LECTURES TO LITTLE FOLKS.

In our last number we gave illustrations of the attraction of all matter towards the Earth's centre. In the present chapter we will treat on the *Mechanical* properties of bodies.

Suppose you were to be asked whether a piece of wood or an iron bar were all solid matter, what would be your reply? You might naturally answer, certainly they are; do we not feel that they are hard and solid? Cannot wood be sawn into small pieces, and a stone broken into fragments, each of which is solid? Doubtless they so appear to you, but in reality such is not the case. A portion of each is empty space; the wood is full of small cavities or pores, and the iron bar has small cavities in it, but less of them, therefore there is more space in the piece of wood than in the iron bar. This difference is expressed by saying that the iron is *denser*, or more compact, than the wood. The empty spaces in the interior of bodies are called *pores*, which are visible in many substances, for example, in sponge, cork, and some kinds of wood. The larger visible pores contain air, and the more minute—in even the densest substances—contain a very subtle ether, which also fills all space.

All matter is capable of being divided into smaller and smaller parts without any apparent limit. There are two ways in which matter can be sub-divided:

1st. *Mechanically*, that is, by pounding, grinding, &c.

2ndly. By *Solution*.

The sub-division of matter by solution can be done in the following manner: Take a grain of blue vitriol, smaller than the smallest pea, and put it into half a gallon of water containing 20 drops of spirits of hartshorn, and it will give the water a blue tinge. Now in this half gallon of water there are no less than 250,000 drops, consequently you will be able to prove that this little bit of blue vitriol, not so large as a pea, has been so subdivided as to have given a portion of its substance into 250,000 drops of water, which again may, by a further dilution, be sub-divided still further. Chemistry, however, informs us that there is a limit to these subdivisions of matter, and that there are last particles that cannot be any further divided; these indivisible particles are called *atoms*—every body of matter is made up of them. But although a piece of wood, stone, or iron, may appear to be a solid mass of atoms closely pressed together, in reality they are not in actual contact with each other, but stand apart, each atom being pulled towards the other, or attracted, just as a magnet attracts a piece of iron that is brought near it, and this attraction between atoms is called *cohesion*. The reason why the atoms do not rush together, and all bodies become solid, is because the heat collected between them or around the atoms exerts a *repulsion*, and keeps them a certain distance apart. The way we know that heat has this effect is from the fact that if the heat be increased the particles are forced farther apart, and if it be diminished they draw nearer together. The forces of attraction and repulsion exerted between the atoms of bodies is enormously great. Iron wire, of one-quarter of an inch thick, could not be broken by the united strength of five horses. This will illustrate to you the force of attraction of the atoms towards each other composing the wire. The power of *repulsion* will be readily understood by you from your acquaintance with the explosive power of gunpowder, which will project a cannon ball of great weight to a long distance, and rend the hardest rocks into fragments.

All substances have different mechanical properties; for example, iron is *hard*, and chalk *soft*; glass is *brittle* and gold is *malleable*. There are other malleable metals which can be hammered out into leaves or rolled into sheets, such as silver, lead, aluminum, tin, copper, zinc, platinum and iron. Some metals are called *ductile*, that is, when they can be drawn out into a wire or thread. Platinum, silver, iron, copper and gold are ductile; zinc, tin and lead are also ductile in an inferior degree. Melted glass is very ductile—it can be drawn out or spun into fine threads.

Another mechanical property of matter is *elasticity*. For instance, a piece of indiarubber, when stretched, will fly back if left to itself, because the particles, when displaced, tend to recover their original positions. When we squeeze a rubber ball in one hand, or bend a piece of whalebone, the same elastic tendency is observed. Glass, ivory, steel, air, and all gases, are highly elastic.

Matter exists in the liquid states—*solid*, *liquid*, and *gaseous*. A stone is solid; water is liquid; and air is gaseous. Some substances may be made to pass from one of these states to another, merely by increasing or diminishing the amount of heat which it contains. Water is converted into vapour by heat, and ice by cold.

Another mechanical property is that of *attraction of adhesion*, or simply *adhesion*. Suppose two polished plates of glass or metal are laid one on the other, and slightly pressed, it will be found that, if you undertake to separate them, they will stick together by the force of adhesion. Common window glass will not do this, because the panes are not smooth enough to come in contact; but if water is placed between them, so as to fill up the inequalities of their surface, the adhesion will be very strong. Another illustration of adhesion is the marks made in writing with chalk, or lead pencil, or on dust on the walls of rooms. If you dip your finger into water it becomes wet, because a film of water adheres to it.

Attraction is another mechanical force which we particularly alluded to in our last lecture, and it manifests itself between bodies at a distance, as well as between those which are in close contact. The Earth attracts all bodies, and causes them, if unsupported, to fall towards its surface.

I hope, "Little Folks," that you will carefully read this introductory lecture on the Mechanical properties of bodies, as it will help you to better understand further illustration on Natural Philosophy, which we purpose continuing in future numbers.

When a teaspoonful of any medicine is prescribed by a physician, it should be borne in mind that the quantity meant is equal in volume to 45 drops of pure water at 60° Fah. It is a good plan to measure off this amount in water in a small wineglass, and mark on the latter the exact hight of the fluid. This will give an accurate and convenient standard for future use. Teaspoons vary so much in size that there is a very wide margin of difference in their containing capacity. It is well to remember, also, that four teaspoonfuls equal one tablespoonful or half a fluid ounce. A wineglassful means four tablespoonfuls, or two fluid ounces; and a teacupful, as directed by cookery books, indicates four fluid ounces or one gill.

Gold Varnish.—16 parts shellac, 3 parts gum sandrach, 4 parts mastic, 1 part crocus, 2 parts gum gamboge, and 140 parts alcohol.

Another.—8 parts gum seedlac, 8 parts sandrach, 8 parts mastic, 2 parts gamboge, 1 part dragon's blood, 6 parts white turpentine, 4 turmeric and 120 alcohol.