PURDUE UNIVERSITY

PURDUE EXTENSION

FNR-430-W

EXPERT REVIEWED

The Nature of Teaching

• UNIT 3 •

Reptiles, Amphibians, and the Scientific Method

Reptiles and amphibians can be used to describe many scientific concepts, including life cycles, thermoregulation, and the scientific method.

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Unit 3 • Overview

Estimated Time

Three 45–60 minute Lessons

Vocabulary

- Amphibians
- Basking spots
- Cold-blooded
- Ectotherms
- Herpetologist
- Metamorphosis
- Reptiles
- Thermoregulation

Unit Objectives

Students will be able to:

- Identify the differences and similarities between reptiles and amphibians.
- Predict how temperatures affect cold-blooded animals.
- Understand the importance of thermoregulation.
- Understand how reptiles and amphibians utilize objects in their environment to thermoregulate.

Targeted Grade-Level Indiana Standards

K–5 Math Standards

1.5.5

2.1.12, 2.5.8

3.5.8

5.5.6

K–5 Science Standards

1.1.2, 1.1.3, 1.1.4, 1.2.7, 1.3.3

2.1.2, 2.1.3, 2.1.4, 2.4.1

3.1.2, 3.1.3, 3.1.4, 3.1.5, 3.4.1, 3.5.1

4.1.2, 4.1.4, 4.1.6, 4.2.5, 4.3.11, 4.3.13

5.1.1, 5.3.10, 5.4.7

K–5 English Standards

1.1.1, 1.6.1

2.6.1

Required Materials

- Teacher Information Packet
- Reptiles and Amphibians Worksheet
- Life Cycle Worksheet
- Habitat Poster
- Reptile and Amphibian Images
- Habitat Selection Worksheet
- Herpetologist Badges
- Ecotherm Experiment Worksheet
- Hot Rock Experiment Worksheet
- Desk clamp lamp with 60-watt bulb
- 20 crickets
- Rock (flat, slate, approximately 6–8 inches wide)
- Thermometer
- Ice packs
- 3 Tupperware containers (clear)
- Reptile and Amphibian Worksheet transparency

Acknowledgments

The authors would like to thank the Indiana licensed teachers Allison Marquis and Lee Sweet for allowing this plan to be presented in their classroom as well as reviewing the plan. The authors would like to give a special thanks to the fellow students of the Nature of Service Learning class, who provided ideas and helpful comments on previous versions of this unit. Photos by Rod Williams, Brian MacGowan, and Dan Annarino.

Purdue University Agricultural Communication Service • Purdue University Cooperative Extension Service • Editor: Becky Goetz • Designer: Dan Annarino 03/11

Teacher Information Packet

Reptile and Amphibian General Overview

Reptiles and amphibians represent a diverse collection of animals. In general, there are six major taxonomic groups (three are reptile, and three are amphibian). The groups and their general characteristics are given below.

Reptiles:

- *Snakes*—long, tubular bodies covered in scales; forked tongue; no legs
- *Lizards*—tubular body covered in scales, generally long tail, four legs with claws
- *Turtles*—body covered in hard shell above and below, four legs

Amphibians:

- Salamanders—generally very small, moist skin, usually four legs, no claws
- Frogs—long back legs, very agile jumpers, short front legs, moist and smooth skin
- Toads—long and strong back legs, great at hopping, skin somewhat drier and warty

Amphibians are a group of animals that are very well known for their moist skin. This moist skin can dry out very quickly, thus amphibians need to live in moist environments or near water. Amphibians are so tied to the water that many spend a major part of their life in the water (more on this in the Life Cycle section). Many amphibians can be seen around the edges of wetlands, lakes, streams, ponds, etc.

Reptiles, unlike amphibians, are not as dependent on water. Their bodies are covered in scales that allow them to keep the water inside their bodies and not dry out. Depending on the time of day, most reptiles can be seen on rocks, logs, or on the forest floor. During the hottest times of the day, they will most likely be hiding (more on this in the Thermoregulation section).

Although they are different, reptiles and amphibians are generally studied as a group. A person who studies reptiles and amphibians is known as a herpetologist. (The field of biology focused on the study of reptiles and amphibians is known as *herpetology.*) However, there is a very key difference between the two groups: their life cycles.

Life Cycle

The life cycles of reptiles and amphibians are remarkably different. Reptiles have three major steps in their life cycle, whereas amphibians have four. A brief description of each cycle can be seen below.

