

Structure of the atom · supported focus

Supported focus · HL

Supported scope

- Supported HL focus. First assessment 2025; full Physics guide acquired (84 PDF pages). Remaining guide, assessment and practical requirements retain their recorded holds.
- State model conditions and distinguish fictional data from measurements.

Atomic Spectra · 1.1

Reasoning

An excited gas produces separate coloured lines rather than every wavelength. The pattern is evidence for discrete atomic energy differences. Start with a prediction. State the quantities or features you would compare, then decide what evidence could distinguish two explanations.

Atomic Spectra · 2.1

Reasoning

Atoms have a small positive nucleus and electrons. Emission and absorption spectra arise from transitions between discrete energy levels . A photon energy equals the level difference and obeys $E = hf$. emission spectrum : Wavelength pattern of radiation emitted by a source; energy level: An allowed energy state in a model.

Atomic Spectra · 3.1

Reasoning

An emitted photon corresponds to a transition to a lower energy level. Absorption requires a compatible energy difference. Rutherford scattering supported a small dense nucleus, but that experiment alone did not establish the complete quantum model. Read a labelled energy-level diagram before calculating. Keep joules and electronvolts distinct and use the given constants. Compare attributed spectra at a common wavelength scale and avoid looking at unsafe light sources.

Atomic Spectra · 4.1

Reasoning

State the known values and their units. Choose the relation because its assumptions fit this case, then rearrange before substitution. Known: energy levels are -6.0 and -2.0 eV. A downward transition releases $4.0 \text{ eV} = 6.4 \times 10^{-19} \text{ J}$ using $1 \text{ eV} = 1.6 \times 10^{-19} \text{ J}$. With $h = 6.4 \times 10^{-34} \text{ J s}$ for this rounded exercise, frequency is $1.0 \times 10^{15} \text{ Hz}$.

Atomic Spectra · 4.2

Reasoning

Levels are -7.0 and -2.0 eV. Find the energy emitted in the downward transition. Use the same sequence: known quantities $\rightarrow$ model $\rightarrow$ relation $\rightarrow$ substitution $\rightarrow$ unit and interpretation.

Atomic Spectra · 5.1

Reasoning

Negative bound-state energies are relative to a chosen zero; they do not mean a negative photon energy is emitted. A larger downward energy difference gives higher frequency. Return to the original observation. Explain what the result supports, which conditions it assumes, and one way to test a competing explanation.

Atomic Spectra · 5.2

Reasoning

A negative bound-state energy means an emitted photon has negative energy. This claim is false: Negative bound-state energies are relative to a chosen zero; they do not mean a negative photon energy is emitted. A larger downward energy difference gives higher frequency.

Atomic Spectra · 5.3

Reasoning

Atomic models and line spectra: An emitted photon corresponds to a transition to a lower energy level. Absorption requires a compatible energy difference. Rutherford scattering supported a small dense nucleus, but that experiment alone did not establish the complete quantum model.

Atomic Spectra · diagram



- Original teaching diagram: Atomic models and line spectra
- Use the labels and the stated model together.

Atomic Spectra · original transfer

Your turn

Levels are -8 , -3 and -1 eV. List all downward photon energies and identify the shortest wavelength. State why these are discrete candidates.

Atomic Spectra · transfer reasoning

Method and interpretation

Differences are 5, 7 and 2 eV; 7 eV has shortest wavelength because $E=hc/\lambda$.
Selection rules and populations may suppress a candidate transition.

Check yourself

- Explain energy level using the stated model.
- Explain emission spectrum using the stated model.
- Change one value in the original transfer; explain which assumption still matters.