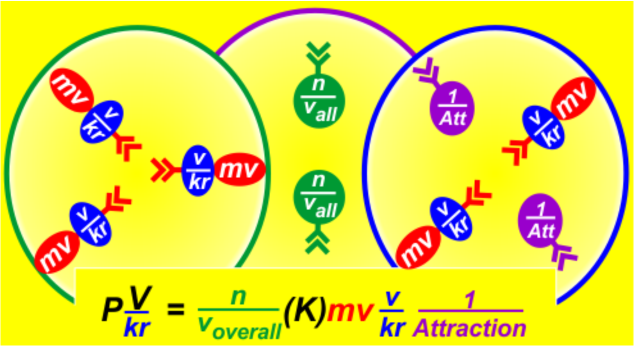
Atomic Heat-Behavior: Impulse vs. Energy



2. Foundations for a Heat-Impulse Theory of Atomic Behavior

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www.Wacky1301SCI.com, *"Looking at serious science, sideways!"*

Abstract: A heat-impulse theory of atomic behavior can be developed through derivation of the gas laws, originating with the relationship between enclosed molecular momentum, surface force, and the definition of pressure as a measure of the transfer of momentum across an atomic interface. All aspects of heat and molecular behavior can be described in terms of molecular momentum and molecular impulse/momentum-transfer.

When heat is added to a substance, the atoms and molecules move faster. According to Descartes' law of conservation for momentum, an object with mass cannot move faster without receiving momentum from another place. Heat, therefore, must involve some type of impulse/momentum-transfer.

This advanced article will delineate the principles of a heat-impulse theory, and will correlate that theory with the gas laws and other heat related concepts. (Simpler discussions of these topics can be found at www.Wacky1301SCI.com, and in *Murdered Energy Mysteries*.)

Currently, there is not a singular unit for momentum or impulse. Therefore, this article will use the symbol rho (ρ), where 1 ρ = 1 kgm/s, as established by Mr. Du in *Murdered Energy Mysteries*. (An edu-novel by Du-Ane Du, Amazon, Kindle, e-book 2018, paperback 2021.)

Devil's Advocate says, "Allow this article to expand your awareness—like you're hiking a new trail, enjoying the view of snow-covered mountains in the distance, sipping cool water from a glacier-fed stream—expanding your appreciation for creativity… now empower your imagination to create a new vision of…"

1) **Pressure**

Surface pressure can be viewed as a measure of the rate of momentum transfer across an atomic interface, with respect to the surface area. The following demonstration of pressure related concepts will begin with a car and sail, having a total mass of 1 kg, experiencing a wind that causes it to accelerate forward.

1a) **Momentums of Momentum**.

If the 1 kg toy car-and-sail has a velocity of 5 m/s, then it has 5 ρ of momentum, or 5 momentums of momentum (where 1 ρ = 1 kgm/s).

1b) **Impulse** can be defined as the transfer of atomic momentum across an interface. If a wind blows against the sail so the toy car's velocity increases from 5 m/s to 9 m/s, then the car will experience an impulse, momentum-transfer of:

$$im\Delta\rho = (1kg)\left(9\frac{m}{s}\right)_f - (1kg)\left(5\frac{m}{s}\right)_i$$
$$im\Delta\rho = 4\ \rho\ or\ 4\frac{kgm}{s}$$

1c) **force**, can be defined as the rate that atomic momentum is being transferred. If the above impulse/momentum-transfer takes place in 2 s, then the force or force-rate is:

$$F = \frac{im\Delta\rho}{time}$$
$$F = \frac{4\ \rho}{2\ s}$$
$$F = 2\frac{\rho}{s}\ , or\ 2\ N$$

1d) **Pascals of pressure** is a measure of the momentum-transfer rate, per square meter. In the above, if the sail has a surface area of 0.1 m^2, then the wind exerted a pressure of:

$$Pascal \ = \frac{force}{area} = \frac{im\Delta\rho/s}{m^2}$$
$$Pascals\ of\ pressure \ = \frac{2\ \rho/s}{0.1\ m^2}$$
$$Pascals\ Pressure \ = \ 20\ \frac{\rho/s}{m^2} = 20\ Pa$$

1e) **Surface pressure is a type of impulse**/momentum-transfer. In other words, it is the rate of momentum transfer across an atomic interface, with respect to the surface area.

2) Concepts common to the *im*Δ*ρ* and *KE* theories of atomic and molecular behavior include,

- Atoms are very tiny,
- Molecules are made of atoms connected with covalent bonds,
- Molecules and atoms move in straight lines unless inhibited by chemical bonds,
- From all perspectives, collisions obey the law of conservation of momentum,
- Momentum does not temporarily disappear during collisions,
- Momentum transfer always obeys Newton's 3rd law, even when the atoms or molecules have different masses.

