



Science Objectives

- Students will simulate environmental temperature changes and observe the effect of temperature change on the metabolic rates of two different animals.
- Students will develop an understanding of the effect of environmental temperatures on endotherms and ectotherms.
- Students will develop an understanding of the relationship between environmental temperature and animal metabolism.

Vocabulary

- circadian rhythms
- ectotherm
- endotherm
- hibernate
- homeostasis
- insulation

About the Lesson

- This lesson involves students using TI-Nspire technology to simulate the effect of environmental temperature on the metabolisms of both endothermic and ectothermic animals.
- As a result, students will:
 - Differentiate between endothermic and ectothermic animals.
 - Develop an understanding of the physiological needs of endothermic and ectothermic animals.

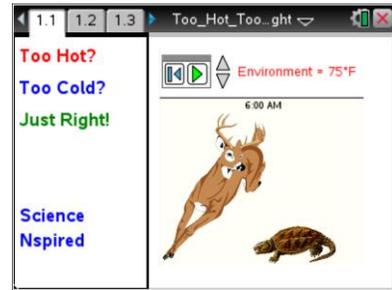


TI-Nspire™ Navigator™

- Send out the *Too_Hot_Too_Cold_Just_Right.tns* file.
- Monitor student progress using Class Capture.
- Use Live Presenter to spotlight student answers.

Activity Materials

- Compatible TI Technologies:  TI-Nspire™ CX Handhelds,  TI-Nspire™ Apps for iPad®,  TI-Nspire™ Software



Tech Tips:

- This activity includes class captures taken from the TI-Nspire CX handheld. It is also appropriate for use with the TI-Nspire family of products including TI-Nspire software and TI-Nspire App. Slight variations to these directions may be required if using other technologies besides the handheld.
- Watch for additional Tech Tips throughout the activity for the specific technology you are using.
- Access free tutorials at <http://education.ti.com/calculators/pd/US/Online-Learning/Tutorials>

Lesson Files:

Student Activity

- Too_Hot_Too_Cold_Just_Right_Student.doc
- Too_Hot_Too_Cold_Just_Right_Student.pdf
- Too_Hot_Too_Cold_Just_Right.tns



Discussion Points and Possible Answers

Regulating body temperature is one of the most critical survival mechanisms for animals. Being able to stay warm or cool can be a real challenge for animals. Although endotherms can regulate their body temperatures, they still need to make use of strategies that help them strictly maintain that temperature. Ectotherms are even more environmentally dependent for their body temperatures.

This would be a good time to brainstorm with your students about the strategic ways that various animals warm up and cool down. This may also be a good time to discuss Circadian rhythms with the students. Circadian rhythms are the daily “patterns” of animals. Some animals are nocturnal—active at night—and others are diurnal—active during the day. If all animals had the same Circadian rhythms, competition for available resources would be more intense.



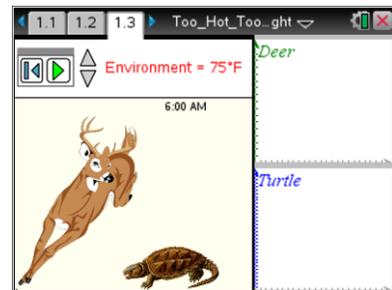
TI-Nspire Navigator Opportunities

Allow students to volunteer to be the Live Presenter and demonstrate how to adjust the environmental temperatures, start the simulation, and reset the simulation.

Move to pages 1.2 and 1.3.

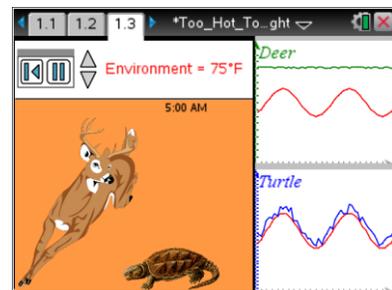
Have students answer Questions 1 – 3 on the activity sheet.

