MODERN PHYSICS DAY 7: THE BOHR MODEL AND QUANTIZED ENERGY LEVELS

CED 15.2 · Skill 2.A · FRQ: Multiple Representations

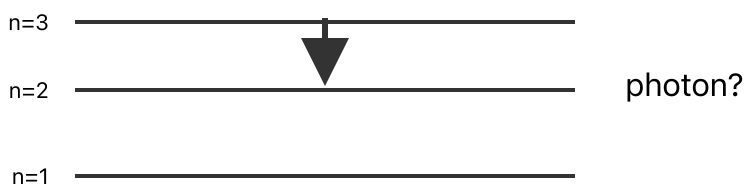
PREDICT

A hydrogen electron changes from $n = 3$ to $n = 2$. What happens?

A. a photon is emitted **B. a photon is absorbed** **C. any energy may be released** **D. the atom is ionized**

Use the arrow direction before calculating the gap.

TRANSITION OUTCOME WITHHELD



State whether the atomic energy increases or decreases.

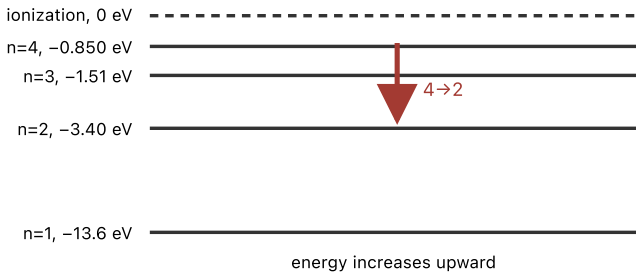
NOTES / REASONING

ALLOWED HYDROGEN ENERGIES

$$E_n = \frac{-13.6\,\text{eV}}{n^2}$$

Bound-state energies are negative. The $0\,\text{eV}$ reference is a free electron at rest far from the proton.

HYDROGEN LEVELS AND A 4→2 TRANSITION



Use the equation to verify the displayed energies for $n = 2$ and $n = 4$.

FROM AN ENERGY GAP TO A PHOTON

WE DO For the $n = 4 \rightarrow n = 2$ transition, calculate the photon energy and wavelength. Use $hc = 1240\,\text{eV} \cdot \text{nm}$.

Downward transition: the atom loses energy and emits a photon. **Upward transition:** the atom gains energy by absorbing a photon with exactly the required gap.

READ AND COMPLETE THE DIAGRAM

1. Draw a $2 \rightarrow 4$ transition beside the supplied $4 \rightarrow 2$ arrow. Classify it and state the photon energy.

2. Find the ionization energy from $n = 2$.

3. A $2.00\,\mathrm{eV}$ photon reaches hydrogen in $n = 2$. Explain why the diagram does not guarantee absorption.

4. A student subtracts the signed energies and reports a negative photon energy. Correct the sign reasoning.