E-ISSN: 2706-8927
P-ISSN: 2706-8919
www.allstudyjournal.com
IJAAS 2020; 2(2): 221-223
Received: 16-02-2020
Accepted: 18-03-2020

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The emergence of chaos

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Abstract

This article talks about the phenomenon of chaos, that chaos means the random movement of particles, that matter consists of atoms, and in thermodynamics, molecules and ions also play an important role. Combining them all, they are called particles. Also, the motion of particles in kinetic and potential energies is considered.

Keywords: atom, molecules, ions, particles, internal energy, correlation, thermodynamics, chaos, coherence

Introduction

Matter consists of atoms. Recognition of this fact was the first step to deviate from the assumptions made on the basis of everyday experiences. Of course, we could go in this direction, given the somewhat more fundamental content of the substance. Perhaps Kelvin was right, because he had assumed that the most fundamental classification of the universe was an energy that would always exist and be preserved, but could easily pass from one form to another, and that its value would probably be zero! Although matter is similar to onions in its structure, we will dwell on the first definition, that it consists of an atom. This can be attributed to the fact that in thermodynamics we have to deal with changes in the state caused by very "soft" thermal effects. In general, the energy that we encounter in thermodynamics, which is transferred to the system during heating, is not enough to break down the atom.

For this reason, thermodynamics has become one of the first fields of scientific research. It was only during the development of ultra-high-energy methods that other, deeper stages in the study of the structure of matter were opened up. In this way, ideas about the internal structure of the atom, nuclei, and later nucleons entered science. Heat, even if it burns or burns, is still a way to have a sufficiently "soft" effect on the atom.

The concept of the atom originated in Ancient Greece and found convincing proof only in the early twentieth century, and by the early 1920s, it was in full swing.

Despite its elegance, logic, and internal proportions, thermodynamics cannot be complete unless the relationship of matter to the atomic model is established. This view (among others) was not accepted by many scholars except Clausius. It was he who later lit the same fire that Boltsman had lit up the whole world.

Although we have always talked about atoms, molecules and ions play an important role in many applications of thermodynamics (the latter being made up of atoms or molecules that carry an electric charge). We then unite atoms, molecules, and ions into particles and call them particles.

Materials and Methods

To understand the structure of matter, we need to define the concept of energy. It is known from elementary physics that any particle can have an energy that arises as a result of its motion and its position in space. So we are referring to kinetic and potential energies.

A particle in the Earth's gravitational field has a potential energy that depends on its height, and this energy is greater the higher the particle is located. Similarly, a deformed spring will have potential energy that depends on its degree of elongation and compression. Charged particles located close to each other have potential energy as a result of mutual electrostatic interactions, and the same is true of a neutral atom, but here the electrostatic effect occurs between the nuclei and the electrons of the atoms.

A moving particle has kinetic energy, and the faster it moves, the more energy there is; at rest the particle does not have kinetic energy. A massive, fast-moving particle, say a nucleus (or a proton in an accelerator), has a significant reserve of energy due to its motion.

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The most important property of a particle's total energy (the sum of its potential and kinetic energies) is that it is conservative and invariant in the absence of external forces. This is the essence of the law of conservation of energy. This phenomenon became a major phenomenon in physics after the notion of the universality of energy, which was discovered during the nineteenth century. The law of conservation of energy explains the motion of "particles" in everyday life - for example, the motion of a stone or a ball - and this law can also be applied to particles the size of an atom. The law of conservation of energy easily explains the nature of the motion of a physical pendulum: in the process of motion, from time to time the potential energy is exchanged for kinetic energy, and vice versa. In this case, the pendulum starts its motion from the highest point of deflection, then quickly (with high kinetic energy), moves to the low potential energy field close to equilibrium, and then, decreasing the speed, to the highest point on the opposite side (turning point). rises, where the kinetic energy is zero and the potential energy is at a maximum. Potential and kinetic energy are equivalent in the sense that each of them can easily pass to the second type, the sum of which remains constant for the object in isolation.

A characteristic feature of thermodynamics is that this science deals with a very large set of particles. The number of these particles can be estimated using the Avogadro number, which is 6 · 1023, and 12 g of carbon contains the same number of atoms.