3) **The gas laws cannot be derived from the law of conservation of energy.**

"Probably the biggest scientific failure of the 1850's," Devil's Advocate says, "was the failure to mathematically derive the relationship between the proposed law of conservation of energy and the established gas laws, based on the behavior of molecules enclosed in a container."

This oversight has never been corrected.

In *Murdered Energy Mysteries*, Chapter 310, "Enclosed Kinetic Energy," the characters fail in their attempt to derive the gas laws originating with the kinetic energy of an enclosed molecule.

Such a derivation is impossible.

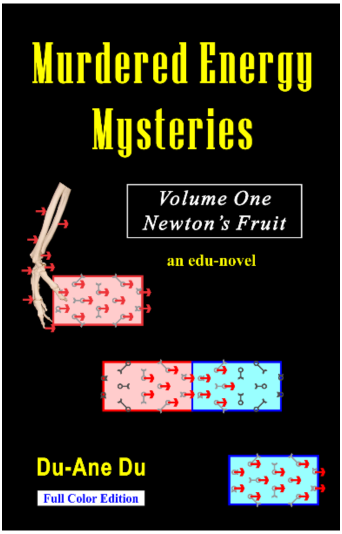
4) **The gas laws *can* be derived from the law of conservation of momentum.**

There are several proof routes, this is probably the shortest:

4a) **Generic volume equations**.

All containers can be thought of as holding billions of tiny spheres. Inside each tiny sphere, there are trillions of gas molecules. These trillions of gas molecules are moving in straight lines, very fast, and they collide with one another many times a second. From the perspective of the molecules, they are in a collection of tiny spheres.

For all practical purposes, from the molecule's perspective all objects are quasi-spherical. In a proportional environment, we can represent the average distance across a quasi-spherical container as $k_1 r$, the surface area as $k_2 \pi r^2$, and the volume as $k_3 \pi r^3$.



4b) **Single momentum-transfer event**. The maximum amount of momentum that a single gas molecule can transfer to the container's surface in a single collision is $mv_{Molecule}$, or mv_M.

4c) **From molecular momentum to pressure**. Earlier, Pascals of pressure was identified as the momentum transfer rate per square meter, or ρ/s/m^2. Surface pressure, therefore, is proportional to the momentum of each molecule, the number of surface collisions per second (S), and the number of mols of gas molecules (n), but surface pressure is inversely proportional to the surface area ($\frac{1}{k_2 \pi r^2}$). The effect of the molecular momentum is inhibited by two factors, the internal collision rate (C) and the intermolecular attraction (A). These concepts may be represented by the equation:

$$Pascals\ of\ Pressure = k_4(mv_M)(S)(\frac{1}{k_2\pi r^2})(n)(\frac{1}{C})(\frac{1}{A})$$

"If no other molecules are present," Devil's Advocate says, "a single molecule will fly back-and-forth from one side of the container to the other. Therefore, the number of surface collisions per second (S) is the molecular velocity divided by the generic diameter of the container."

Some of the constants can then be combined to the front, as follows:

$$P = k_4(mv_M)(\frac{v_M}{k_1 r}\frac{1}{k_2\pi r^2})(n)(\frac{1}{C})(\frac{1}{A})$$

$$P = k_4(\frac{mv_M^2}{k_1 r})(\frac{1}{k_2\pi r^2})(n)(\frac{1}{C})(\frac{1}{A})$$

$$P = K_5(mv_M^2)(\frac{1}{k_3\pi r^3})(\frac{n}{C})(\frac{1}{A})$$

4d) Note that the **molecular force** applied to the surface of the container is now associated with the equation $(\frac{mv_M^2}{k_1 r})$, in ρ/s or *N*,

4e) Also, the **enclosed molecular momentum** is currently associated with the equation mv_M^2! When a molecule strikes the side of the container only once, then the maximum momentum transfer is mv_M. However, when the same molecule bounces back and forth from one side of the container to the other, the momentum transfer is directly proportional to the square of the velocity, mv_M^2. The equation, mv_M^2, becomes representative of enclosed molecular momentum. The significance in this enclosed momentum behavior will become apparent shortly.

