Bohr's model is incomplete

The Bohr model of hydrogen was a tremendous success in some respects because it explained several features of the spectra of hydrogen that had previously defied explanation. Bohr's model gave an expression for the radius of the atom and predicted the energy levels of hydrogen. This model was also successful when applied to hydrogen-like atoms, that is, atoms that contain only one electron. But while many attempts were made to extend the Bohr model to multi-electron atoms, the results were unsuccessful.

Bohr's model of the atom also raised new questions. For example, Bohr assumed that electrons do not radiate energy when they are in a stable orbit, but his model offered no explanation for this. Another problem with Bohr's model was that it could not explain why electrons always have certain stable orbits, while other orbits do not occur. Finally, the model followed classical physics in certain respects but radically departed from classical physics in other respects. For all of these reasons, Bohr's model was not considered to be a complete picture of the structure of the atom, and scientists continued to search for a new model that would resolve these difficulties.

SECTION REVIEW

1. Based on the Thomson model of the atom, what did Rutherford expect to happen when he projected positively charged alpha particles against a metal foil?
2. Why did Rutherford conclude that an atom's positive charge and most of its mass are concentrated in the center of the atom?
3. What are two problems with Rutherford's model of the atom?
4. How could the atomic spectra of gases be used to identify the elements present in distant stars?
5. Bohr's model of the atom follows classical physics in some respects and quantum mechanics in others. Which assumptions of the Bohr model correspond to classical physics? Which correspond to quantum mechanics?
6. How does Bohr's model of the atom account for the emission and absorption spectra of an element?
7. **Critical Thinking** A Norwegian scientist, Lars Vegard, determined the different wavelengths that are part of the northern lights. He found that only a few wavelengths of light, rather than a continuous spectrum, are present in the lights. How does Bohr's model of the atom account for this observation?