**Criterion B - PROBLEM/QUESTION**

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| **Level** | **What do I have to do?** | **What does this look like?** |
| **Beginning** | State the problem/question you’re going to explore in your lab with limited success | Does salt make it boil sooner? |
| **Developing** | **Clearly state** the problem/ question you’re going to explore in your lab | If we dissolve salt in water, will it boil faster than fresh water? |
| **Accomplished** | **Outline** the problem/question you’re going to explore in your lab | Lots of people put salt into their water believing that it makes their water reach its boiling point faster, but is it really true? If we increase the salinity of water (how much dissolved salt is in it) will the speed at which the temperature of the water increase, and by how much?   |  |  |  | | --- | --- | --- | | **Website name** | **Title of webpage** | **URL** | | SwRl Lighter Side | Does Water Boil Faster if you put Salt in the Water? | http://www.swri.org/10light/water.htm | | Live Science | Does Salt Make Water Boil Faster? | http://www.livescience.com/56214-does-salt-make-water-boil-faster.html | |
| **Exemplary** | **Describe** the problem/ question you’re going to explore in your lab | Lots of people put salt into their water believing that it makes their water reach its boiling point faster, but is it really true? Water boils when the substance changes state from liquid to gas. This happens when the particles in the water gain enough energy to start moving in all directions and have minimal attraction to each other, a process called evaporation. Salt is a molecule with sodium and chlorine in it, which might get in between the water particles and make them less attracted to each other (so easier to boil). If we increase the salinity of water (how much dissolved salt is in it) will the speed at which the temperature of the water increase, and by how much?   |  |  |  | | --- | --- | --- | | **Website name** | **Title of webpage** | **URL** | | SwRl Lighter Side | Does Water Boil Faster if you put Salt in the Water? | http://www.swri.org/10light/water.htm | | Live Science | Does Salt Make Water Boil Faster? | http://www.livescience.com/56214-does-salt-make-water-boil-faster.html | |

**Criterion B - HYPOTHESIS**

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| **Level** | **What do I have to do?** | **What does this look like?** |
| **Beginning** | State the hypothesis that will be tested in your lab | If the temperature is changed, then the mass will change |
| **Developing** | **Outline** a hypothesis **based on scientific reasoning** that will be tested in your lab | If the temperature of water is increased, then the density of the water will decrease because the particles are different |
| **Accomplished** | Outline and **explain** a hypothesis that will be tested in your lab using scientific reasoning | If the temperature of water is increased, then the density of the water will decrease because the particles are different and move differently at different temperatures and have different space between them so they take up more or less space, and this is what density measures. |
| **Exemplary** | Outline and explaina hypothesis that will be tested in your lab using **correct** scientific reasoning | If the temperature of the water is increased, then the density of the water will decrease because at higher temperatures, there is more thermal energy in a substance. As the amount of thermal energy increases, the amount of kinetic energy each particle possesses also increases, which causes the particles to move faster and get further apart from each other. As particles get further apart from each other, the mass does not change but the volume of the substance should increase slightly and the number of particles in a certain area should decrease. Density is the amount of particles in a certain amount of volume, shown by the equation **D=m/V.** If the volume increases but the mass does not change, then the value of density will decrease as dividing by a larger number results in a smaller number. |

**Criterion B - VARIABLES**

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| **Level** | **What do I have to do?** | **What does this look like?** |
| **Beginning** | State the variables of your lab | My Independent Variable is: The temperature of the water  My Dependent Variable is: How dense the water is  My Controlled Variables are: The amount of water, the container, the environment, and the type of water |
| **Developing** | **Outline how to manipulate** the variables, and **state how you will collect data for the dependent variable** in your lab. | My Independent Variable is: The temperature of the water (hot, room temperature, and cold).  My Dependent Variable is: How dense the water is  My Controlled Variables are: The amount of water, the container, the environment, and the type of water  *We will use the electronic balance to get the mass and beaker to get the volume of the water then calculate the density by dividing the mass by the volume which gets the density.* |
| **Accomplished** | Outline how to manipulate the variables, and **outline** bothhow you will collect data and **how you will collect enough data** for the dependent variablein your lab. | My Independent Variable is: The temperature of the water (hot, room temperature, and cold).  My Dependent Variable is: The density of the water (found by obtaining mass and volume and dividing them)  *We will use the electronic balance to get the mass and beaker to get the volume of the water then calculate the density by dividing the mass by the volume which gets the density.*  My Controlled Variables are: The amount of water, the container, the environment, and the type of water  *We will repeat the experiment at least three times in case there is an outlier result unlike the other ones and so if you have more trials it gets rid of the result that was way different than the others.* |
| **Exemplary** | **Describe** how to manipulate the variables, and **describe** bothhow you will collect data and how you will collect enough data for the dependent variable in your lab. | My Independent Variable is: The temperature of the water  *We will have three different temperatures of water: Hot (50-80°C), Room Temperature (20-40°C) and Cold (0-15°C). The temperature of each sample will be measured and recorded using a standard thermometer.*  My Dependent Variable is: The density of the water  *We will use an electronic balance to get the mass (in grams) and a 100mL graduated cylinder to get the volume of the water. We will then calculate the density in g/mL using the formula* ***D=m/V*.**  My Controlled Variables are: The amount of water (75mL), the container (250mL beaker), the environment (conducted at the same time and in same place), and the type of water (tap water, all trials of the same temperature done simultaneously)  *We are using three intervals for temperature (hot, room temperature, and cold) and repeating the experiment three times. This will result in 9 different measurements and will allow us to calculate average mass and volume (and density) of water at each temperature and we will also have enough data to ignore any potential outliers.* |

