C moves to a lower level 
- D leaves the atom

Worked steps

C.

Exam-style 3.3 ■ 2 marks

An electron drops from a level at -0.85 eV to one at -3.4 eV .

- (a) Find the energy of the photon, in eV.
- (b) State whether the photon is absorbed or emitted.

Solution 3.3

Method: Photons and level changes

Worked steps

(a) $E = (-0.85) - (-3.4) = 2.55 \text{ eV}$ **M1** **A1**. (b) emitted (the electron drops to a lower level) **B1**.