

# Turtle Thermoregulation: Finding the Turtle's Comfort Zone

Pet: turtle	Class: 3-5		
<b>Brief Overview:</b> In this lesson, students learn about thermore and how reptiles like turtles rely on external s maintain their body temperature. After experi with different temperatures, the students des build a miniature habitat for the turtle that mo desired temperature range. This lesson can be adapted for other grades of	Lesson Breakdown Lesson 1: What is Thermoregulation and How Can We Observe This in Our Turtle? Lesson 2: Making Observations and Planning		
<b>Essential Question</b> How do reptiles, like turtles, maintain their bo temperature in different environments?	our Habitat <b>Lesson 3:</b> Create a Model Habitat		

Subjects ✓ Science ✓ ELA ✓ Math ✓ STEM ☐ Art	Stem Connections Science: life science, what animals need Technology: thermometers Engineering: creating a habitat Math: measurement, graphing
<ul><li>Art</li><li>Other</li></ul>	

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# Performance Expectations/ Standards NGSS Standards:

4-LS1-1. Construct an argument that plants and animals have internal and external structures that function to support survival, growth, behavior, and reproduction.
4-LS1-2. Use a model to describe that animals receive different types of information through their senses, process the information in their brain, and respond to the information in different ways.

**3-5-ETS1-1.** Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost.

# CCSS

**4.MD.1.** Know relative sizes of measurement units within one system of units **4.MD.4**. Make a line plot to display a data set of measurements in fractions of a unit

# English Language Arts

**CCSS.ELA-LITERACY.RI.4.7** Interpret information presented visually, or ally, or quantitatively

**SL.4.1.** Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners

**SL.4.3.** Identify the reasons and evidence a speaker provides to support particular points. **CCSS.ELA-LITERACY.W.4.1** Write opinion pieces on topics or texts, supporting a point of view with reasons and information.

**CCSS.ELA-LITERACY.W.4.2** Write informative/explanatory texts to examine a topic and convey ideas and information clearly.

## I CAN statements

- explain how reptiles maintain their body temperature.
- conduct an experiment to test turtle temperature preference.
- analyze data and draw conclusions from my experiment.
- communicate my findings effectively through graphs and discussion
- design a habitat for the turtle that regulates the temperature

## Materials

- <u>Turtle Thermoregulation Presentation</u>
- <u>Turtle Thermoregulation Student Worksheet</u>
- Heat lamp or ice packs
- Large bin or terrarium that can be divided into three sections
- Thermometers
- Stopwatch/ timer
- Cardboard, paper, and other recyclable materials, glue, tape, scissors

### Teacher Background

Unlike mammals and birds, whose internal furnaces keep them warm-blooded, turtles are ectothermic. Thus their body temperature directly reflects the environment. They possess a toolbox of thermoregulatory strategies to maintain a vital range for optimal function.

**Internal Heat Generators:** While internal heat production in turtles is limited compared to warm-blooded animals, it still plays a role. During digestion, food breakdown generates metabolic heat, warming their bodies from within. Muscle activity, particularly while basking in the sun, can also contribute to a slight temperature rise.

**Sun-Seeking Soaks**: Basking in sunlight is arguably the most iconic turtle thermoregulatory behavior. Their dark shells act as efficient solar collectors, absorbing heat and increasing their internal temperature. By strategically positioning themselves perpendicular to the sun's rays, they maximize heat gain. Conversely, during overheating, they may shift their posture to reduce exposure or seek shade.

**Watery Escapes:** Water provides another avenue for temperature control. Diving allows turtles to escape scorching air temperatures and find cooler depths. Some species utilize the "diving bell" technique, trapping air bubbles under their shells for underwater breathing while staying insulated from ambient water temperature.

**Strategic Shelter:** When the sun sets or temperatures plummet, turtles seek refuge in burrows, logs, or under vegetation. These sheltered microclimates offer protection from harsh extremes and help them retain precious body heat. Some species even huddle together, sharing warmth like cozy reptilian roommates.

**Behavioral Choices:** Every movement matters. Turtles adjust their activity levels based on temperature. On warm days, they may be more active, hunting for food or exploring their surroundings. During cooler periods, they tend to slow down, basking or resting to conserve energy.

**The Shell Factor:** The shell, composed of bone and keratin, provides insulation, protecting internal organs from temperature fluctuations. Blood flow within the shell can be regulated, directing heat to vital organs or away to cool down.

**The Benefits of Balance:** Maintaining their preferred temperature range is crucial for turtles. Optimal temperatures allow for efficient digestion, muscle function, and reproduction. Deviations too far above or below can impair these processes, impacting their health and survival.

**Challenges and Adaptations:** Climate change adds a new layer of complexity to turtle thermoregulation. Rising temperatures may limit suitable habitats and force them to adapt their behavioral patterns. Some species may shift their basking times or rely on cooler refuges more frequently.