Reptile:

Egg ⇨ Sub-adult ⇨ Adult

Amphibian:

Egg ⇨ Aquatic Larva ⇨ Sub-adult ⇨ Adult

Amphibians have an extra step within the life cycle: the aquatic larva. These larvae hatch from eggs laid in water (a pond, wetland, etc.). Larvae are adapted to live in the water. Young larvae have gills for breathing in water and a flat tail for swimming, and they lack legs. After a period of time (a few days to a few years), these larvae begin to metamorphose. They lose their gills and develop lungs, begin to grow legs, and absorb their tails (if they are frog or toad larvae). They are then ready to live on land as sub-adults. The name amphibian literally means "two lives," and it is important that they can live in these two completely different environments. Living both in water and on land allows them to use a vast array of resources that many other species cannot use.

Reptiles differ from amphibians in that they hatch from eggs directly into sub-adults (or miniature versions of an adult). Reptile eggs differ from amphibian eggs in that they have leathery shells that resist drying out (unlike amphibian eggs, which must be in water). These eggs are usually laid in nests of soil or leaves, covered to hide them from predators.

Note: We are describing the general life cycles for amphibians and reptiles. Some species within these groups deviate from the general patterns. For more details on unique life cycles, see the following references: *Salamanders of Indiana, Frogs and Toads of Indiana, Turtles of Indiana,* and *Snakes and Lizards of Indiana*.

Thermoregulation

While the life cycles of reptiles and amphibians differ greatly, both groups of animals are similar in that they are cold-blooded. Cold-blooded animals cannot generate heat in their bodies. Birds and mammals (like ourselves) are warm-blooded and use a process in our body (i.e., *metabolism*) that creates heat from the food that we eat. However, reptiles and amphibians generate very little heat from food, and must obtain heat using another method, thermoregulation.

(Note: The term *cold-blooded* is misleading in that reptiles and amphibians have blood that can be warm at times using the process described in the following paragraph. A more accurate term for the inability of an animal to generate its own body heat is *ectothermic*. However, for simplicity, teachers with younger students can use the term cold-blooded.)

The process of thermoregulation is simply when an animal uses the environment around it to heat and cool itself to a desired temperature. For instance, if a lizard is too cold in the morning, it will lay out in the sun until it becomes warm. On the other hand, if the lizard becomes too warm, it may hide in the shade under a rock or another object to cool down. Animals have even discovered that some objects (such as logs and rocks) become warmer than the surrounding ground, and they use these areas as "basking" spots to warm up more rapidly. If a cold reptile or amphibian cannot bring its body to a desired temperature, its body may not function correctly. It may become slow, or may not be able to digest food properly. Alternatively, when temperatures skyrocket, many species use objects in their environment to hide from the sun. By hiding under moist logs or leaves on the forest floor, many amphibians avoid drying out on hot days. Salamanders are well known for hiding under the layers of leaves on the ground, or under rotting logs that hold moisture.

Lesson 1: Habitat Selection

This lesson helps students understand the differences and similarities between amphibians and reptiles, including how they may select habitat.

Estimated Time ▶ 50-60 minutes

Required Materials

- Teacher Information Packet
- Reptiles and Amphibians Worksheet
- Life Cycle Worksheet
- Habitat Poster
- Reptile and Amphibian Images
- Habitat Selection Worksheet
- Herpetologist Badges
- Reptile and Amphibian Worksheet transparency

Procedure

1. Pass out the Reptiles and Amphibians Worksheets, Reptile and Amphibian Images (one from each of the six taxonomic groups), and the Life Cycle Worksheet.
2. Introduce the six different taxonomic groups (turtles, lizards, snakes, frogs, toads, salamanders). Help students fill in the blanks for group characteristics on the Reptiles and Amphibians Worksheets using the transparency.
3. Introduce the term *herpetologist* and explain that the students are going to be herpetologists today. Discuss how reptiles and amphibians are similar and different. Explain that different groups may select different habitat types within an area.
4. Pass out the Herpetologist Badges.
5. Explain the difference between reptiles and amphibians with respect to their life cycles. Here, introduce the life cycle information found in the Teacher Information Packet. Help the students complete their Life Cycle Worksheets.
6. Explain how reptiles and amphibians are similar by using thermoregulation. Here, introduce the information given in the thermoregulation section of the Teacher Information Packet. Have each student write the definition of thermoregulation in a complete sentence on his or her worksheet.
7. Pass out the Habitat Selection Worksheet.
8. Place a picture from each taxonomic group on the Habitat Poster using information given in the introduction to determine the most suitable placement for each animal. Reasoning for each placement is as follows:
    - **Snake/Lizard:** as reptiles, snakes and lizards do not need to live close to water. Thick scales protect reptiles from drying out. They do, however, need sun and shade to help them thermoregulate.
    - **Frog/Toad:** Because they are amphibians, frogs and toads are in danger of drying out and need to be close to water. However, they also go through changes

that allow them to live on land (i.e., they develop legs and lungs).

