

INTEGRATING PHYSICS**● Atomic Fingerprints**

In the Bohr model of the atom, electrons can be found only in certain energy levels. Electrons “jump” from one level to the next without passing through any of the regions in between. When an electron moves from one level to another, it gains or loses energy, depending on the direction of its jump.

Bohr’s model explained an unusual event. When electric current flows through a gaseous element, the gas produces a glowing light, like in a neon sign. If this light is passed through a prism, a pattern of lines appears, each line having a different color. The pattern depends on the element—neon has one pattern, and helium has another. What causes these lines, and why are they always the same for a given element?

Electrons Release Energy in Certain Quantities

In Bohr’s model, the lines are caused by electron jumps from higher to lower energy levels. Because only certain jumps are possible, electrons release energy only in certain quantities. These packets of energy produce the lines that are seen.

Because the energy levels in each element are different, each element has a unique set of lines—a sort of atomic fingerprint. These lines can be used to identify unknown elements. This method is often used to identify gases in a mixture, and it can be used to determine the chemical composition of stars and interstellar gases.

Your Turn to Think

1. What limitation is placed on electrons in the Bohr model of the atom?
2. When the light from a gas is passed through a prism, why is there only a certain number of lines rather than a continuous spectrum?
3. How is the series of lines emitted by a gas similar to a fingerprint?
4. Explain how scientists can use the pattern of lines from an unknown gas to identify what elements are contained in the gas.