Capillary rise method surface tension pdf

After this lesson, students should be able: Describe the difference between adhesive and adhesive forces. Explains how it's a menus formed. Describes how adhesive and cohesive force combinations cause water to rise in a thin tube or other small spaces (capillary action). Explains how to use capillary actions. NGS Performance expects HS-PS1-3. Plan and perform an investigation to gather evidence to compare the structure of substances to the scale essential for infecting the strength of electrical strength between particles. (Grade 9 - 12) Do you agree with this alignment? Thanks for your feedback! Click to see other curriculum aligned in this Hope performance lesson focused on three-dimensional learning aspects of NGS: Science & Engineering Practice Core Disciplinary Core Concept Plan and conduct an investigation investigation individually and collaboratively to produce the data serve as the basis for evidence, and in the design: deciding on type, how much, and precision of data needed to produce reliable measures and consider limitations on the accuracy of the data (e.g., the number of trials, prices, risk, time), and refined the design accordingly. Agreement Alignment: Thank you for your feedback! Structures and interactions in question at the scale are essential to determined by electrical strength in and between atoms. Agreement Alignment: Thank you for your feedback! Different patterns can be observed in each of the balances in which a system is studied and can provide evidence for the causality of the phenomenon explanation. Agreement Alignment: Thank you for your feedback! Knowledge gained from other fields of study has a direct effect on the development of technological products and systems. (6th - 8) More Detail View aligned curriculum you agree with this alignment? Thanks for your feedback! Suggest an alignment that is not listed above A basic understanding of cohesive strength (attraction to liquid molecules with each other) and surface tension. (In advance, there is handy a glass of water, food / coloring water, and white paper towels, to use as described below.) (Catch a beak or glass of colored water and food.) Imagine you were outside during a warm July day. You come inside and pour a large glass of water. (Set glass on top counter.) Now let's say you start talking to your parents or a brother or sister and... (knock the glass to fall some of the water and eat water.) What are you going to do now? (Hopefully someone suggests using a paper towel in clearing it.) (Place an edge in a white paper towel in the colored development. Let the water up in paper towels while you talk.) Can someone in front who can see what happens in the towel describes it to those in the back? (Hopefully a student describes how the color will go up the towel.) Why is this happening? (Give students some time to answer. Expect a student to mention their space or hole in the towel.) Good. What else can you think of what is zinc and Water? (Various responses are possible. An example is a sponge). The ability towel paper towels to absorb liquids is an example of capillary action. (Lift the towel paper out of the liquid and show the grade how the liquid went up.) What if I tried to do this with a plastic bag, who would absorb the water? why not? Let's list some material that can be absorbed with some hardware. We'll see what every group has in common. (With students'ed, create two lists and look for the simulator in each group and the difference between them.) A very accurate method of measuring surface tension is in capillary action, since the height water increases in a thin tube related to the surface tension in the climbing liquid. For many industrial processes, an accurate measurement of important surface tension - such as paintings or coating an object (layer of a pot and oil from a spray can, applying soldiers form electrical connections on a circuit board, applying ink using inkjet printing, paint planes, etc.), so tension to surface in the layer carefully keeps them producing the desired thickness without creating any uneven plates. The strength and efficiency of detergents are also partially determined by surface tension. Besides providing a method of measuring surface tension, the capillary action itself has many different applications. Can you think of any example of capillary action in the real world? (Take suggestions from students.) What's about: cleaning up with a sponge, how did you absorb rainwater you absorb rainwater, successfully ride a villain, or how do your T-shirts become wet when you sweat? What about some applications engineers can be involved with? Well, capillary action in part determines the behavior of soil water, which makes it important for civil engineers and the environment to understand stability of buildings and roads as well as the environmental impact of human development. Petroleum engineers use their understanding of capillary actions in the extraction of its oil inefficient stones. And, understand the capillary action of the liquid transport of vital animals in biomedical engineering. We have already learned about surface tension and strength to hold water drops together. Today we're going to discuss why wood water in other things and even raise some objects. We will see that these phenomena provide us with a method of accuracy measuring surface tension. Cohesive and Scotch Force Figure 1. In the body of water, coherent forces act on a water molecule to pull in all directions and thus cancel outside. On the surface of the water, coherent forces pull inner water molecules. In any liquid, intermolecular forces cause the liquid molecules to be attractive to each other. Those forces that pull liquid molecules toward each other are known as cohesive forces. In the body of a liquid, a molecule is enclosed by other molecules in all directions, so the forces are attractive and the molecule feels no strength in general (see Figure 1). On the surface of the liquid kides/air, however, a molecule in the liquid feels the attractive forces of the other molecules from the liquid, but none from the outside. This causes layers of the outside of the liquid to act like a stretch membrane and minimize the surface area. We call this elastic membrane-like surface tension to elastic behavior. Figure 2. Scotch forces between the water and the glass molecules water to face the glass walls and create the well-known shape of the menisk. Besides