4f) **Volume**. The bottom of the first (blue) fraction is now the volume equation, therefore:

$$P = K_5(mv_M^2)\left(\frac{\mathbf{1}}{\boldsymbol{k_3\pi r^3}}\right)\left(\frac{n}{C}\right)\left(\frac{1}{A}\right)$$

$$P = K_5(mv_M^2)\left(\frac{\mathbf{1}}{\boldsymbol{Volume}}\right)\left(\frac{\boldsymbol{n}}{\boldsymbol{C}}\right)\left(\frac{1}{A}\right)$$

Next, the internal collision rate **(C)** is related to the number of particles of gas **(*n*)**, which is already a part of the equation. This is affected by the average velocity of all of the gas molecules in the container. The faster they travel, the more they collide. The internal collision-related velocity is inversely proportional to the pressure. The symbol for the overall average velocity will be $\boldsymbol{v_{overall}}$, and the velocity's constant of proportionality can be merged with the attraction's constant, as follows:

$$P = K_5(mv_M^2)\left(\frac{1}{Volume}\right)\left(\frac{\boldsymbol{n}}{\boldsymbol{k_v}(\boldsymbol{v_{overall}})(\boldsymbol{k_a}Attraction)}\right)$$

$$P = \left(\frac{\boldsymbol{n}}{Volume}\right)K_5\left(\frac{mv_M^2}{\boldsymbol{k}(v_{overall})(Attraction)}\right)$$

"Pausing at this point," Devil's Advocate says, "it's worth examining the units. If either of the constants has the unit of attraction, then the equation produces the unit of momentum per volume, which is a type of pressure (see also, *MEM* Ch 401). Note that there are at least three different types of pressure:"

4g) **Molar Pressure**, measured in momentums per mole, *ρ/mol*, is the amount of atomic momentum and molecular momentum that a substance has as the result of its temperature. Molar pressure is a type of trapped impulse. Molar pressure causes volumetric pressure.

4h) **Volumetric pressure**, measured in momentums per liter, *ρ/l*, is the amount of atomic momentum and molecular momentum that a substance or a mixture has as the result of its temperature. Volumetric pressure is also a type of trapped impulse. Volumetric pressure causes surface pressure.

4i) **Surface Pressure**, measured in momentums per second per square meter, $\rho/s/m^2$, or *kPa*, is the measure of the transfer rate of molecular momentum across an atomic interface (per surface area).

4j) **Basic gas laws.** The last pressure equation can now be rotated into traditional forms, such as:

Ideal Gas, $PV = nR\left(\frac{mv_M^2}{k(v_{overall})(Attraction)}\right)$

Combined Gas, $\frac{P_1V_1}{n_1\left(\frac{mv_M^2}{k(v_{all})(Att)}\right)_1} = \frac{P_2V_2}{n_2\left(\frac{mv_M^2}{k(v_{all})(Att)}\right)_2}$

Temperature: $T = \frac{mv_M^2}{k(v_{overall})(Attraction)})$

The power and logic of this derivation can be seen in the behavior of gas mixtures and pure gases.

4k) **Dalton's law of partial pressures** relates to the momentum transferred to the container surface, by the individual molecules of the gases involved. Given three gases, A, B, and C, at the same temperature, the maximum impulse/momentum-transfer to the container surface, by a single collision of one enclosed molecule of each gas is:

When $T_A = T_B = T_C$

$$im\Delta\rho_{single} = \left[\frac{m_A v_A^2}{k(v_{all})(Att)}\right] + \left[\frac{m_B v_B^2}{k(v_{all})(Att)}\right] + \left[\frac{m_C v_C^2}{k(v_{all})(Att)}\right]$$

Note the overall average velocity and the overall attraction affect all three gases the same, as long as the mixture does not change. The constant varies with the mixture and the specific heat of each substance present.

The total amount of impulse/momentum-transfer will be the individual momentums times the number of molecules of each gas.

$$im\Delta\rho_{total} = \left[\boldsymbol{n_A}\frac{m_A v_A^2}{k(v_{all})(Att)}\right] + \left[\boldsymbol{n_B}\frac{m_B v_B^2}{k(v_{all})(Att)}\right] + \left[\boldsymbol{n_C}\frac{m_C v_C^2}{k(v_{all})(Att)}\right]$$

The ideal gas constant and the volume are the same for all three gases, therefore:

$$P_{Total} = \left[\frac{\boldsymbol{n_A R}}{\boldsymbol{V}} \frac{m_A v_A^2}{k(v_{all})(Att)}\right] + \left[\frac{\boldsymbol{n_B R}}{\boldsymbol{V}} \frac{m_B v_B^2}{k(v_{all})(Att)}\right] + \left[\frac{\boldsymbol{n_C R}}{\boldsymbol{V}} \frac{m_C v_C^2}{k(v_{all})(Att)}\right]$$

Recall that:

Ideal Gas, $P = \frac{nR}{V}\left(\frac{mv_M^2}{k(v_{all})(Att)}\right)$

Therefore, each of the individual momentum transfer rates is now a partial surface pressure. Thus:

Dalton's law, $P_{Total} = P_A + P_B + P_C$

"This means," Devil's Advocate says, "Dalton's law of partial pressures is actually caused by the individual molecular momentums of the enclosed gases present in the mixture. Dalton's law is a function of impulse and momentum-transfer."

