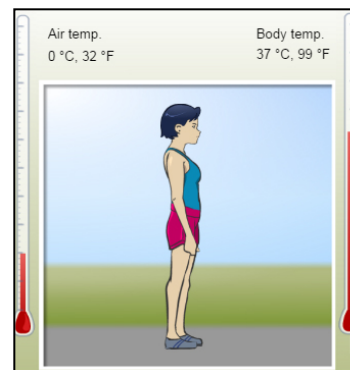




Human Homeostasis

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.



Activity A:	<u>Get the Gizmo ready:</u>	
Body temperature	<ul style="list-style-type: none"> If necessary, click Reset (↺). 	

Question: What factors increase or decrease body temperature?

- 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? _____

- 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			

- 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.
 - Which factor raised body temperature the most? _____
 - Why do you think this process raises body temperature?
 - Which factor lowered body temperature the most? _____
 - Why do you think this process lowers body temperature?

Activity B: Thermoregulation	<u>Get the Gizmo ready:</u> <ul style="list-style-type: none"> Click Reset. 	
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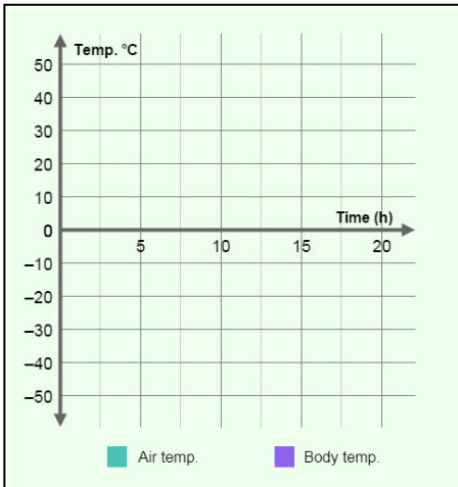
Introduction: **Thermoregulation** is the process in which a steady temperature is maintained inside the body. Some responses to temperature changes, such as sweating and shivering, are **involuntary**—they occur automatically. Other actions, such as exercising or putting on clothes, are called **voluntary** 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? _____ Why? What is happening at the cellular level?

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? _____ Why? What is happening at the cellular level?

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. Paste the image into OneNote.

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: 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. Pick ONE of the situations modelled in this GIZMO & draw a feedback loop