

Chromatography

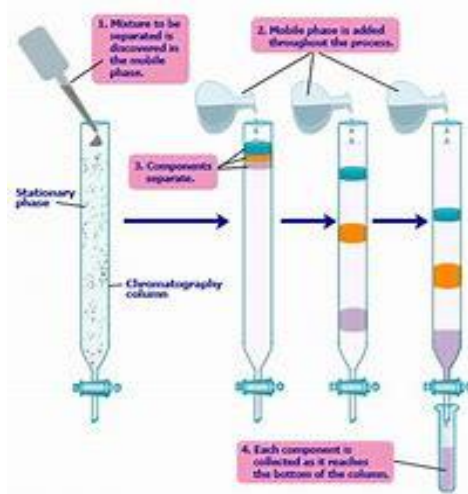
Imagine a race. Now imagine all of the runners lined up at the starting line. The gun goes off indicating for all runners to begin. In the middle of the race, all the runners are spread apart because they all have different abilities. Some move faster than others. This is the same idea behind chromatography. Since all particles have different 'abilities' they will move at their own speeds and some will go farther than others.



Chromatography is a way of separating a mixture of chemicals. In this technique, there is a substance that is either solid, liquid or gas, moving over another stationary substance that is in a different phase than the first. The overlapping of these two substances causes them to separate. The substance that is moving is called the mobile phase and the substance that is not moving is called the stationary phase.



You might have observed that when you accidentally spill water onto a piece of paper, the writing on the paper smudges. Do you know why? Chromatography is the answer. When the paper is dipped in water, some of the particles in the ink stick to the water and the water pulls it along with it. This spreading happens because some particles stick better to the liquid than others. The technical term for this sticking is known as polarity, so material which is polar is going to attract to polar material better than a nonpolar material.



Chromatography is important in the field of engineering. One important application of chromatography is in forensics. Many chemical engineers are hired by forensic companies to try and figure out what components make up a piece of evidence. Chromatography is also used in the pharmaceutical industry. It is used to analyze the compounds in a particular medicine and to see if it is contaminated or not.

What is a Non-Newtonian Fluid?

A non-Newtonian fluid typically exhibits properties of both a solid and a liquid. It all depends on how a force is applied to it. If you were to slowly place your hand in a mixture of cornstarch and water it acts as a liquid. However, if you were to try and punch this same mixture it would act as a solid. Essentially, its viscosity (or its resistance to flow/deform) changes when force is applied to it. Not all non-Newtonian fluids react in the same way when force is applied to them. Think about putting ketchup on your fries! You tilt the bottle upside down and nothing comes out, but if you squeeze it, the ketchup flows out easily.



Non-Newtonian Fluids in Everyday Life

We interact with non-Newtonian fluids almost on a daily basis whether we realize it or not. In fact, many of us start out our morning by using a non-Newtonian fluid to brush our teeth...toothpaste! Toothpaste acts

similarly to ketchup where it exhibits properties of a liquid when force is applied. There are also many foods that are considered non-Newtonian fluids. If you don't put ketchup on your fries, do you put Mayonnaise on your sandwich? Mayonnaise, honey, and of course cornstarch are all non-Newtonian fluids too. How many of these non-Newtonian fluids do you use on a regular basis?



Ketchup is a non-Newtonian fluid. It doesn't follow the rules!

www.scienceforkids.com

Much of the plastic that we use in our everyday life was once a fluid at some point. It is not uncommon for these highly viscous liquids to exhibit non-Newtonian properties. This has to be taken into consideration when manufacturing large quantities of plastic products. How would you

transport this fluid throughout a manufacturing plant? Or would you?

Importance of Non-Newtonian Fluids

As mentioned above, not all non-Newtonian fluids act in the same way as this basic mixture of cornstarch and water. While the cornstarch mixture becomes a solid when pressure is applied, there are other substances that do just the reverse. This becomes extremely important when it comes to building, especially in earthquake prone areas. If the ground acts as a non-Newtonian fluid when more force is applied, and becomes more viscous, it could have devastating effects on surrounding structures.



What is Surface Tension?

Surface tension is the attractive force on the surface of a liquid that allows it to stay together. As you can see on the right, it is what allows bugs to walk on water. Water molecules hold tightly to each other and always want to clump together. Surface tension is a fundamental topic in chemical engineering. It is used frequently because we are frequently looking at flowing liquids.



Cohesion of Alcohol



Surface tension is the special term for cohesion of water molecules (bonding of water molecules). Water has strong forces that interact between the molecules called hydrogen bonds. The cohesion of alcohol is the bonding of alcohol molecules. Alcohol's cohesion is not as strong as water because it does not have this strong force of hydrogen bonding. This can be seen when comparing the two liquids. When a drop of rubbing alcohol is placed on a penny, it flattens out and cannot hold as much liquid on a penny as water can.



The Coating Industry

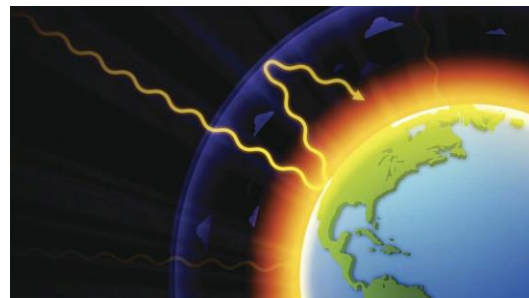
Surface tension is kept in mind when different types of coatings are designed. In the industrial setting, coating processes are used for protecting nearly everything, including architecture and transportation services. In the consumer industry, coatings and paints are used in mirrors, adhesives, insulation, waterproof materials, and more. When these products are produced they need chemical engineering for the various processes.