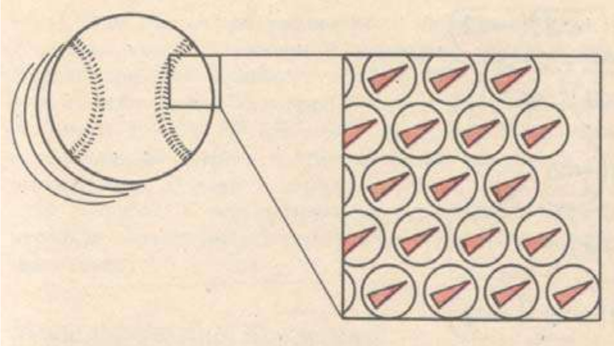
The energy of a thermodynamic system (for example, if we take water consisting of molecules in a simple glass, the number of molecules is several times greater than the number of Avogadro) is the sum of the kinetic and potential energies of all particles. From this it is clear that full energy is preserved. However, in a thermodynamic system consisting of a large number of particles, a new type of motion occurs that is not limited to individual particles.

Consider the kinetic energy in a set of particles. If all the particles suddenly move in the same direction and at the same speed, the whole system will be in flight mode like a tennis ball. In this case, the system behaves like a massive particle and the usual law of dynamics can be applied to it (such a motion is called the center motion of the masses).

However, there is another type of movement. It can be imagined that the particles of the system move chaotically, not in order: the total energy of the system will be the same as before, but there will no longer be a final motion, because the speed and direction of motion of the atoms will be chaotic. If we could observe one particular particle, the particle would travel a little distance to the right, hit the adjacent particle, bend slightly to the left, hit another, and so on. the main feature of this type of motion is the absence of correlation between the motion of different particles; in other words, their motion is not coherent (disorderly).

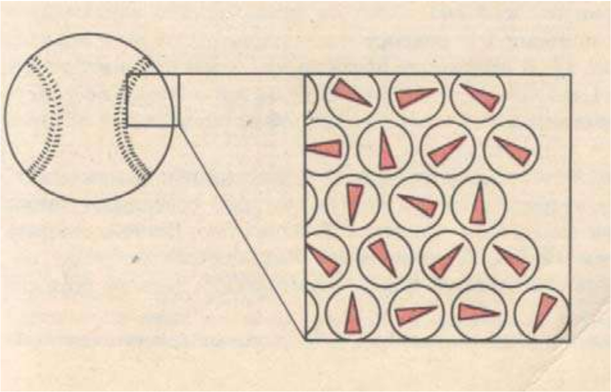
Results and Discussions

The random, chaotic, uncorrelated, non-coherent, unregulated motion we describe is called thermal motion. It is clear that the concept of thermal motion cannot be applied to a single particle. In the transition from considering the motion of individual particles to a multi-particle system, if we want to consider the existence of correlations in their motion, we move from simple dynamics to a new branch of physics - thermodynamics. Such an expansion of the imagination greatly enriched physics, including the understanding of the mechanism of motion of the steam engine, as well as the explanation and use of many other phenomena in nature and technology.

