Molecular kinetics

Current theory holds that molecular kinesis in fluids entails molecules in constant random rectilinear motion, colliding with each other, resulting in molecular diffusion that can be explained by Einstein's "random walk" mechanism. However, it is physically and mathematically impossible for collisions with water molecules to displace particles one trillion times their mass through the density and viscosity of water through many multiples of their diameters. As well, there might be other mechanisms of molecular kinesis that could cause diffusion in the random walk way.

If molecules were to exhibit simple harmonic (SH) oscillation about their centers of mass, they would collide with each other and be jostled around, resulting in random walks. The amplitude of oscillation would be directly related to the Kelvin temperature. The eccentric masses of component atoms would contribute to the random walk by physics somewhat like Mexican jumping-bean kinetics.

On the other hand, molecular oscillation could be secondary to SH oscillation of component atoms. The atomic oscillation frequency could be atomic-weight-dependent, with heavier atoms oscillating more slowly than lighter atoms. The oscillation frequency could be independent of amplitude (and the directly-related Kelvin temperature). Each atom on the periodic table would then have a specific frequency of oscillation.

Since each atom has a characteristic arrangement of negative-charge electrons in "orbital rings," and specific arrangement of nuclear positive-charge protons, the oscillation of charged components may be associated with emitting an electromagnetic flux with an element-specific spectrum. Heating an element to incandescence produces such an element-specific spectrum.[1]

Heating a solid (e.g. a metallic ore in a blast furnace) could increase atomic oscillation amplitude to a specific temperature at which the atoms loosen the inter-atomic molecular bonds of a solid, causing melting and assuming the molecular bonding characteristic of the liquid state, at temperatures specific for each solid (melting point). The molecular oscillation amplitude associated with heating to a much higher specific temperature would break the liquid atomic/molecular bonds, freeing atoms from molecular compounds (like iron from iron oxides in a blast furnace.

SH oscillation of atoms in fluid molecules would result in a compound/complex, net molecular oscillation, with eccentric atomic masses, resulting in Mexican jumping-bean translational motion in all planes, and diffusion by the random walk mechanism.

Atomic/molecular oscillation can explain the inverse relationship of temperature and viscosity in gases and liquids. For gases in a confined space, as the temperature rises, the amplitude of molecular oscillation would increase – as would the "roughness" of adjacent laminae, increasing resistance to sliding between adjacent laminae. In liquids, the increasing temperature will stretch and weaken the molecular bonds characteristic of the liquid state, decreasing the viscosity.

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[1]Alter D., On certain physical properties of light produced by the combustion of different
metals in an electric spark refracted by a prism. Am J Sc Arts, 18:55-57 (1854)

As the Kelvin temperature approaches absolute zero, the amplitude of oscillation of liquid helium molecules would approach zero, with laminar thickness approaching the dimensions of helium molecules, creating smooth and "slick" laminae, as viscosity approaches zero (an ideal liquid).

The Physics of heat and the temperature related changes in the viscosity of liquids and gases

Heat can be transferred through the vacuum of space as infrared emanations, as we note from the heating effects of the sun. We also are aware that a fireplace transfers heat to the side facing the embers, but our opposite side is in the infrared shadow. However, we tend to ignore the radiant cold that we feel on the side of our body closest to a cold wall, with the opposite side of our body being in the shadow of the wall's longer wavelength infrared radiation. Under a large tree on a hot sunny day, one feels cooler by being shaded from the sun, but also from exposure to the cooling effect of the longer infrared rays from the earth that has been shielded from heating by the sun. Two solid objects, separated in a vacuum by a short distance, will share their heat status, not through conduction, or convection, but through the interplay of hot to cold and cold to hot radiant energy of heat, affecting the amplitude of molecular oscillation, eventually reaching an equilibrium with similar infrared emanations from each object.

Thus, it is proposed that heat displays two energy components – a mechanical component made up of molecular vibrational momentum – and an electromagnetic component. Adhesion bonds of solids are responsible for their spectrum of brittleness / hardness / toughness – and malleability / softness and stretchability / elasticity. Molecular vibrational amplitude will increase with temperature. At a critical point, the stretched adhesion bonds characteristic of solids break, with the retention of the cohesion bonds that are responsible for the interrelated liquid characteristics of laminar flow / viscosity / volatility and surface tension – and the inter-surface contact effects (positive – wet-ability, and negative – which cause "beading" of water droplets on oily surfaces) and gravity-induced fluid levels.

Further rising temperature and amplitude of molecular vibration increase will break liquids' cohesion bonds, creating gases; laminar flow and viscosity properties will continue in gases, while a mutually molecular repulsive force could cause the even distribution of molecular density, that is influenced only slightly by gravity effects. The repulsive force may be secondary to vibrating molecules bumping into each other. (It is remotely possible, though, that there is an actual repulsive force between adjacent gas molecules). Cooling (or compression, in the gas to liquid transformation) will reverse these processes.

Chemical bonds yield to high vibrational amplitudes in smelters. Cohesion bonds will link liquid molecules in all directions in subsurface fluid.