- Students read the instructions on page 1.2 and then run the simulation on page 1.3 at 75°F. Each plot shows the animal's body temperature and the environmental temperature. The simulation, when run to completion, displays temperature and metabolism for two entire days.



- To the right, draw a sketch of the graphs that were produced when the environmental temperature was 75°F.

Sample Answer: The simulation to the right was run at a temperature of 75°F.

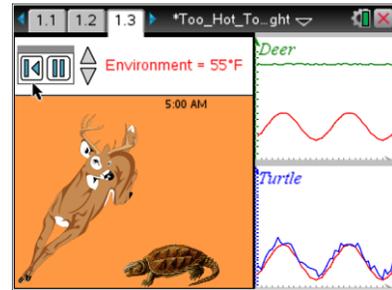


- Students reset the simulation by selecting . They use the down arrow to lower the environmental temperature and run the simulation again. Then they raise the environmental temperature above 75°F and run the simulation again.



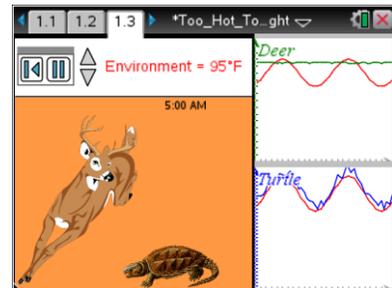
Q2. Draw a sketch of the graphs that were produced when the environmental temperature was **lower** than 75°F.

Sample Answer: The simulation to the right was run at a temperature of 55°F. Note the difference in position of the plots in the graph area.



Q3. Draw a sketch of the graphs that were produced when the environmental temperature was **higher** than 75°F.

Sample Answer: The simulation to the right was run at a temperature of 95°F. Again, note the positions of the plots.



Move to pages 2.1 – 2.3.

Have students answer questions 4 – 6 on either the device, on the activity sheet, or both.

Have students answer questions 7 – 14 on the activity sheet.

Q4. Which animal's temperature fluctuated with the environmental temperature?

Answer: A. turtle

Q5. Which animal's temperature remained pretty constant, even when the environmental temperature changed?

Answer: B. deer

Q6. Which variable were you able to manipulate in the simulation?

Answer: B. temperature

Q7. As the sun rose and the temperature got warmer, what happened to the metabolism of the turtle? Why?

Answer: It increased. The turtle is an ectotherm, and its body temperature depends on the environmental temperature.



Q8. As the sun rose and the temperature got warmer, what happened to the metabolism of the deer?
Why?

Answer: It stayed the same. Deer are endotherms, so their body temperatures don't fluctuate very much.

Q9. As the sun set and the temperature got cooler, what happened to the metabolism of the turtle?
Why?

Answer: It decreased. The turtle is an ectotherm, and its body temperature depends on the environmental temperature.

Q10. As the sun set and the temperature got cooler, what happened to the metabolism of the deer?
Why?

Answer: It stayed the same. Deer are endotherms, so their body temperatures don't fluctuate very much.

Q11. What do you predict would be the normal body temperature of the deer?

Answer: About 100°F

Q12. What do you predict would be the body temperature of the turtle?

Answer: It depends largely on the environmental temperature.

Q13. During cold winter months, it's common to see deer, but not common to see turtles. Why not?
What happens to the turtles?

Answer: The turtles are probably hibernating in the mud at the bottom of ponds and lakes.

Q14. What strategies do you think deer use in the cold winter months to retain their body heat?

Sample answer: Grow more and longer hair; put on body fat as winter approaches; stay out of the cold wind.



Wrap Up

When students are finished with the activity, pull back the .tns file using TI-Nspire Navigator. Save grades to Portfolio. Discuss activity questions using Slide Show.

Assessment

- Formative assessment will consist of questions embedded in student worksheet or the .tns file. The questions will be graded when the .tns file is retrieved. The Slide Show will be utilized to give students immediate feedback on their assessment.
- Summative assessment will consist of questions/problems on the chapter test.