**How Fast Do Fluids Flow?**

(Science Power 8 Page 117)

Some liquids can flow \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ than others. Orange juice flows freely from a jug or carton, but how would you describe the flow of chocolate syrup from a bottle or the flow of honey from a jar?

If you wanted to know how fast you could run, you might ask a friend to time how long it would take you to run, say, 100m. This measurement would be your speed. In a similar way, you could measure how fast a fluid “runs”. You would measure the time it takes for the fluid to flow from one point to another (its distance). This characteristic is called the fluid’s flow rate.

Applications of Viscosity (Science Power 8 page 120)

Why might it be important to know how to determine the flow rate and, therefore, the viscosity of a liquid? The viscosity of liquids is an important property that must be measured precisely in some industries. For example, the viscosity of paints, varnishes, and similar household products is closely regulated so that the paints and varnishes, and similar household products is closely regulated so that the paints and varnishes can be applied smoothly and evenly with a brush or a roller. In fact, antique dealers and many householders are glad that furniture stripping liquid has finally been thickened. Previously, this thin, smelly liquid was difficult to use because it tended to run down and off the furniture before it had a chance to remove old paint and finishes. Now, however, the viscosity has been increased to produce an almost gel-like texture, so that the product is easier to apply and sticks well to the surface of the furniture. The viscosity of medications, such as the various liquids used to remove warts, has also been modified for easier application. Drug companies manufacture medicines, such as cough syrup, that have a high viscosity yet are still drinkable, in order to coat and soothe the throat.

People in many occupation need to know how to adjust the viscosity of a substance to suit specific applications. For example, chefs need to know how to make gravies thinner than sauces and frostings thicker than icings. Mechanics must choose an engine oil that is the right viscosity for the season. Artists need to know how to thin or thicken oil paints or acrylics. Technicians must control the viscosity of various chemicals in chemical processing plants.

Why Viscosity Varies (Science Power 8 page 123-124)

Imagine that you and a friend are moving through a crowded shopping mall. Could you make your way through the crowd more quickly if your group were small rather than large? Small groups can move through a crowd more quickly than large groups because they can fit into the empty spaces between other groups more easily. In a similar way, the particle theory suggests that small particles can move past each other more easily than large particles can. Large particles take up more space.

Also imagine that you, your friends, and everyone in the shopping mall are carrying huge parcels and knapsacks. It would be even more difficult to squeeze through the crowd because everyone’s bulkiness would be taking up even more space. Similarly, some particles are bulkier than others because of their shape. For examples, oil particles are bulkier than water particles. Thus, oil is more viscous than water.

Next imagine that everyone in the mall is wearing shoes made entirely of Velcro. Every time you would try to walk by someone, your shoes would stick to theirs, with every step, you would have to stop and pull your foot away from another person’s foot. No matter how large or small the people in the crowd, it would take a very long time to walk through the mall. In a manner similar to people wearing Velcro shoes, all particles attract each other. However, certain types of particles attract and hold onto each other more tightly that other types. It is very hard for these particles to flow past each other, so they do so very slowly. The strength of the attraction that particles have for each other is the most important factor in determining a fluid’s viscosity.

Finally, imagine that everyone in the shopping mall is moving very, very slowly and will not move out of the way as you and your friends try to pass. In this situation, it would take an even longer time to move through the crowd. This is similar to what happens to particles when they are cooled – they slow down.

Even though all fluids flow smoothly, they flow at different rates because they have different viscosities. Another way to define viscosity is resistance to flow. Resistance to flow means that the particles can move around, but it may be difficult for them to pass by each other; this resistance generates internal friction. Another work for friction is “rubbing.” It is easier to skate on ice than on pavement because the friction between the skates and the ice is less than the friction between skates and pavement. Similarly, it is easier for some fluid particles to move past each other, compared to other fluids.

A liquid’s ability to flow also depends on the energy that the particles have to move around. The warmer the liquid becomes, the more energy the particles have to move out of the way and make room for other particles to pass. However, as the temperature drops, the particles have less and less energy to move around, so the empty spaces between them get smaller and smaller. In general, a fluid’s viscosity decreases as the fluid is heated and increases as the fluid is cooled.