- **Salamander:** Because it is an amphibian, a salamander needs to live close to water to prevent itself from drying out. However, since it has very thin skin, it also needs to stay in the shade, if it does leave the water. (Note: all amphibians live near water, since they lay eggs in wet areas, as well).
- **Turtle:** Although turtles are reptiles and have scales to help keep them dry, they are actually very well adapted to live in the water (with webbed feet and flat shells for swimming) and spend almost all of their time there. This is beneficial for them, since it makes it harder for predators to capture them, and because there is plenty of food in the water. (Note: turtles do lay eggs on land like other reptiles).

9. During the activity, students will write the appropriate taxonomic group name (i.e., turtle, salamander) in each blank that correlates with the Habitat Selection Worksheet.
10. After completing the activity, briefly review the major difference (life cycle) and similarity (thermoregulation) between reptiles and amphibians. Inform the students that by knowing these important attributes, they can better understand how reptiles and amphibians live in and use their environments.




Reptiles and Amphibians Worksheet • KEY

REPTILES

Turtles:

Dry body protected by hard _____Shell_____

_____Four_____ legs, body covered in ***scales***

Snakes:

Long, dry, tube-like body covered in ***scales***

Forked _____Tongue_____

_____Zero_____ legs

Lizards:

Dry body covered in ***scales***

_____Four_____ legs, each toe has a ***claw***

AMPHIBIANS

Frogs:

Long, powerful back legs, good for _____Jumping_____

Very ***moist***, _____Smooth_____ skin

Toads:

Powerful back legs, good for _____Hopping_____

Skin drier than frog's, covered in _____Warts_____

Salamanders:

Small animal with ***moist*** skin

_____Four_____ legs, toes with ***no*** claws

WORD BANK

- ☐ FOUR
- ☐ FOUR
- ☐ FOUR
- ☐ HOPPING
- ☐ JUMPING
- ☐ SHELL
- ☐ SMOOTH
- ☐ TONGUE
- ☐ WARTS
- ☐ ZERO

Reptiles and Amphibians Worksheet

REPTILES

Turtles:

Dry body protected by hard _____

_____ legs, body covered in ***scales***

Snakes:

Long, dry, tube-like body covered in ***scales***

Forked _____

_____ legs

Lizards:

Dry body covered in ***scales***

_____ legs, each toe has a ***claw***

AMPHIBIANS

Frogs:

Long, powerful back legs, good for _____

Very ***moist***, _____ skin

Toads:

Powerful back legs, good for _____

Skin drier than frog's, covered in _____

Salamanders:

