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| Anatomy & Physiology 12  **Water Lab** | Name:  Block:  Date: |

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| Pre-Lab Reading |

Matter is made up of atoms, and atoms join together to form “molecules”. A water molecule is made of two hydrogen atoms and one oxygen atom (H2O). The combination of hydrogen and oxygen atoms in water makes water molecules “polar”. A polar molecule has two ends; one end has a positive charge and the other has a negative charge (just like a magnet has a north pole and a south pole). The positive end of water molecules attracts the negative end of other water molecules. That’s why two wet sheets of paper stick together. It’s more difficult to slide two sheets of wet paper apart than to peel them apart because sliding involves breaking the attraction of many more water molecules. Water molecules are also attracted to paper; paper contains molecules that have polar parts.

“Stickiness” involves two forces of attraction. When two different substances are attracted, the force is “adhesion”. For example, water adheres to grains of sand on a beach. When a substance is attracted to itself, the force is “cohesion”. Water coheres to itself. The combination of adhesion and cohesion is what makes it possible to build sand castles. Dry sand won’t stick together, but add a little water and you can form the sand into all sorts of shapes.

The force that attracts molecules of the same substance to each other is called “cohesion”. Water molecules have a cohesive force – they are strongly attracted to one another. Water molecules that are surrounded by other water molecules are attracted in all directions. However, water molecules at the surface of a glass of water have no water molecules above them. They are all pulled strongly in the same direction – downward to the water molecules underneath them. The attraction between molecules on a liquid’s surface is called “surface tension”. The surface of the water acts as if it has a thin skin over it. The surface tension is strong enough to prevent a “full” glass of water from spilling as paper clips are added. As more and more paper clips are added, the surface of the water begins to look curved – like a lens – until the water finally spills over the rim of the glass.

Surface tension is caused by an attraction between molecules on the surface of a liquid. Adding soap (or detergent) to water will weaken the attraction of water molecules to each other. Soap has a lower surface tension than water. Soap molecules are interesting because they are both polar and non-polar. A soap molecule is long; with one end being polar, and the other end is non-polar. The polar part of the soap mixes with the polar water molecules and lowers the surface tension of water.

Dishwashing liquids clean greasy dishes well because water on its own is repelled by grease. Oil molecules are non-polar and non-polar molecules don’t mix well with polar molecules like water. When dishwashing liquid is added to the greasy dishes, the non-polar end of the dishwashing liquid molecule mixes with the non-polar oil. The polar end of the dishwashing liquid mixes with the polar water.

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| Purpose |

To investigate the properties of water and how they affect its interaction with other matter.

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| Station 1: Sticky Water |

*Equipment: 2 sheets of paper towel, 2 sheets of different type of paper and water*

1. Hold two sheets of paper together. Do they stick to each other? \_\_\_\_\_\_\_\_\_\_\_
2. Completely wet each sheet of paper with water. Hold the two sheets together. Do they stick to each other? \_\_\_\_\_\_\_\_\_\_\_
3. Try to slide them apart. Is it easy to slide them apart? \_\_\_\_\_\_\_\_\_\_\_
4. Try to peel them apart. Is it easy to peel them apart? \_\_\_\_\_\_\_\_\_\_\_
5. Repeat the steps with a different type of paper. What do you notice?
6. Dispose of the paper in the paper-recycling bin.

*Questions*

1. Name and define the two forces that cause the soaked papers to stick together?
2. What is meant when molecules are described as being “polar”?
3. How does polarity of water molecules make it more difficult to separate wet paper than dry?

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| Station 2: Full Glass |

*Equipment: test tube, test tube rack, numerous paper clips, water, dishwashing liquid*

1. Fill a test tube to the rim with water.
2. Slowly drop 1 paper clip into the test tube. Be careful not to drop the paper clip from high above.
   1. What do you notice? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
3. Carefully add more paper clips. How many paper clips can you get into the “full” test tube before the water spills? Five? Ten? Twenty? Thirty? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
4. Make a labeled sketch of the test tube and its contents, using a side view, showing its appearance just before the spill.
5. Empty the test tubes and repeat this procedure. Before adding the paperclips, add 3 drops of detergent. How many paper clips fit into the test tube now before spillage? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. Is this more or less then the test tube with only water? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
6. Empty the water into the sink and dry the paper clips. Return dried paper clips to the original container.

*Questions*

1. What is “surface tension”?
2. Explain how cohesion creates surface tension.
3. What evidence did you observe that suggests water exhibits surface tension?

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| Station 3: Pepper power |

*Equipment: Petri dish/watch glass, pepper, soap, water*

1. Partially fill the petri dish with cold water. Place it flat on the lab bench.
2. Sprinkle pepper over the surface of the water.
3. Put 1 drop of dishwashing liquid into the centre of the pepper. Observe.
4. Make a labeled sketch below of before and after. Describe what happened.
5. Wash the petri dish.

*Question*

1. Describe a soap molecule.
2. Why is dishwashing liquid better at cleaning greasy dishes than plain water?

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| Station 4: Copper Sulphate Observation |

*Equipment: 250 mL beaker, powdered solute, water, scoopula, timer*

1. Fill a 250 mL beaker ¾ full of water (~190 mL)
2. Use a scoopula to scoop one spoonful of powered solvent into the water.
3. Wait 10 minutes. Observe. Make a labeled sketch of the beaker and the contents to show what you observe.
4. The contents of the beaker can be disposed of by rinsing it down the sink with lots of cold water.

*Questions*

1. Explain how the powdered solute dissolves in water.
2. Would the temperature of the water speed up the process of dissolving? Why or why not?

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| Station 5: Oil and Water |

*Equipment: Test tube, oil, water, test tube stopper, test tube brush, timer*

1. Fill a test tube ½ of water.
2. Fill the remainder of the test tube with oil.
3. Observe. Make a labeled sketch in the table below.
4. Place the test tube stopper on the test tube.
5. Shake the test tube vigorously for 1 minute. Be sure to hold onto the test tube stopper while shaking.
6. Observe. Make a labeled sketch in the table below.
7. Make another observation 5 minutes after shaking. Make a labeled sketch in the table below.

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| **Before the shaking** | **After the shaking** | **5 mins after the shaking** |
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1. The contents of the test tube can be disposed of by rinsing it down the sink with lots of hot water. Use detergent and test tube brush to wash the test tube.

*Question:*

1. Referring to their molecules, why do the oil and water in Station 5 behave as you have seen?