Drop vs. Drop

Experiment a little and count how many drops of water it takes for the water to spill over the edge compared to the rubbing alcohol. It will take much more liquid for the water to spill over the penny.

Pocket Full of Sunshine

Global warming occurs when various types of gases and pollutants are released into the air, making it unclear and unnatural. These gases collect in the atmosphere and absorb sunlight that should be hitting Earth's surface. Since the gases block the sun's rays, our planet heats up. This phenomenon is known as the greenhouse effect. Everyday things contribute to global warming, such as exhaust from cars and smoke from factories.



Reduce! Cut back on the amount of waste you produce. This includes simple actions such as turning off the water when brushing your teeth.

Reuse! Find new ways to use trash instead of throwing it out. Turn old boots into a flower pot and plant flowers. This gives the boots a new purpose along with planting something that helps clean the air we breathe.

Recycle! Look for the recycle logo on any product to see if it can be recycled. If it can, place it in a separate container that is usually blue and says "Recycle" on it.

You can also use alternative energy! Solar and wind power are both used in place of electricity and they are just as efficient as fossil fuels and other types of power. Have you ever noticed those big rectangular panels on some houses? Those are solar panels! These panels trap energy from the sun and convert it into energy. If more people try to reduce, reuse, recycle and use alternative energy, we can definitely make a big change!

More Information:

Various K-12 activities about Global Warming:

<https://climatechangelive.org/index.php?pid=180>

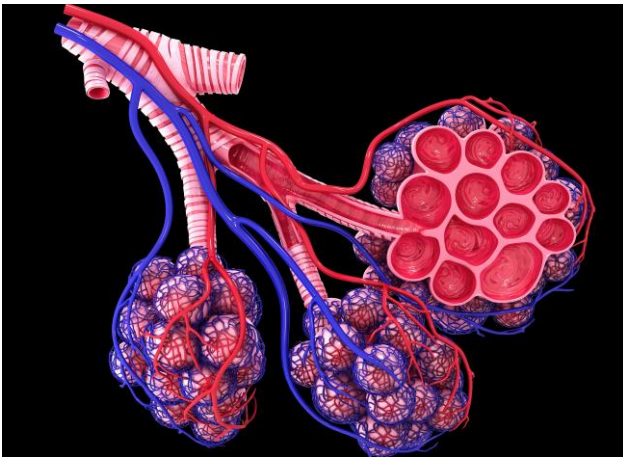
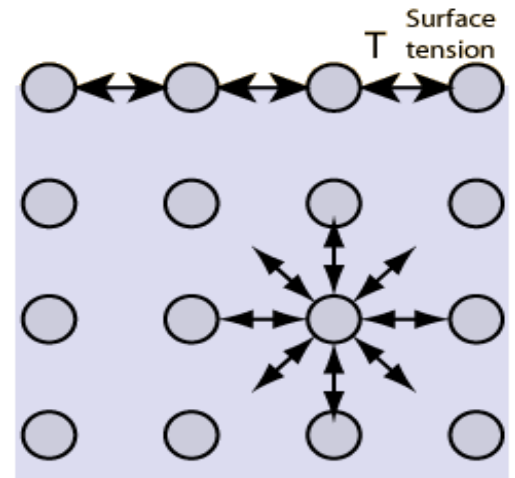


Surface Tension

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How do things float?

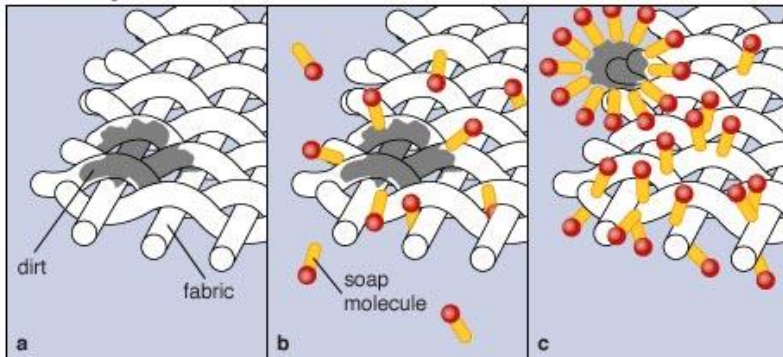
Surface tension causes small objects to float. When the object is on the surface of the fluid, the surface tension causes the fluid to behave like a flexible membrane. Without surface tension, everything would sink. The marine life ecosystem would be completely destroyed.



Surface Tension Applications

Surface tension has many functions. It causes floating/walking on water for certain small creatures. Have you ever seen those small water bugs on a body of water? That's because of surface tension! Surface tension also keeps our lungs inflated. The air inside your lungs is moist which causes surface tension within the tissue of your lungs. The tiny air sacs in your lungs are called the alveoli. These sacs are very elastic. This allows the force of surface tension to deflate the alveoli during exhalation.

How Detergents Clean Clothes



Surfactants

A surfactant is a substance that works to decrease the surface tension of the liquid it was dissolved in. Surfactants like soaps and detergents help clean clothes. They decrease the surface tension of the water in the washing machine so it can more easily soak into the pores of dirty areas.