Interpreting Planck's Constant

In this theory, Boltzmann’s constant has acquired the definition of:

\[ k = \frac{2}{3} k_T \Delta t_c \]

I have previously shown a relationship between Planck’s constant \( h \) and Boltzmann’s constant \( k \):

\[ h = k \Delta x_c \]

Substituting for \( k \) and rearranging terms:

\[ h = k_T \left( \frac{2}{3} \Delta x_c \right) \Delta t_c \]

I moved the fraction into the parenthesis with photon length because, as has been shown earlier in the theory, this term demonstrates the definition to include a remote measurement. In other words, we determine the value of Planck’s constant by making remote macroscopic measurements of the energy of photons.

This interpretation of Planck’s constant allows for a modification to the definition of entropy. Using the equation:

\[ \Delta E = \Delta S \, T \]

Since:

\[ T = \frac{2}{3} \Delta x_c \omega \]

Substituting:

\[ \Delta E = \Delta S \frac{2}{3} \Delta x_c \omega \]

Since:

\[ \Delta S = k_T \Delta t_c \]

Substituting:

\[ \Delta E = k_T \Delta t_c \frac{2}{3} \Delta x_c \omega \]
Rearranging:

\[ \Delta E = k_T \frac{2}{3} \Delta x_c \Delta t_c \omega = h \omega \]

Planck's constant is a part of the above equation so long as it applies to an ideal gas. However, for the entropy definition \( \Delta t_c \) was replaced with the variable \( \Delta t \) in order that the equation may apply to more general cases. Making the same change in this analogous derivation:

\[ \Delta E = \left( k_T \frac{2}{3} \Delta x_c \Delta t \right) \omega \]

Defining an analogy to entropy for frequency:

\[ \Delta S_p = \left( k_T \frac{2}{3} \Delta x_c \Delta t \right) \]

Substituting:

\[ \Delta E = \Delta S_p \omega \]

So, Planck's constant is the constant \( \Delta S_p \) for an ideal gas, while the form above is the variable form for general cases. Now I wish to give a detailed general definition for Planck's constant.

**Analyzing Planck's Constant**

The potential energy of the hydrogen electron in its first energy level is:

\[ \Delta E_{eH1} = h \omega_{eH1} \]

Where:

\[ \omega_{eH1} = \frac{v_{eH1}}{\lambda_{eH1}} = \frac{v_c \alpha}{2\pi \Delta x_c} \]

Substituting for the speed of light:

\[ \omega_{eH1} = \left( \frac{\Delta x_c}{\Delta t_c} \right) \alpha = \frac{\alpha}{2\pi \Delta t_c} = \frac{1}{2\pi \alpha^{-1} \Delta t_c} = \frac{1}{2\pi (137) \Delta t_c} \]
The denominator on the right side is the period of the frequency. Therefore:

$$\Delta E_{eH1} = \frac{h}{2\pi \alpha^{-1} \Delta t_c}$$

Also, the potential energy for a circular orbit can be expressed as:

$$\Delta E_{eH1} = f_{eH1} \Delta x_c$$

Therefore:

$$f_{eH1} \Delta x_c = \frac{h}{2\pi \alpha^{-1} \Delta t_c}$$

Solving for Planck’s constant:

$$h = f_{eH1} \Delta x_c \Delta t_c 2\pi \alpha^{-1}$$

This result defines Planck’s constant in terms of properties of the hydrogen atom.

**Defining Temperature**

I have preliminarily defined temperature as:

$$T = k_T \frac{\Delta E}{\Delta t_c}$$

I have also derived:

$$h = k_T \left(\frac{2}{3} \Delta x_c\right) \Delta t_c$$

Solving for $k_T$:

$$k_T = \frac{h}{\left(\frac{2}{3} \Delta x_c\right) \Delta t_c}$$

Since:

$$h = f_{eH1} \Delta x_c \Delta t_c 2\pi \alpha^{-1}$$

Then:
\[ k_T = \frac{f_{eH1} \Delta x_c \Delta t_c \cdot 2\pi \alpha^{-1}}{\left(\frac{2}{3} \Delta x_c\right) \Delta t_c} = \frac{3}{2} f_{eH1} 2\pi \alpha^{-1} = 3f_{eH1} \pi \alpha^{-1} \]

**Defining Boltzmann’s Constant**

I have established a relationship between Planck’s constant and Boltzmann’s constant in the form of:

\[ k_B = \frac{h}{\Delta x_c} \]

Substituting for Planck’s constant:

\[ k_B = k_T \frac{2}{3} \frac{2 \Delta x_c \Delta t_c}{\Delta x_c} = k_T \frac{2}{3} \Delta t_c \]

Substituting for \( k_T \):

\[ k_B = \frac{3}{2} f_{eH1} 2\pi \alpha^{-1} \frac{2}{3} \Delta t_c = f_{eH1} 2\pi \alpha^{-1} \Delta t_c \]

Or, in terms of momentum:

\[ k_B = e_{eH1} \Delta P 2\pi \]

Where:

\[ \Delta P_{eH1} = f_{eH1} \alpha^{-1} \Delta t_c = f_{eH1} \Delta t_{eH1} \]

**Defining Frequency**

I have defined:

\[ h = k_B \Delta x_c \]

Substituting for \( k_B \):

\[ h = e_{eH1} 2\pi \Delta x_c = e_{eH1} \lambda_{eH1} \]

Also:
\[ \Delta E_{eH1} = h\omega = \Delta P_{eH1} \lambda_{eH1} \omega_{eH1} = \Delta P_{eH1} v_{eH1} \]

And, from an earlier result:

\[ h = f_{eH1} \Delta x_c \Delta t_c \frac{2\pi\alpha^{-1}}{1} \]

Yielding:

\[ \Delta E = h\omega = f_{eH1} \Delta x_c \Delta t_c \alpha^{-1} 2\pi\omega = (f_{eH1} \Delta x_c)(\alpha^{-1} \Delta t_c)(2\pi\omega) \]

The first set of parenthesis contains the potential energy of the hydrogen electron in its first energy level. The second set is the period of time required for the electron to complete one radian. The third set is the angular velocity of the electron in units of radians per second.

This theory's definition of Planck's constant first changes frequency into radians per second. Then, it converts radians per second, for the subject frequency, into a measure of the number of radians traveled during the period of time required for the hydrogen electron to travel one radian. Finally, the result of the first two steps is multiplied by the potential energy of the hydrogen electron in its first energy level. In other words, Planck's constant uses fundamental properties of the hydrogen atom as the standard by which to convert frequencies into quantities of energy.