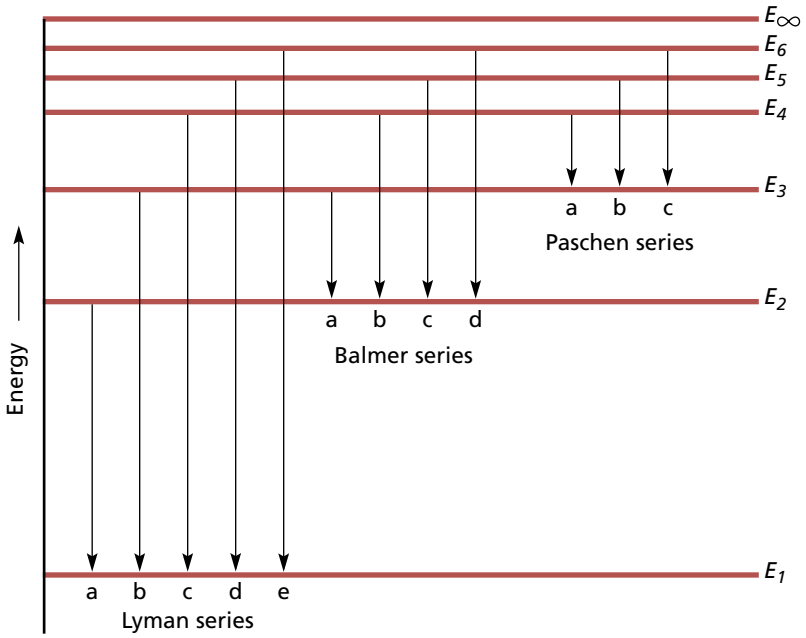

FIGURE 9 This energy-state diagram for a hydrogen atom shows some of the energy transitions for the Lyman, Balmer, and Paschen spectral series. Bohr's model of the atom accounted mathematically for the energy of each of the transitions shown.

atom. He then related the possible energy-level changes to the lines in the hydrogen emission spectrum. The five lines in the Lyman series, for example, were shown to be the result of electrons dropping from energy levels E_6, E_5, E_4, E_3, and E_2 to the ground-state energy level E_1.

Bohr's calculated values agreed with the experimentally observed values for the lines in each series. The origins of three of the series of lines in hydrogen's line-emission spectrum are shown in **Figure 9.**

Bohr's model of the hydrogen atom explained observed spectral lines so well that many scientists concluded that the model could be applied to all atoms. It was soon recognized, however, that Bohr's approach did not explain the spectra of atoms with more than one electron. Nor did Bohr's theory explain the chemical behavior of atoms.

SECTION REVIEW

1. What was the major shortcoming of Rutherford's model of the atom?
2. Write and label the equation that relates the speed, wavelength, and frequency of electromagnetic radiation.
3. Define the following:
   a. electromagnetic radiation **b.** wavelength
   c. frequency **d.** quantum **e.** photon
4. What is meant by the dual wave-particle nature of light?
5. Describe the Bohr model of the hydrogen atom.

Critical Thinking

6. **INTERPRETING GRAPHICS** Use the diagram in **Figure 9** to answer the following:
   a. Characterize each of the following as absorption or emission: an electron moves from E_2 to E_1; an electron moves from E_1 to E_3; and an electron moves from E_6 to E_3.
   b. Which energy-level change above emits or absorbs the highest energy? the lowest energy?