Small animal with ***moist*** skin

_____ legs, toes with ***no*** claws

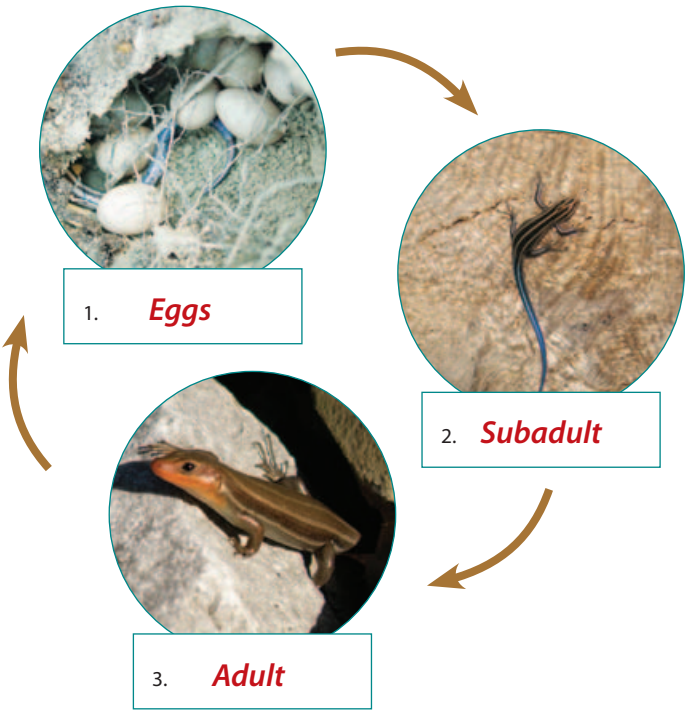
WORD BANK

- ☐ FOUR
- ☐ FOUR
- ☐ FOUR
- ☐ HOPPING
- ☐ JUMPING
- ☐ SHELL
- ☐ SMOOTH
- ☐ TONGUE
- ☐ WARTS
- ☐ ZERO

Life Cycle Worksheet • KEY

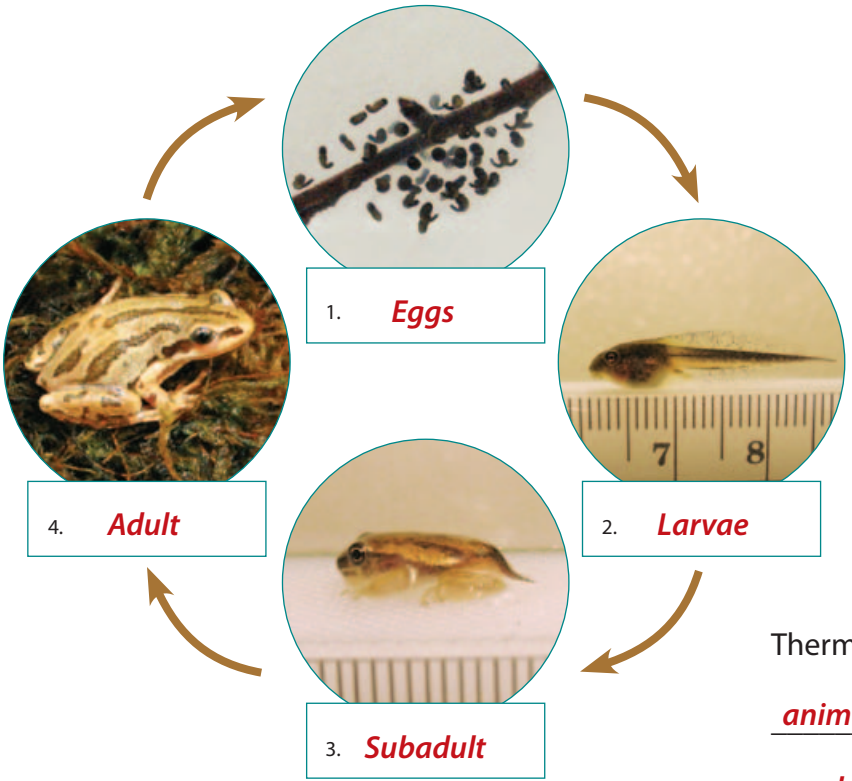
Reptile Life Cycle (Lizard)

Eggs are laid in _____*Land*_____



Amphibian Life Cycle (Frog)

Eggs are laid in _____*Water*_____

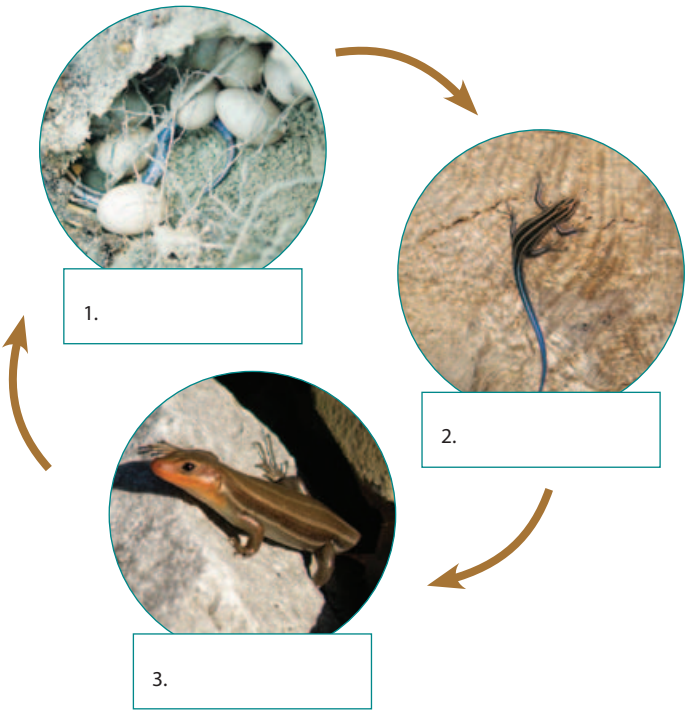


Thermoregulation: *The process by which animals use heat from the environment as well as objects in the environment to control their body temperatures.*

