Name: _____ Date: _____

Student Exploration: Human Homeostasis

Vocabulary: dehydration, heat stroke, homeostasis, hypothermia, involuntary, thermoregulation, voluntary

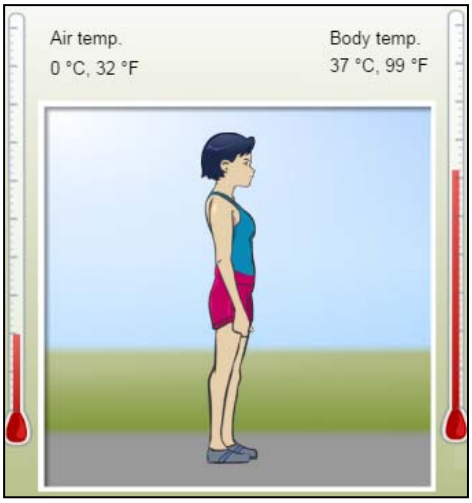
Prior Knowledge Questions (Do these BEFORE using the Gizmo.)
A thermostat is a device that regulates the temperature inside a building.

1. What does a thermostat do if it gets too cool? _____
2. What does a thermostat do if it gets too hot? _____
3. How do our bodies sometimes act like a thermostat? _____

_____

_____

Gizmo Warm-up
To survive, an organism must be able to maintain stable internal conditions in a changing environment. This process is called **homeostasis**. The *Human Homeostasis* Gizmo™ allows you to explore how the human body stays at a nearly constant temperature in different conditions. Notice the **Air temp.** and **Body temp.** thermometers representing the air temperature and body temperature.



1. What is the initial air temperature? _____
2. What is the initial body temperature? _____
3. Next to each factor listed below, write “increase,” “decrease,” or “same” based on how you expect that factor to affect body temperature.

Raising air temperature: _____ Sweating: _____

Lowering air temperature: _____ Shivering: _____

Adding clothing: _____ Exercising: _____

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Activity A: **Body temperature**	Get the Gizmo ready: • If necessary, click **Reset** ( ).	

Question: What factors increase or decrease body temperature?

1. Observe: With the **Air temp.** at 0 °C (32 °F) and **Body temp.** at 37 °C (99 °F), click **Play** ( ). After one simulated hour (does not have to be exact), click **Pause** ( ).

   What is the body temperature after one hour? _____

2. Gather data: Fill in the first line of the data table below. Then, use the same procedure to test the effect of each of the following factors. Click **Reset** between each trial. Record the initial and final body temperatures in the table below. (Leave the last column blank.)
   - Set the **Exercise level** to 70%. (All other settings in default position.)
   - Set the **Sweat level** to 70%.
   - Under **Body position**, select **Shivering**.
   - Next to **Clothing**, click **Add** four times to add a sweatshirt, hat, pants, and parka.

Factor	Initial body temp.	Body temp. after one hour	Effect of factor on body temperature
Standing still			
Exercising			
Sweating			
Shivering			
Adding clothing			

3. Analyze: To determine the effect of a factor on body temperature, compare the final body temperature with that factor to the final body temperature while standing still. Based on this comparison, fill in the last column of the data table.

   A. Which factor raised body temperature the most? _____

   B. Why do you think this process raises body temperature? _____

   _____

   C. Which factor lowered body temperature the most? _____

   D. Why do you think this process lowers body temperature? _____

   _____

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Activity B: **Thermoregulation**	Get the Gizmo ready: • Click **Reset**.	

Introduction: **Thermoregulation** is the process in which a steady temperature is maintained inside the body. Some responses to temperature changes, such as sweating and shivering, are **involuntary**—they occur automatically. Other actions, such as exercising or putting on clothes, are called **voluntary** responses because they are things we have to think about doing.

Question: In the *Human Homeostasis* Gizmo, you can control both involuntary and voluntary responses to temperature changes. How good are *you* at thermoregulation?

1. Play the Gizmo: Click **Play**. After one hour, the air temperature will start to fluctuate. Using what you have learned, try to maintain a steady body temperature by manipulating the **Exercise level**, **Sweat level**, **Body position**, and **Clothing**. (You may wish to click **Pause** occasionally to give yourself time to think.)

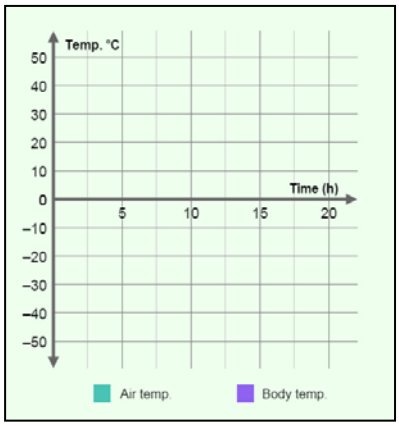
   Click **Pause** after at least 10 hours have passed, if you can survive that long! Select the GRAPH tab. Sketch the resulting graph into the space at right.

   What does this graph show? _____

   _____

   _____

   _____



2. Investigate: Click **Reset**. Click **Play**, and deliberately create a situation in which the body temperature gets so low that the simulation stops.

   A. How did you do this? _____

   B. What is the name for this condition? _____

   C. At what body temperature is immediate medical treatment required? _____

3. Investigate: Click **Reset**. Click **Play**, and create a situation in which the body temperature gets so high that the simulation stops.

   A. How did you do this? _____

   B. What is the name for this condition? _____

   C. At what body temperature is immediate medical treatment required? _____

(Activity B continued on next page)

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Activity B (continued from previous page)

4. Challenge yourself: Click **Reset**. Click **Play**, and see if you can maintain a constant body temperature of 37 °C (99 °F) for 24 simulated hours or more. You will have to click **Drink water** or **Eat food** to avoid **dehydration** (lack of water) and low blood sugar. If the **Fatigue level** gets too high, you will have to rest.

   If you succeed, click **Pause**. Select the GRAPH tab and click the **camera** (📷) icon to take a snapshot of the graph. Right-click the image, and click Copy Image. Open a blank document and paste the snapshot into the document. You can print out the document and hand it in with this worksheet.

5. Analyze: Select the TABLE tab. The air temperature and body temperature are recorded every hour. Scroll through the table to find the highest and lowest air temperatures.

   A. What was the highest air temperature you had to deal with? _____

   B. How did you respond to this temperature? _____

   _____

   C. What was the lowest air temperature in the simulation? _____

   D. How did you maintain a constant body temperature at this time? _____

   _____

6. Think and discuss: Other than the options available in the *Human Homeostasis* Gizmo, what other methods are used to maintain body temperature? Try to think of both voluntary and involuntary responses.

   _____

   _____

   _____

   _____

   _____

7. Critique: On a separate page, describe the advantages and disadvantages of the model of human homeostasis used in the Gizmo. In what ways is the model realistic? What factors are not included in the model?

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