# Lesson 1: What is Thermoregulation and How Can We Observe This in Our Turtle?

Time	Materials	Activity
10 mins		Ask students: Imagine you're playing outside on a hot sunny day- what happens to your body (sweating). What about on a cold day (shiver). Our bodies like to stay at a certain temperature. Turtles like to stay at the same temperature too, but how do they do that?
10 mins	<u>Turtle</u> <u>Thermoregulation</u> <u>Presentation</u>	Share the presentation, Turtle Thermoregulation, to help the students understand thermoregulation and the behaviors and adaptations of the turtles.
5 mins		Explain to students that they will be studying theri turtle to observe how it regulates its temperature.
10 mins		Set up the experiment together as a class. Divide a large bin or terrarium into three sections using cardboard dividers. Place a heat lamp over one section, an ice pack in another, and leave the middle section at room temperature.
		Place a thermometer in each of the sections. Measure the temperature in each section with a thermometer to create a gradient from warm to cool.
10 mins	<u>Turtle</u> <u>Thermoregulation</u> <u>Student</u> Worksheet	Have the students record the temperature in their Student Worksheets and make a hypothesis about where they think the turtle will spend most of its time.
		Guide the students to complete the Variables section: Independent Variable: What are you changing? (temperature) Dependent Variable: What are you measuring? (time spent in each section, activity level in each section) Controls: What will stay the same? (turtle, bin)

Lesson 2: Making Observations and Planning our Habitat			
Time	Materials	Activity	
15 mins	<u>Turtle</u> <u>Thermoregulation</u> <u>Student</u> <u>Worksheet</u>	Gently place the turtle in the center section and observe its movements for 15 minutes. Every 5 minutes, record the turtle's location and the temperature of the area it occupies. Record how active the turtle is in each of the sections.	
15 mins	<u>Turtle</u> <u>Thermoregulation</u> <u>Student</u> <u>Worksheet</u>	Give the turtle a break in its regular habitat. While the turtle is resting, divide the students into small groups . Challenge students to design a model of a habitat for the turtle that maintains a desired temperature range. Encourage them to brainstorm dn then create their designs.	
15 mins	<u>Turtle</u> <u>Thermoregulation</u> <u>Student</u> <u>Worksheet</u>	Repeat the experiment.	

Lesson 3: Create a Model Habitat			
Time	Materials	Activity	
15 mins	<u>Turtle</u> <u>Thermoregulation</u> <u>Student</u> <u>Worksheet</u>	Repeat the experiment.	
5 mins	<u>Turtle</u> <u>Thermoregulation</u> <u>Student</u> <u>Worksheet</u>	Have a class discussion about the results. Guide the students as they complete their Analysis and Conclusion questions.	
15 mins	<u>Turtle</u> <u>Thermoregulation</u> <u>Student</u> <u>Worksheet</u>	Allow the students time to design their model habitats.	
10 mins	<u>Turtle</u> <u>Thermoregulation</u> <u>Student</u>	Have the students share their designs with their classmates	

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# Lesson 3: Create a Model Habitat

<u>Worksheet</u>

### Differentiation

### For students who need additional support:

- Simplify the experiment by using only two temperatures: warm and cool. Provide additional support with data recording and analysis.
- For students with limited mobility, provide alternative ways to collect data, such as using a thermometer with a long probe or having a partner record the observations.

### For students who need additional challenges:

- Introduce the concept of thermal conductivity and have them investigate how different materials (sand, rocks, water) affect the turtle's temperature preferences.
- Have the student calculate the average temperature the turtle preferred and create graphs to represent the data.

Assessment				
Data Collection & Analysis	Accurately recorded temperature data for all sections of the habitat and multiple experiments. Identified and explained the section where the turtle spent the most time.	Recorded data for most sections and experiments. Partially explained why the turtle preferred a specific section.	Recorded some data but may be incomplete or inaccurate. Struggled to explain turtle preference.	Data collection inaccurate or incomplete. Could not explain turtle preference.
Graph Creation & Interpretation	Created a clear and accurate graph with labeled axes, title, and	Created a graph with mostly correct labels and elements. Partially	Graph missing some labels or elements, making it difficult to	Graph missing key information or poorly constructed. Could not make

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	legend. Explained	explained the	interpret.	connections
	how the graph	relationship	Explanations	between
	shows the turtle's	between	about the graph	temperature and
	temperature	temperature and	and turtle	turtle behavior.
	preference.	turtle behavior.	preference unclear.	
	Designed a			
	creative and			
	functional habitat			
	with clear	Designed a mostly	Design had some	
	temperature zones	functional habitat	flaws in	
	and materials that	with identifiable	functionality or	Model lacked clear
	support	temperature	temperature	temperature zones
	thermoregulation.	zones.	zones.	or functionality.
Model Habitat	Built the model	Construction is	Construction is	Construction is
Design &	with care and	neat and mostly	slightly messy or	messy or
Construction	attention to detail.	accurate.	inaccurate.	incomplete.
	Clearly presented			
	findings and	Presented findings		
	explanations to	with some clarity,	Presented findings	
	the class, using	using data and	with limited clarity.	Presentation
	data, graphs, and	graph partially	Data and graph	unclear or
	the model	effectively.	not fully utilized.	incomplete. Data
	effectively. Worked	Collaboration is	Some	and model
	collaboratively and	good with some	collaboration	underutilized.
Communication &	respectfully with	minor	issues or	Collaboration is
Collaboration	team members.	disagreements.	disruptions.	poor or disruptive.

Grading Scale:

18-20 points: Excellent understanding of thermoregulation and strong implementation in all project aspects.

15-17 points: Good understanding of thermoregulation and successful completion of most project aspects.

12-14 points: Satisfactory understanding of thermoregulation and satisfactory completion of project aspects.

10-11 points: Basic understanding of thermoregulation and some shortcomings in project aspects. Below 10 points: Limited understanding of thermoregulation and significant shortcomings in project aspects.

### Extension

- Take the students outside to observe how other reptiles, like lizards or snakes, bask in the sun or seek shade to regulate their temperature.
- Research the adaptations of different desert animals for body temperature control.
- Discuss the challenges and consequences of climate change for reptiles and their habitats