Life Cycle Worksheet

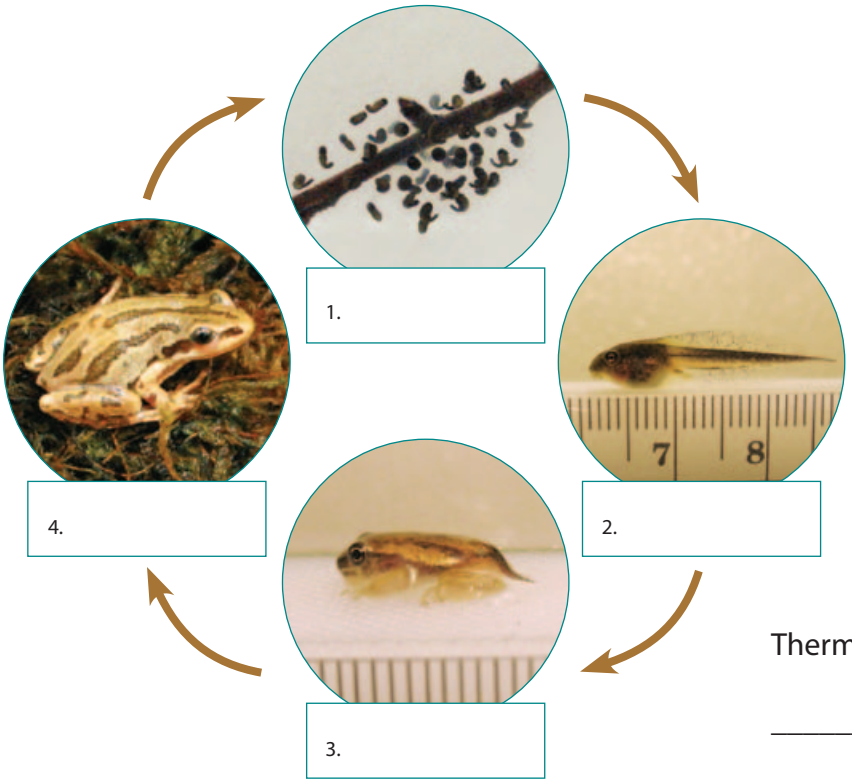
Reptile Life Cycle (Lizard)

Eggs are laid in _____



Amphibian Life Cycle (Frog)