**Criterion B - METHOD**

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| **Level** | **What do I have to do?** | **What does this look like?** |
| **Beginning** | Try to design a method | 1. Pour water into three beakers 2. When water boils remove the beaker from the hot plate with beaker tongs and empty it 3. Repeat steps 1&2 three times but with 2.5mL sugar 4. Repeat steps 1&2 three times but with 5mL sugar |
| **Developing** | **Successfully** design a method **that includes safety, materials, and equipment** | **Safety Warnings:**  **Wear safety glasses. This lab uses a hot plate - never leave hot objects unattended and use care when handling them.**   1. Pour 100mL of water into three beakers 2. When water boils (until bubbles erupt on the surface) check the temperature using a thermometer 3. Remove the beaker from the hot plate with beaker tongs and empty it 4. Repeat steps 2&3 two more times 5. Pour 100mL of water into three beakers 6. Dump 2.5mL of sugar into each beaker & mix well. 7. Place one sugar water-filled beaker on the hot plate 8. When water boils (until bubbles erupt on the surface) check the temperature using a thermometer 9. Repeat steps 7-9 two more times 10. Pour 100mL of water into three beakers 11. Dump 5mL of sugar into each beaker 12. Stir the sugar water until the sugar dissolves 13. Place one sugar water-filled beaker on the hot plate 14. When water boils (until bubbles erupt on the surface) check the temperature using a thermometer 15. Remove the beaker from the hot plate with beaker tongs and empty it 16. Repeat steps 25-29 two more times |
| **Accomplished** | Successfullydesign a **complete** method that includes safety, materials,  and equipment | **Safety Warnings:**  **Wear safety glasses at all times.**  **This lab uses a hot plate - never leave hot objects unattended and use care when handling them.**   1. Plug in the hot plate and turn the knob on the hot plate to “high” 2. Wait for about 15 minutes for the hot plate to heat up 3. Pour 100mL of water into three beakers 4. Place one water-filled beaker on the hot plate 5. When water boils (until bubbles erupt on the surface) check the temperature using a thermometer 6. Record that temperature that it boils at in the data table provided 7. Remove the beaker from the hot plate with beaker tongs and empty it 8. Place the empty beaker to the side 9. Repeat steps 4-8 two more times 10. Rinse out the beakers 11. Pour 100mL of water into three beakers 12. Dump 2.5mL of sugar into each beaker 13. Stir the sugar water until the sugar dissolves (do this for each beaker) 14. Place one sugar water-filled beaker on the hot plate 15. When water boils (until bubbles erupt on the surface) check the temperature using a thermometer 16. Record that temperature that it boils at in the data table provided 17. Remove the beaker from the hot plate with beaker tongs and empty it 18. Place the empty beaker to the side 19. Repeat steps 14-18 two more times 20. Rinse out beakers 21. Pour 100mL of water into three beakers 22. Dump 5mL of sugar into each beaker 23. Stir the sugar water until the sugar dissolves (do this for each beaker) 24. Place one sugar water-filled beaker on the hot plate 25. When water boils (until bubbles erupt on the surface) check the temperature using a thermometer 26. Record the temperature that it boils at in the data table provided 27. Remove the beaker from the hot plate with beaker tongs and empty it 28. Place the empty beaker to the side 29. Repeat steps 24-28 two more times |
| **Exemplary** | Successfully design a **logical** and complete method that includes safety, materials, and equipment | **Safety Warnings:**  **Wear safety glasses at all times.**  **This lab uses a hot plate - never leave hot objects unattended and use care when handling them.**   1. Plug in the hot plate and set the temperature to “high”. It will take approx. 15 minutes to heat up.   **0% SUGAR TEST**   1. Fill three 250mL beakers each with 100mL of water 2. Place one water-filled beaker on the hot plate until the water boils ( bubbles erupt on the surface). Record the temperature of this water in Data table 1. 3. Carefully remove the beaker from the hot plate and dispose of the water down the sink. 4. Repeat steps 3 & 4 with the remaining 2 beakers of water. 5. Rinse out the beakers   **2.5mL SUGAR TEST**   1. Fill three 250mL beakers each with 100mL of water 2. Use a measuring spoon to add 2.5mL sugar into each beaker. Stir with stir rod until sugar has completely dissolved. 3. Repeat steps 3-6   **5mL SUGAR TEST**   1. Fill three 250mL beakers each with 100mL of water 2. Use a measuring spoon to add 5mL of sugar into each beaker. Stir with stir rod until sugar has completely dissolved. 3. Repeat steps 3-6 4. Clean up and return all materials. Wipe lab bench thoroughly and wash hands. |