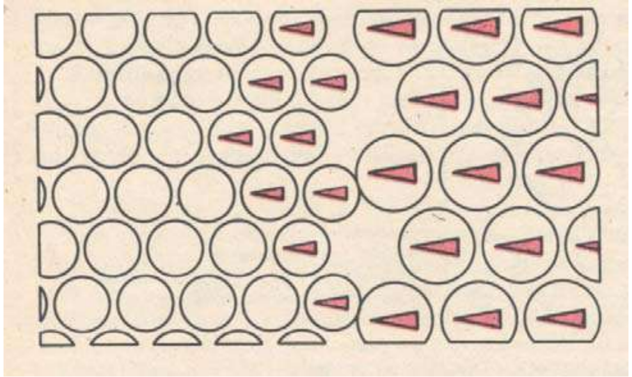


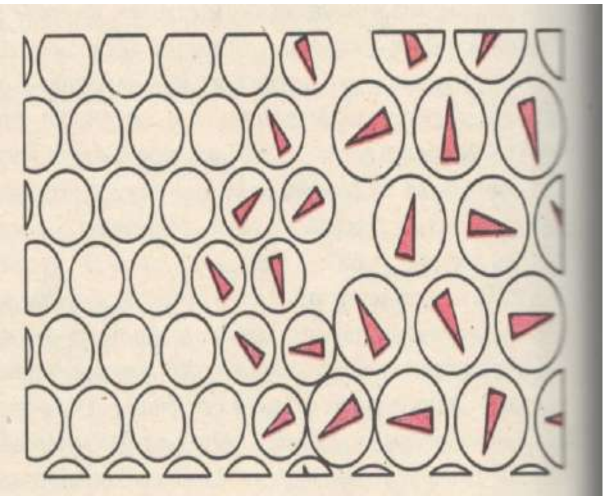
The particles of a flying ball move in an orderly manner, that is, they are in a state of orderly motion.

Thus, we found that there are two types of particle motion in complex systems: motion can be coherent, in which all particles move in unison (“in the same step”), or, conversely, unregulated, i.e., all particles move chaotically. After getting acquainted with the basics of thermodynamics, we are convinced that there are two ways to transfer energy to the system: by heating it and by working on it.



The same amount of energy can be concentrated in a quiescent but heated ball. In this case, the particles of the ball are in a state of irregular motion. Such a random, incoherent, chaotic motion is called thermal motion.





The work involves the transfer of energy using the motion of the particles of the environment surrounding the system (from left). The particles of the system can “assimilate” the orderly motion and “dissipate” it into the thermal motion. Heat- refers to the movement of energy (from the right) with the chaotic motion of environmental particles. By colliding with the particles of the system, they attract the particles to a disproportionate thermal motion.

These two facts can be combined into one definition:
As we work on the system, we force its particles to move in an orderly fashion; and conversely, if the system is working on the environment, it calls for orderly action in the environment.

When a system heats up, we encourage its particles to move erratically, and conversely, when heat passes from the system to the environment, chaotic motion occurs.

The differences between these two methods of energy transfer are shown in the figures.

We explain this in examples. Let’s say we want to change the energy of a piece of iron with a mass of 1 kg (it consists of a cube with an edge close to 5cm). One possibility is that if we want to lift it, when the lift height is 1m, the increase in potential energy of the sample will be close to 10J (1J is the amount of work required to move a body of mass 1 kg to 1 m. 1 J = 1N m = 1 kg m2 / s2). As a result of the lift, we move all the atoms of the sample in a sequence of 1 m. In this case, the energy is transferred to the sample by means of work, now all the atoms of the sample are concentrated in the form of gravitational potential energy.

Then, suppose the sample is thrown in one direction in a horizontal plane. In this case, all its atoms move in a similar order, increasing their kinetic energy. If they all move at the same speed, say, 4.5 m / s, then the sample will have an energy of 10 J. The energy is transferred back to the sample by doing the work, but now all the atoms of that sample are concentrated in the form of kinetic energy.

Conclusion

Finally, we throw the sample into the fire and heat it (i.e., increase its temperature). In this way we increase the energy of the sample, but it remains in its initial position and apparently does not move. However, if the temperature of the sample rises by only 0.030S, the energy transferred to it will reach the 10 J known to us. Now the energy is concentrated in the form of the thermal motion energy of the atoms. In essence, it will be concentrated in the form of the kinetic and potential energy of the particles, as before, but this form of energy storage should not interest us at all. However, in this case the position and velocity of the atoms are not correlated with each other, there is no final migration of the sample as a whole. The energy is transferred to the sample by means of heating, which causes chaotic motion in it.

References

1. Etkins P. "Order and disorder in nature" "Mir" Publishing House, 1987
2. Fenn JB. Engines, Energy and Entropy. - W.H.Freman and Co., 1982 (Russian translation: Fen Dj.B. Mashiny, energy and entropy.- M.: Mir, 1986).
3. Leontovich MA. Introduction to thermodynamics and static physics. –M.: Nauka, 1983
4. Bazarov IP. Thermodynamics (izd.3-e).- M.: Vysshaya shkola, 1983
5. Ter Xaar D. Vergeland G. Elementary thermodynamics. - M.: Mir, 1968