Eggs are laid in _____



Thermoregulation: _____

_____

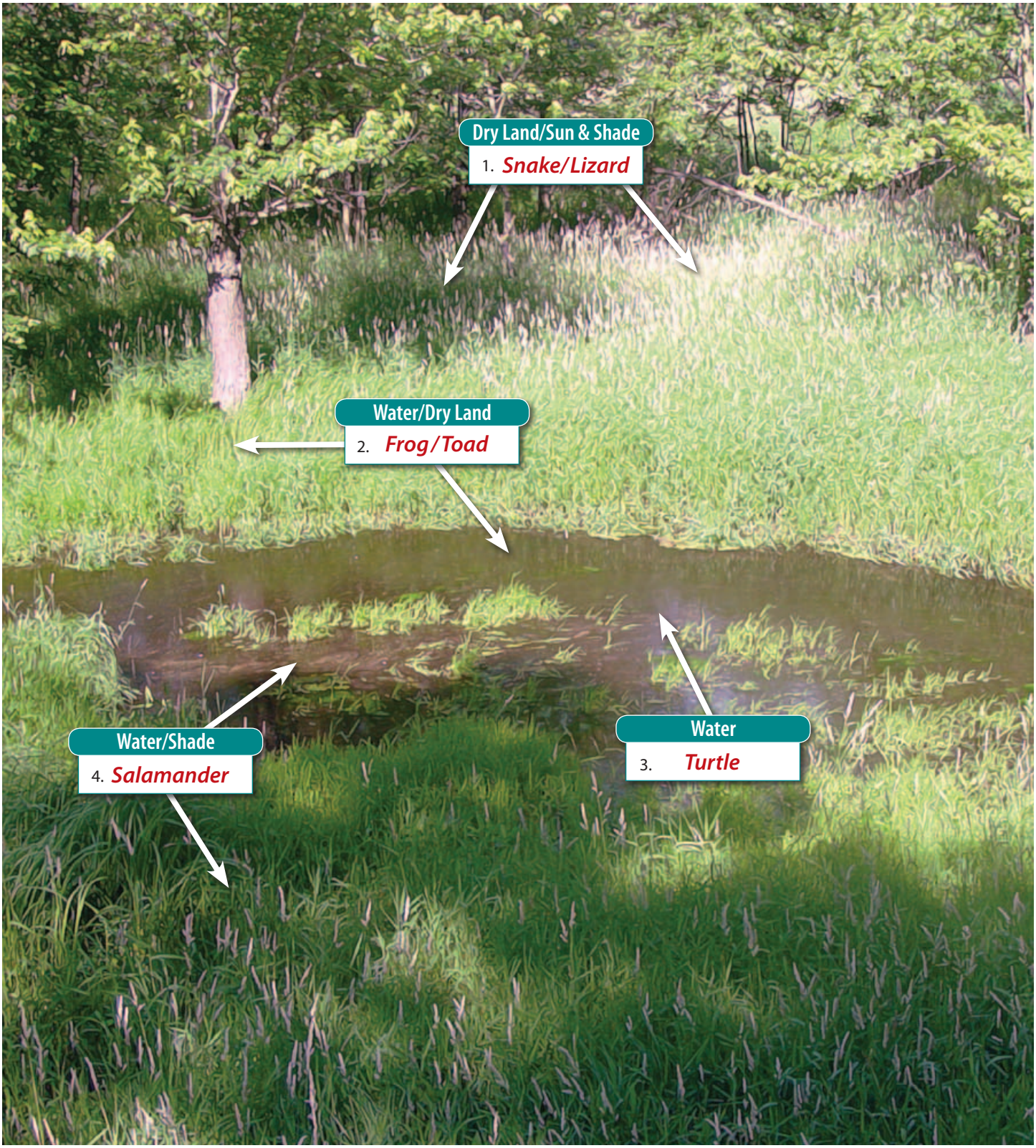
_____

_____

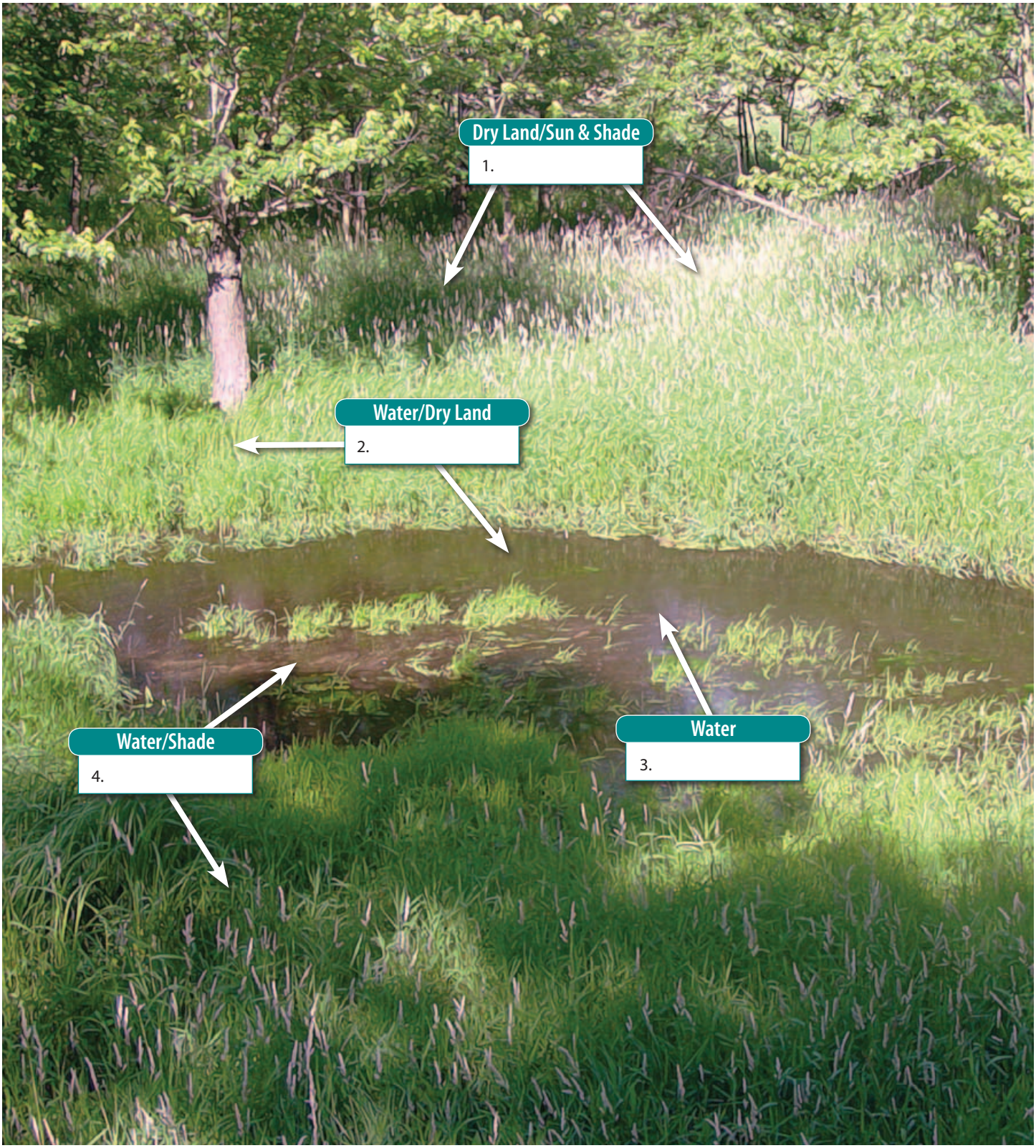
Habitat Poster

Reptile and Amphibian Images

Habitat Selection Worksheet • KEY



Habitat Selection Worksheet



Herpetologist Badges

Lesson 2: Icy 'N Hot Crickets

This lesson helps students understand how temperature affects ectothermic (cold-blooded) animals.

Estimated Time ▶ 45 minutes

Required Materials

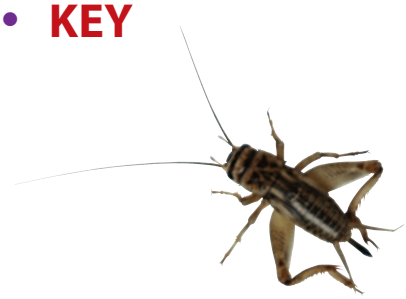
- Teacher Information Packet
- Habitat Poster
- Ectotherm Experiment Worksheet
- Heat lamp with 60-watt light bulb
- 30 crickets
- Ice packs
- 3 Tupperware containers (clear)

Procedure

1. Place ten crickets in each of the three Tupperware containers before conducting the lesson plan. One container will contain the ice packs, one will have the heat lamp shining on it, and the remaining container will have nothing affecting the temperature. Label the crickets with the ice pack and the crickets under the lamps as the "Treatment Crickets," and the room temperature crickets as "Control Crickets."
2. Pass out the ectotherm experiment worksheet.
3. Briefly review the main differences between reptiles and amphibians using the poster, if desired.
4. Review what a herpetologist is and inform them that they will be herpetologists again today. Pass out the herpetologist badges.
5. Explain that students will be conducting an experiment to understand how a reptile or amphibian's temperature is affected by the environment.
6. Review the basic steps of the scientific process: Hypothesis (a proposed explanation for an observation), Experiment, and Conclusion.
7. Explain how an ectotherm's (such as a reptile, amphibian, or cricket) body temperature changes with the environmental temperature. Have them fill in the ectotherm definition on their worksheets.
8. Have the students hypothesize how the crickets will move in the cold environment and the hot environment. Have them write this hypothesis in complete sentences on their worksheets.
9. Explain that the treatment groups consist of crickets whose environments are being changed. The control group is the group to which no changes are made.
10. Have the students observe each cricket group for 30 seconds (begin with control crickets). Afterwards, have the students write their observations of how each cricket group moved. The movements should be described as: slow, fast, or medium.

