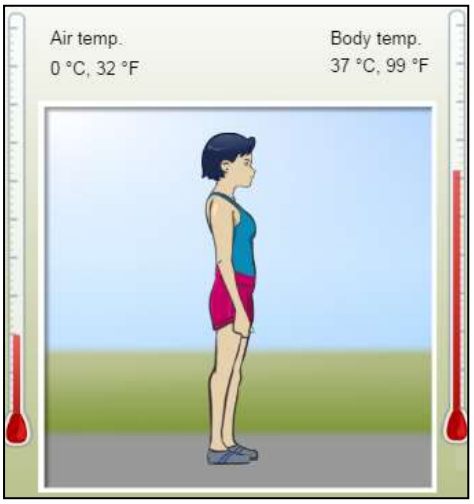
Student Exploration: Human Homeostasis

PRIOR KNOWLEDGE QUESTIONS (Do these BEFORE using the Gizmo.)
A thermostat is a device that regulates the temperature inside a building.
Answer the questions on your student sheet.

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.

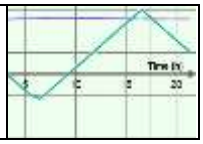
Notice the **Air temp.** and **Body temp.** thermometers representing the air temperature and body temperature.

Answer the questions on your student sheet.

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

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

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** ( ). Answer question.
2. Gather data: Fill in the first line of the data table. 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.)
   A. Set the **Exercise level** to 70%. (All other settings in default position.)
   B. Set the **Sweat level** to 70%.
   C. Under **Body position**, select **Shivering**.
   D. Next to **Clothing**, click **Add** four times to add a sweatshirt, hat, pants, and parka.
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. (increase/decrease/no change)

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.

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 on your answer sheet.

1. Investigate: Click **Reset**. Click **Play**, and deliberately create a situation in which the body temperature gets so **low** that the simulation stops.
2. Investigate: Click **Reset**. Click **Play**, and create a situation in which the body temperature gets so **high** that the simulation stops.
3. 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 Sketch the resulting graph on your answer sheet.
4. 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.
5. 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.
6. Critique: 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?