On gravity-dependent horizontal liquid surfaces, the cohesion bonds will be substance-specific in strength along air-exposed surfaces, resulting in variable evaporation tendencies. Volatile liquids have weaker cohesion bonds. Mercury's cohesion bonds are strong, leading to low volatility and high surface tension, shown by drops of mercury with sphere-inducing surface tension effects being dominant over gravitation's flattening effects. Meniscus effects at liquid / solid interfaces will result from the interplay of positive, or negative, wet-ability factors.

This molecular vibration concept can explain the differences in the viscosity response of liquids and gases to temperature change. In liquids, an increase in temperature stretches and weakens the cohesion bonds, lowering the viscosity, which varies inversely with the temperature. The nature of liquid inter-molecular bonding and the repulsive relationship of gas molecules might allow laminar flow to operate down to multiples of molecular dimensions, where laminar flow may originate, something that is difficult to consider with the current concepts of Brownian motion and the Kinetic Theory.

The heat of friction and the effects of lubrication

Two interrelated phenomena are the heat of friction and the effect of oil lubrication. Sound generation by friction may be a transient instantaneous phase increasing the heat of friction. The higher the frequency of this sound generation, the shorter will be the distance of sound absorption and heat production; in unfocused sound, the inverse square law prevails, thus producing, at times, intense heating along the contact surfaces where sound is generated.

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Heating a solid (e.g. a metallic ore in a blast furnace) could increase atomic oscillation amplitude to a specific temperature at which the atoms loosen the inter-atomic bonds of a solid, causing melting and assuming the molecular bonding characteristic of the liquid state, at temperatures specific for each solid (melting point). The molecular oscillation amplitude associated with heating to a much higher specific temperature would break the atomic/molecular bonds, freeing atoms from molecular compounds (like iron from iron oxides in a blast furnace).

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Atomic/molecular oscillation can explain the inverse relationship of temperature and viscosity in gases and liquids. For gases in a confined space, as the temperature rises, the amplitude of molecular oscillation would increase – as would the "roughness "of adjacent laminae, features that are operative in automobile mechanical clutches. In liquids, the increasing temperature will stretch and weaken the molecular bonds characteristic of the liquid state, decreasing the viscosity. Thus, laminar thicknesses may approach molecular oscillation dimensions, something that the current kinetic theory won't allow.

As the Kelvin temperature approaches absolute zero, the amplitude of oscillation of liquid helium molecules would approach zero, with laminar thickness approaching the dimensions of helium molecules, creating a viscosity that approaches zero (an ideal liquid).

Two interrelated phenomena are the heat of friction and the effect of oil lubrication. As previously suggested, sound generation friction may be a transient instantaneous phase in creating the heat of friction. The higher the frequency of this sound generation, the shorter will be the distance of sound absorption and heat production; in unfocused sound, the inverse square law prevails, thus producing, at times, intense heating along the contact surfaces where sound is generated.

The loud, high pitch squeal of braking automobile tires is sixteen times as loud at one quarter of the distance from the observer, and will be extremely loud at the points of contact between tire and pavement, thus, the dissipation of intense sound energy can account for the smoke and smell of burning rubber at the sound source. Sparks may fly when bare metal scrapes against another hard surface and metals may melt when they grind together without lubrication, because of friction generating high intensity audible sounds and levels of ultrasound that we have been largely unaware of. Also, frictional sound and heat energy generated when tectonic plates grind together at immense pressure along fault lines must account for at least some of molten lava and explosive outbursts of volcanic activity.

Here we see mechanical energy (sound) being transmuted into electromagnetic radiation, with sparks indicating that the spectrum involved covers, not only the infrared range, but extends into the "white hot" range of incandescence in the visible spectrum. The temperature of objects can be determined from a distance by the electromagnetic spectrum emitted, with the infrared spectrum being used most commonly

The grabbing and releasing occurring in the friction between two metal surfaces scraping together transfers vibrational energy to the molecules and this vibrational energy creates (or is at least associated with) electromagnetic radiation (infra-red to white light spectrum). The momentum of the vibrational heat is responsible for heat conductivity, while the electromagnetic component is responsible for radiant heat – and, the often ignored, radiant cold. Both forms obey the inverse square law, generally not considered in relation to conductivity in the vibrational momentum form of heat; this is best understood by considering heat transfer from a hot ball bearing dropped into a cold liquid, where heat is transferred by conductivity equally in all directions from the total surface area (a squared relationship) of the hot ball.

Friction will be markedly reduced when there is a thin layer of oil between two smooth interfaces, which will limit the oil's laminar flow potential to the very narrow space between these surfaces. The developing BLFs in the oil will be extremely confined and the potential for increasing in amplitude so restricted, that they will remain flattened and of low amplitude. Since transition to turbulence is dependent on BLO amplitude exceeding a critical point, that will not occur, so laminar flow will persist, resulting in a high degree of slipperiness between the surfaces and marked reduction in sound generation and thus the generation of very little heat of friction. With lubrication, there is no generation of grinding and clanking sounds (low frequency audible), no squealing and squeaking (high frequency audible), and no unheard ultrasound frequencies generated by non-lubricated hard surfaces (probably a major source of intense heating when bare metal grinds against bare metal).

Put in other words, in the thin layer of lubricating oil, the simple-harmonic boundary flutter waves (BLFs) that create laminar vibrations (coherent sound energy) are very restricted, heat production is minimal and transition to turbulence does not occur.