

CHAPTER 3 ATOMIC THEORIES

Reflect on Your Learning

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- In the 20th century, we have moved from Dalton's solid indivisible atom model, to the Thomson model which includes electrons embedded in a positively charged sphere, to the Rutherford nuclear atom model, to the Bohr model of electron orbits, and finally, to the quantum mechanical atom model based on electron "clouds."
(A more complete answer might include the distinction between orbits and orbitals.)
 - The current quantum mechanical model differs from all previous atomic models in its complexity, lack of a clear analogy or physical model, and in the way electrons are represented.
(A more complete answer would include the concept of electron waves and probability distribution of electrons in specific energy states.)
- Scientific concepts are revised and/or replaced when new evidence is discovered that conflicts with or contradicts the current concept.
(A more complete answer would also include the requirement for the new evidence to be replicated by independent scientists and the development of a new or revised concept that is acceptable to the scientific community.)
- Quantum mechanics has changed the way we describe electrons in atoms from small particles travelling in specific paths or orbits to electrons occupying regions of space called orbitals.
(A more complete answer would include the treatment of electrons as waves and the description of orbitals in terms of probability distributions.)
 - Our understanding of the periodic table is much greater because of quantum mechanics.
(Initial answers will be nebulous but eventually, students should be able to describe the importance of electron configurations, especially of d-block atoms, in greatly extending the explanation of the periodic table.)
- (Answers will vary. A typical answer might be the following.) Plastics technologies are based on bonding nonmetal atoms in extremely long carbon-based chains to make very large molecules. Specialized wafers of semiconductor atoms are used to produce microchips with high processing speeds for all types of computer applications.
(A more complete answer might include an explanation of semiconductors or the operation of a laser related to electron energy levels.)
 - Technological products and processes, like anything else, have risks associated with the benefits they provide. Computer technology provides many benefits but is also used in so-called "smart bombs." Advances in molecular biology make it possible to cure some diseases, but genetic engineering may be used for questionable purposes such as human cloning.

Try This Activity: Molecules and Light

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- The fluorescein solution transmits orange light, but reflects green.
- If the fluorescein solution did not emit light when illuminated, it would appear orange by reflected light, the same colour as when viewed by transmitted light.
- The glow stick is a slow chemical reaction that begins when an inside container is broken, allowing the chemicals to mix. The reaction continues, and emits light energy, for a considerable time. Since the label says the light will be brighter when the stick is warmer, heating speeds this chemical reaction, as we would expect.
- Fluorescence and chemiluminescence both involve the emission of light; but fluorescence is not a chemical reaction—it requires light input to the substance before light can be emitted, and the substance doesn't change. Chemiluminescence is a reaction producing new products, with light produced only while the reaction is occurring.
- Molecular structure changes in chemiluminescence, because new substances (molecules) are formed. Fluorescence must depend on the ability of a molecule to store energy temporarily, somehow without changing its structure.