MAXWELL'S DEMON EXISTS

Origin of the Term – In 1867, in a letter to fellow physicist Peter Tait, the great Scottish physicist James Clerk Maxwell proposed a thought experiment. He postulated a chamber divided by an impermeable partition into two equal parts. Both part contained equal amounts of a gas at equal temperatures.

He then proposed a "finite being[1]" that could open and close a door in the partition at will. He endowed this being with the ability to discern molecular speeds and positions. The being then proceeds to open to door to fast molecules moving from space A to space B, and to slow molecules moving from B to A. The being closes the door when opposite conditions occur.

In this manner, the being brings about a situation where B contains a hotter gas than does A. This temperature differential can then be used to drive a heat engine and to do work in violation of the Second Law of Thermodynamics—a law that Maxwell himself had earlier worked to prove most rigorously.

We need not concern ourselves either with Maxwell's motives (entirely laudable) or the Second Law (still generally accepted) at this point. Instead, let us consider the experiment itself. Let us look at the experiment's defining characteristics.

Essential Characteristics of the Demon – The "demon" has two essential characteristics. Firstly, he can distinguish between fast molecules and slow ones. Secondly, he can either pass or bar the passage of molecules through a plane depending upon their speed. Simply put, the two characteristics enable the demon to engage in molecular selection.

[1] By "finite" we have to assume that he meant that the being was not supernatural. A supernatural being would not be bound by natural laws and would render the experiment moot. By the way, Maxwell himself did not refer to the being as a "demon". Lord Kelvin first called the being by that name.

It should be noted that the experiment does not need a "finite being" to identify and segregate the molecules. This task could equally well be done by a device or a force.

Such devices have been developed, although they do require some outside source of energy to drive them (no violation of the Second Law here). The forces also exist and are ubiquitous. They are our—by now familiar—forces of intermolecular attraction.

The Demon in the Interface – In earlier papers in this series, we saw that each of the changes of phase which water undergoes also involve molecular selection and segregation. Vaporization and melting involve the preferential selection of faster molecules. Slower ones are rejected. Condensation and freezing involve the preferential selection of slower molecules. Faster ones are allowed to continue about their business. In each of these cases, the "demon" is hard at work doing the same job as Maxwell assigned to him in his famous thought experiment.

The location of these acts of selection, of course, is not the partitioned chamber Maxwell described. It is, instead, the interface between the two phases—a partition of sorts. The agent of this selection is the collective forces of intermolecular attraction that play the role of demon and do the actual sorting. Maxwell's demon may thus be found everywhere water or ice evaporates, everywhere water vapor condenses, everywhere ice melts and everywhere water freezes. Within the free atmosphere, the demon is ubiquitous.

Water, of course, is not the only substance playing host to the demon. We may assume that this same sort of selection and sorting takes place at the change of phase of any substance have two or more phases.

Summary – Thus we see that Maxwell's Demon does exist. He goes by many names: force of intermolecular attraction, surface tension, surface energy and so on. But he exists and is hard at work.

REFERENCES

INTERNAL REFERENCES: These are other papers in this collection that are either cited or linked during the course of the discussion or whose content is especially relevant to the current discussion.

GROSS VAPORIZATION – Definitions. The zone of attraction. Surface tension, hygroscopic forces, and ionic forces. Departure and outflow. Thermal distributions. Selection and escape. Heat of vaporization.

GROSS CONDENSATION – Definitions. Free atmospheric considerations. Condensation nuclei. The zone of attraction. Molecular inflow rates. Forced and unforced inflows. The effects of moving air. Molecular selection and capture. Enthalpy transfer during condensation.

THE LATENT HEAT FALLACY – This paper offers an alternative hypothesis to the conventional hypothesis of the nature of latent heat. The temperature changes are shown to be a result of molecular selection in the change of phase processes.

EXTERNAL REFERENCES: These are papers by other authors that contain statements or data that are specifically incorporated into the current discussion.

Maxwell's Demon – Wikipedia – retrieved 27 June 2011
http://en.wikipedia.org/wiki/Maxwell%27s_demon