digging adhesives, duct force also exists; they cause water molecules to try to stick, or understand, to solid surface. The most common example of the effect of adhesive force is the menisk that is often seen when using graduate cylinders. The water molecules respond to an attractive force scotch pull them towards the glass walls. Near the walls of the cylinder, the adhesive force pulls the water toward the glass stronger than the coherent force pulling the water molecules together. This attractive force pulled the water up the sides of the glass tube against the bottom crawling into gravity (see Figure 2). Look at the Exploring Capillary Action Activity for having students replicate these effects with a hands-on and testing procedure. Figure 3. Different than water, mercury creates a menus that is up high. Conversely, mercury fluids recover rather than attractive glass. The mercury is trying to minimize its contact with the glass walls. This causes a bowarding upward of the mercury fluid against the crawl downwards of gravity as it tries to maximize the contact between mercury atoms and minimize the contact with glass walls (see Figure 3). Capillarity is the combined effect of adhesive forces and adhesives that cause water and other liquids to ascend into thin tubes or other construction space. Inside a thin glass tube, the force adhesives, attractions between the water and the glass walls, draw water up the sides of the glass tube to form a menus. The cohesive force, the attraction of the water molecules with each other, then try to minimize the distance between the water molecules by pulling the bottom of the menisk up against the force of gravity. Figure 4. Water rises at different heights, depending on the capillary tube's diameter. In large diameter tubes, this ride to the water level is innocent. However, in the small tube-diameter tubes, the cohesive forces can draw the appreciated water distances (see Figure 4). The water will continue to climb the tube until the gravity force under the water equals the upper strength caused by tension of the surface. Figure 5. The height, RG, which water will climb due to capillary action related to angles of contact, θ, and the rays of the tube, a. A simple relationship determines how far the water pulls up the tube (see Figure 5). The upper strength due to surface tension is by this relationship: In this relationship, γ is the liquid-air surface tension of 20o C, 2πa is the circumference of the tube, and θ is the contact angle of water on glass, a measure of attraction of the liquid within the walls. The opposite force is descended by the force of gravity on the water that pulls above the reservoir level. Here, ρ = 1000 kg/m3 is the water density, g = 9.8 m/s2 is the acceleration due to gravity, and (hπa2) is the volume of the water in columns above the reservoir. Measuring a single tension surface by measuring the surface blood pressure of a liquid is measuring the liquid height that is mounted in a capillary tube. By putting the above two forces equal, we get tension from the surface to be: For pure water and cleaning, the contact angle is almost zero. In a typical high school lab, this may not be the case, but θ is small and we assume that the θ racing is close to 1. Note that students must be converted ρ, g, a and h into SI units before entering the equation. The surface unit for surface tension is J/m2 (or N/m). The accepted value of the surface tension in water in the air of 20o C is γ = 0.073 J/m2. However, you must use pure water and very clean glass to get this result. Generally, the measured surface tension is at least half of that number. Students can practice surface tension measuring with a hands-on experience of the Surface Measuring Tension activity. meniskis: the convex or concave upper surface of a column of liquids, the curve in which is caused by surface tension. (plural: Menus) Source: Dictionary.com. Surface tension: The property of the surface of a liquid allows it to resist an external force. This property is caused by joints of such molecules and explains many of the behaviors of liquids. Source: Wikipedia, May 2011. Pre-Lesson Assessment Discussion Questions: Ask students and discuss as a class: Who can remind the class what we have already learned about surface tension? When you water a plant, wherever in the soup you pour into the water, the water reaches all the roots. How is he doing that? Why does a paper towel absorb water, while a piece of plastic doesn't do that? Problem Evaluation Post-introduction To Check to Understand: Ask students to work individually (or in pairs or small groups) to respond to these two problems. Review and discuss responses as a class (or have students compare responses) in order to measure their level of understanding before moving on to make the lab activity associated. Estimation, in cm, how high water will occur in capillary action if the tube is the diameter of a human hair, 150μm (1.5 x 10-4 m), if we assume the surface tension in water in the air is 0.073 J/m2. (Answer: 19.86cm. See solution if needed.) Explain in short sentence why water is able to move up a thin tube. Expanded Homework Expanded Lesson Summary Assessments on What You Learn: Either in class or at home, give students investigating a real-life example of captivity Action. Use the examples mentioned in the Introduction / Motivation section or others offered by the teacher. Ask each student to prepare a poster and/or three-minute presentation that includes at least four photos to illustrate the example, and the answers to the following questions: How would you describe the example of your abilities? Why is your topic an example of captivity? What are your practical uses or effects examples? Adamson, Arthur W., et al. Physics chemistry on the Surface. New York, NY: Wiley, 1997, p. 16-19. Brown, Theodore, et al. Chemistry: The Central Science. 9th edition. Upper Saddle River, NJ: Pearson Education, Inc., 2003. (General information on surface tensions and capillary actions. Jrank Science & Arts Encyclophy science philosophy. Capillary action. Science.jrank.org. Accessibility in June 2010. Mike. Tree Physics 1: Capillary action, tree height, and the best placement of Branches. Posted July 2009. Npand.wordpress.com access to August 2009. (Derivation at water height of the capillary tube). Robinson, Clay. Capillary action. Last updated January 27, 2009. 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