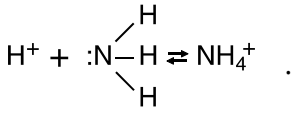
b9 Laws and principles < math equations, common sense statements >

I have not yet disclosed the cause of gravity ... since I could not understand it.
—*Newton*, who would not be persuaded to contrive an ad hoc mechanism for explaining his law of gravity: "*Hypotheses non fingo*" ("I stick to the facts").[1]

I am reminded, beginning to read John S. Rigden's new book [*The Story of H*, 2002],[2] of a joke that pokes fun at how physicists model the world. Various consultants are investigating a dairy farm to determine how to increase its productivity. Each makes a detailed report until the last one, a physicist, comes to the podium, draws a big circle on the blackboard behind him and says, 'Let us imagine the cow is a sphere.'
—Lawrence M. Krauss.[3]

I have not told the public what it does not need to know.
—Jean Baptiste Joseph Delambre on the coverup of co-surveyor Pierre Françoise André Méchain's error that in 1799 made the "metre" (meter), defined as one ten-millionth of the distance from Pole to Equator, 0.2 mm short on the platinum-iridium bar standard and this now perpetuated in 1960 in terms of the wavelength of light emitted by a specific energy transition in the Krypton-86 atom, and, in terms of the second, defined in 1967 as 9,192,631,770 oscillations or cycles of the cesium atom's resonant frequency, in 1983 as the distance light travels in a vacuum in 1/299,792,458 seconds.[4]

Laws of nature discovered by physical sciences *can* be written as mathematical equations and precise expressions (87,000 are listed in functions.wolfram.com)[5] that relate measurables. For example, Newton's equation of motion $F = ma$, and G. N. Lewis' definition[6] of a base as anything which has an unshared pair of electrons as so of NH_3 in the reaction



Scientific laws are truths that cannot be proved except for their degree of accuracy, and for which there is no fundamental understanding but that they embody regularity. In their application scientific laws make possible qualitative explanations and quantitative predictions using mathematics-enabled[7] exact science: primarily, physics. However, physicist Richard Feynman did quip, "There's a reason physicists are so successful with what they do, and that is they study the hydrogen atom and the helium ion and then they stop." Technology, and engineering that build on and feed back into science, achieve what they do by pre- and post-production testing. Formulas and expressions of well known laws of physics and chemistry are given in reference books such as the *CRC Handbook of Chemistry and Physics*.[8]

Scientific principles are statements that if successful become the common sense of scientific disciplines. Principles *cannot* be written as mathematical equations. In their application they help structure and assemble the working hypotheses and discovered facts of science disciplines.

To describe a physical processes, scientific laws and principles are invoked.[9] Some geological examples are: To explain the existence of bauxite, a physio-chemical argument is given for how weathering of leucogranite, a product of earlier magmatic differentiation, can proceed in wet tropical climatic conditions.[10] To explain the existence of folds in rock, extrapolations are made from the observed elastico-plastic behavior of layered rock in scaled laboratory conditions for how the folding of original structures, such as horizontal layers of sediments, occurred.[11] Karst is explainable as a scenery due to limestone dissolution.[12] These explanations are well within the accepted understanding of the physical sciences. Many geological *phenomena* have aspects, such as the timing of volcanic eruptions, that cannot be so easily understood. These are explained by hypotheses that principles allow. In the confidence of the present plate tectonics era, "Earth systems" is replacing "physical geology" by its addition of global environmental changes for contemplation, testing and forecasting.

This is the living scientific method. ❑