4l) **Graham's Law** can be derived from the same starting point:

When $T_A = T_B = T_C$

$$\left[\frac{m_A v_A^2}{k(v_{all})(Att)}\right] = \left[\frac{m_B v_B^2}{k(v_{all})(Att)}\right] = \left[\frac{m_C v_C^2}{k(v_{all})(Att)}\right]$$

$$m_A v_A^2 = m_B v_B^2 = m_C v_C^2$$

Graham's law, $v_A\sqrt{m_A} = v_B\sqrt{m_B} = v_C\sqrt{m_C}$

4m) **Temperature change** is related to the change in pressure, which is related to momentum transfer. For example, when there is only one gas present, v_{all} is equal to v_M, therefore:

$$\Delta T_{single\ gas} = \left[\frac{mv_{final}^2}{k(v_{final})(Att)}\right] - \left[\frac{mv_{initial}^2}{k(v_{initial})(Att)}\right]$$

$$\Delta T_{single\ gas} = \frac{mv_{final} - mv_{initial}}{k(Attraction)}$$

4n) Thus, ***heat** is the addition of molecular momentum*. Since impulse is the addition or subtraction of momentum, heat is a type of impulse. The concept of heat-impulse therefore becomes as important as the concept of heat-energy, and heat-impulse may be more valid.

"This brings up a question," Devil's Advocate says. "When scientists think they are measuring heat-energy, are they actually measuring heat-impulse?"

Yes!

4o) **Specific Heat-impulse**, then is related to all of the interatomic behaviors that inhibit an object's rise in temperature as additional molecular momentum is introduced (see also, *MEM* Ch 316).

5) **Graham's Ratio** = $v\sqrt{z}$ or $v\sqrt{m_{Molecule}}$

This is the marker for when two substances have equalized molecular momentum, equalized atomic momentum, and an equalized temperature.

"In *Murdered Energy Mysteries*, Chapters 311-13," Devil's Advocate says, "Mr. Du uses the law of conservation of momentum and Newton's third law to develop a 'two force collision model' for atomic collisions, based on momentum exchanges."

When the atoms/molecules of two different substances have different Graham's ratio values, they are at different temperatures. The one with the lower Graham's ratio has the lower temperature, and the one with the higher Graham's ratio has the higher temperature.

When the molecules substances collide, the molecule with the lower Graham's ratio will experience a rise in its momentum, and the molecule with the higher Graham's ratio will experience a corresponding drop in its momentum (see also, *MEM* Ch 314 and 315[5]).

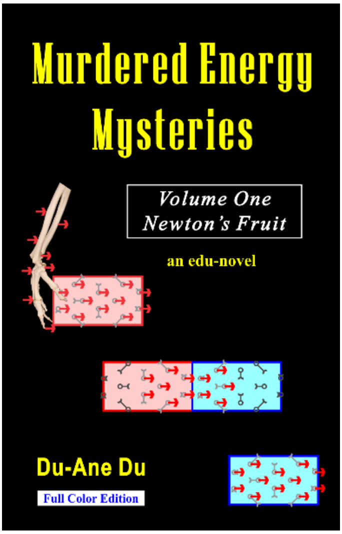
After numerous collisions, the molecules of two different substances will achieve identical Graham's ratios. At that point the momentum is said to be "equalized, but not equal," and the temperatures will be the same.

"This means," Devil's Advocate says, "Graham's ratio is not a measure of momentum, rather it is a marker for when the molecular momentum and atomic momentum of two or more substances are in equilibrium."

CONCLUSION 1: All of the gas laws can be derived from the law of conservation of momentum as it relates to the surface pressure caused by the momentum of an enclosed molecule. These derivations show the most likely formula for temperature is:

$$T = \left[\frac{mv^2_{Molecule}}{kv_{all}(Attraction)}\right]$$

CONCLUSION 2: It is likely that chemical bonds store heat-impulse, and when chemical bonds break, the heat-impulse is released to increase the momentum of surrounding atoms and to increase the momentum of receiving objects—hence the need for a heat-impulse theory of atomic behavior.



CONCLUSION 3: The question remains, "Are scientists actually measuring heat impulse, when they think they are measuring heat-energy?" More research

needs to be done into the relationship between mechanical energy and other theoretical forms of energy. Many common beliefs may actually be philosophical myths.

Murdered Energy Mysteries is an edu-novel that seeks to increase understanding of the various forms of momentum and momentum transfer, as well as the various forms of energy and energy transfer. The lack of understanding on the part of the scientific community is substantial, and more research needs to be done.

—Du-Ane Du, author of the edu-novel *Murdered Energy Mysteries* (Amazon, Kindle, e-book 2018, paperback 2020.)

More information, see:

Murdered Energy Mysteries, an edu-novel, Amazon
Atomic Heat-Behavior: Impulse vs. Energy
Article 1. *Chemically Stored Impulse, or Energy?*
Article 3. *Cal-Energy's Disappearing ΔT Fallacy*
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