THE LAWS OF THERMOCHEMISTRY

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In this paper we give the Laws of Thermochemistry which generalize the Laws of Thermodynamics and Chemistry and prove the Climate Equations.

The Laws of Thermodynamics and Chemistry are incomplete because do not apply to thermochemical systems in the large. In a thermochemical system in conditions of small variations of pressure, volume, temperature, energy and entropy the molecular variations of pressure, volume, temperature, energy and entropy can be considered all equal for most of the molecules, however in a thermochemical system in conditions of large variations of pressure, volume, temperature, energy and entropy the molecular variations of pressure, volume, temperature, energy and entropy depend on the global pressure, volume, temperature, energy and entropy and so vary in all the molecules of the thermochemical system.

First Law of Thermochemistry: An isolated thermochemical system evolves irreversibly to the state of thermochemical equilibrium.

$$dU \to 0 \text{ as } t \to \infty$$

in which U is the energy of the isolated thermochemical system at time t.

Second Law of Thermochemistry: In a thermochemical system the molecular energy is conserved.

$$\frac{dU}{U} = \frac{dQ + dW + dE + c^2 dm + \gamma dA}{Q + W + E + mc^2 + \gamma A}$$

in which U is the total energy, Q is the heat, W is the mechanical energy, E is the electromagnetic energy, mc^2 is the relativistic mass energy, and γA is the surface tension of the thermochemical system.

Third Law of Thermochemistry: In a thermochemical system the sum of the molecular variation of pressure and the molecular variation of volume is the molecular variation of temperature.

$$\frac{dP}{P} + \frac{dV}{V} = \frac{dT}{T}$$

in which P is the pressure, V is the volume, and T is the temperature of the thermochemical system.

Fourth Law of Thermochemistry: In a thermochemical system the molecular variation of entropy is the molecular variation of heat minus the molecular flow of matter per molecular relative temperature.

$$\frac{dS}{S} = \frac{dQ - \sum a_{ik}\mu_{ik} d\xi_k}{(Q - mc^2)T_m/T}$$

in which S is the entropy, Q is the heat, T is the global temperature, T_m is the molecular temperature, mc^2 is the relativistic mass energy, and a_{ik} and μ_{ik} are the stoichiometric coefficients and the chemical potentials of the i chemical reactants, products and compounds in the k irreversible and reversible matter and energy exchanges and irreversible chemical reactions with extent of reaction ξ_k of the thermochemical system.

Fifth Law of Thermochemistry: In a thermochemical system the molecular variations of entropy due to irreversible matter and energy exchange and irreversible chemical reactions are always positive.

$$dS_i \geq 0$$

where S_i is the molecular entropy of the thermochemical system due to irreversible thermochemical processes.

Sixth Law of Thermochemistry: In a thermochemical system the molecular entropy tends to zero as the molecular temperature tends to zero.

$$S \to 0 \text{ as } T \to 0$$

The Climate Equations

Now we give the Climate Equations for Meteorology, Oceanography and Geology.

By the Third Law of Thermochemistry, since the atmosphere is a thermochemical system within a spherical ring volume with a radius h for which small variations of temperature and large variations of pressure occur within small variations of radius, for $\frac{dV}{V} = \frac{dh}{h}$, its thermochemical differential equation is

$$\frac{dP}{P} + \frac{dh}{h_0} = \frac{dT}{T_0}$$

and so

$$Pe^{h/h_0} = P_0 e^{T/T_0 - 1}$$

in which P, h and T are the pressure, the heigth and the temperature of the atmosphere and P_0, h_0 and T_0, the pressure, the radius and temperature of the atmosphere at sea level.

By the Third Law of Thermochemistry, since the Earth is a thermochemical system in which small variations of temperature and large variations of pressure occur within large variations of radius, its thermochemical differential equation is

$$\frac{dP}{P} + \frac{dh}{h} = \frac{dT}{T_0}$$

and so

$$Ph = P_0 h_0 e^{T/T_0 - 1}$$

in which P, h and T are the pressure, the radius and the temperature of Earth and P_0, h_0 and T_0, the pressure, the radius and the temperature of Earth at sea level.

By the Third Law of Thermochemistry, since the nucleus of Earth is a thermochemical system in which large variations of temperature and large variations of pressure occur within small variations of radius, its thermochemical differential equation is

$$\frac{dP}{P} + 3h^2 \frac{dh}{h_0^3} = \frac{dT}{T}$$

and so

$$T_0 P e^{h^3/h_0^3 - 1} = P_0 T$$

in which P, h and T are the pressure, the radius and the temperature at the magmatic core and $P_{0,}$ h_0 and T_0, the pressure, the radius and the temperature at the magmatic core surface.