11. Ask them to compare what they observed with what they hypothesized. Have the students make a general statement as to how temperature may affect the crickets' behavior (slow to find food, eaten more easily, etc.), and write it in the conclusion section on their experiment worksheet (in full sentences).
12. Ask the students why they think we used crickets instead of reptiles or amphibians (because they are small and easy to manipulate, and because they are also ectotherms).
13. Follow up the activity with a discussion about ectothermy. Discuss a real-world situation that would apply to the topic. For instance, ask the students how a cold turtle might act in the environment, and how this would affect it (easier to catch, slower digestion). Explain that although the crickets are not amphibians and reptiles, they show how those groups would behave given the different environmental conditions. Explain that many times experiments use substitutes for animals or objects that cannot be used for research (i.e., for endangered, hard to capture or handle, hard to care for animals or objects).

Ectotherm Experiment Worksheet • KEY



Name: _____

Ectotherm: *An animal whose temperature changes with the environment's temperature.*

Hypothesis: *Control Crickets will move more than the Ice Crickets and less than the Hot Crickets.*

Observations:

Cricket Group	Cricket Movement
Control Crickets	*Medium*
Ice Crickets	*Slow*
Hot Crickets	*Fast*

Conclusion: *Ectotherms move slowly in cold environments and fast in hot environments.*

Ectotherm Experiment Worksheet

Name: _____

Ectotherm: _____

_____

Hypothesis: _____

_____

Observations:

Cricket Group	Cricket Movement
Control Crickets	
Ice Crickets	
Hot Crickets	

Conclusion: _____

_____

Lesson 3: Hot Rock

This lesson demonstrates how ectotherms use the environment to control their body temperature.

Estimated Time ▶ 50-60 minutes

Required Materials

- Teacher Information Packet
- Hot Rock Experiment Worksheet
- Desk clamp lamp with 60-watt light bulb
- Rock (flat, slate, approximately 6–8 inches wide)
- Thermometer

Procedure

1. Set up the hot rock model by first placing the rock on a table and clamping the desk lamp above the rock. The lamp should be positioned so that part of the heat is projected on the rock, while the rest of the heat is projected on the table.
2. Review that an ectotherm cannot generate its own body heat like humans. Instead, they must utilize objects in their environment and the heat from the sun to control their body temperatures.
3. Ask the students to recall the process by which an ectotherm (such as an amphibian or reptile) controls its body heat (i.e., thermoregulation).
4. Review that thermoregulation is the process of an animal using the environment around it to heat and cool itself to the desired temperature. When an ectotherm thermoregulates, it must move throughout its habitat to warmer areas to raise its body temperature, and cooler areas to lower its body temperature.
5. Pass out the Hot Rock Experiment Worksheet.
6. Remind the students that scientists studying amphibians and reptiles are herpetologists.
7. Review the basic steps of the scientific process: Hypothesis (an explanation of observations), Experiment, and Conclusion.
8. Explain to the students the general procedure of the experiment: Students observe how temperature can vary depending on the exposure to sunlight and the type of surface that is exposed to the heat. Students use both touch and a thermometer to observe these differences.
9. Have the students make a hypothesis about which object will be the hottest: the air under the lamp, the top of the rock, the underside of the rock, or the surface next to the rock (not under the rock).
10. Check temperatures starting from the coldest spot to the hottest. This will allow the thermometer to record temperatures at a faster rate. Lift and record a temperature from directly underneath the rock. Have the students take the temperature of the surface next to the rock, then the temperature of the air, and then the temperature on the top of the rock. Before you move the thermometer, record the temperature for each location. Also, have the students touch all four spots where a temperature was taken to feel the temperature of each location.
11. Complete the lesson with a discussion of the activity. Draw conclusions about the experiment based on the observations recorded. Discuss how temperatures of objects in the environment may be affected by their colors or by the materials of which they are made. Ask the students to list the objects from coldest to hottest. Create real-world situations based on the observations. For example, if a lizard woke up on a cold morning, where would it most likely go in order to warm up? If it became too hot, where might it go to cool down?

Hot Rock Experiment Worksheet • KEY

Name: _____

Hypothesis: *The temperature on the rock will be the hottest.*

	Air	Surface Next to Rock	On Rock	Under Rock
Temperature (ºF)				

Conclusion: *Discuss how an animal in the wild may use these different objects to regulate its temperature. An option may be to create a real-world situation about a rock, or perhaps create a story about animals using rocks to regulate temperature.*

Hot Rock Experiment Worksheet

Name: _____

Hypothesis: _____

_____

	Air	Surface Next to Rock	On Rock	Under Rock
Temperature (ºF)				

Conclusion: _____

_____

_____

_____