

What do scientists mean by *Scientific Explanation*?

Explanations must be *Consistent*. The explanation for one set of phenomena cannot contradict the explanation for other sets of phenomena. If explanations are inconsistent, they must be rectified or abandoned.

Explanations must be *Testable*. Explanations must be examined in laboratories, in nature, in the field or through the study of past events and must be capable of shown to be incorrect. If they are incorrect they must be changed or abandoned.

Preferred Explanations should be *Elegant (Simple)*. Explanations that require the invention of the fewest “missing pieces” have the greatest reliability. Explanations cannot include pieces that are either inconsistent with what is already known or that are untestable.

What is “normal”?

The molecule H₂O comes in three forms – solid (ice), liquid (water) and gas (water vapor). Which form is normal?

How can evolution be both a “fact” and a “theory”?

H₂O will transform from liquid to gas at 100° centigrade.

Fact: Something that happened or exists (H₂O exists. So does the transformation of H₂O).

Hypothesis: A testable explanation of why or how something happened or exists (Will H₂O will transform from liquid to gas at 100° centigrade?).

Theory: A testable explanation of why or how something happened or exists that is strongly supported by evidence and testing (H₂O transforms from liquid to gas at 100° centigrade at STP).

Law: A testable explanation of why or how something happened or exists that is strongly supported by evidence and testing for a long period of time. Often it can be described in scientific or mathematical terms (Liquid H₂O + energy \rightleftharpoons Gaseous H₂O).

What is a scientific law?

$E=MC^2$. Energy equals mass times the speed of light squared. This formula describes the relationship between energy and mass. Great energy requires great mass. In a vacuum like outer space, when mass approaches zero, potential energy (heat or temperature) approaches absolute zero. In a star with dense mass, potential energy (heat or temperature) will be tremendous.

Question: How did Einstein know that the speed of light had to be squared?