Arizona Chili Peppers

Teacher
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Topic & Title:
Growing Arizona Chili Peppers
Breeding out the heat

Grade Level:
2-4

Relevant AZ Science Standards, Grades 2-4:
- S1.C2.PO2. Participate in guided investigations in life, physical, and Earth and space sciences.
- S1.C3.PO2. Construct reasonable explanations of observations on the basis of data obtained (e.g., Based on the data, does this make sense? Could this really happen?).
- S1.C4.PO1. Communicate the results and conclusions of an investigation (e.g., verbal, drawn, or written).
- S1.C4.PO3. Communicate with other groups or individuals to compare the results of a common investigation.
- S3.C2.PO1. Identify ways that people use tools and techniques to solve problems.
- S4.C3.PO1. Describe ways various resources (e.g., air, water, plants, animals, soil) are utilized to meet the needs of a population.
- S4.C4.PO1. Recognize that successful characteristics of populations are inherited traits that are favorable in a particular environment.

Objective:
Students will be able to describe what genetic traits are, and identify genetic traits in various organisms.
They will be able to describe the purpose behind farmers breeding out the heat of their chili peppers.

Evidence of Mastery:
Formative - Student worksheets and informal questioning.
Summative - Students ability to accurately draw their new chili pepper according to the selected genetics.
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Background Knowledge:
Living organisms pass on their genetic traits to their offspring.
Design process- ask, explore, model, evaluate, explain

Misconceptions (Possible misleading thoughts students might have):
Only visible traits are genetic and can be selected for through breeding.

Process Skills (Skills are you introducing or reinforcing; ex. observation – reinforcing; prediction – introducing):
Observation, Predictions, Scientific testing, and Analysis

Safety (Safety rules and procedures that need to be addressed):
Use caution when cutting things with scissors.

Management Technique:
General classroom management procedures: call backs, timers, questioning, etc.

Essential Question:
What are genetic traits?
Which organisms have genetic traits that can be passed to their offspring?

Inquiry Questions (Testable in the here and now):
How do Chili Pepper farmers make their chili peppers the right size, color, and hotness?
Why do farmers need to be able to control the heat level in their chili peppers?

Key vocabulary (List and define):
Genetics: the study of heredity and the variation of inherited characteristics.
Traits: a distinguishing quality or characteristic
Artificial Selection: The breeding of plants and animals to produce desirable traits.
DNA: material present in nearly all living organisms that is the carrier of genetic information.

Materials:
- Identifying traits cards for Fruit Fly, Dog, and Chili Pepper. (1 set per class)
- Envelopes (1 per group)
- DNA strips, provided
- Chili Pepper Key, provided (1 per group)
- Drawing sheet (1 per student)
- Coloring markers for each student

Engage

Identifying Traits in Living Things

Teacher Will:

1) Show the class one picture at a time of the three living organisms.
2) For each organism (fruit fly, dog, chili pepper) ask students to identify the traits of each living thing.
3) Include discussion about how each of these traits are actually genetic traits that can be bred out or maintained throughout the generations by artificial selection.

Student Will:

1) Students will identify the genetic traits of each organism.

Explore

Chili Pepper Genetics Activity

Teacher Will:

1) **Pose inquiry question**: How do Chili Pepper farmers make their chili peppers the right size, color, and hotness.
2) Follow directions on the "Chili Pepper Genetics" activity (provided).

Student Will:

1) Students will discuss how they think farmers control chili pepper traits.
2) In groups students will use their supplies to discover the answer to the inquiry question through the "Chili Pepper Genetics" activity.

Explain

www.curryseedandchile.com

Teacher Will:

- Open the Curry Farms website (www.curryseedandchile.com)
- Scroll down to read the summary of the Curry Chile Farm.
- Emphasize the purpose of Curry Farms: to develop new and improved hybrids of chilis that can be produced with uniform quality, flavor, and heat.

Student Will:

- Listen to the summary read by the teacher regarding the purpose and history of Curry Farms and their chili production.
- Ask questions about the farm or what they do.

Elaborate

YouTube video: "Chile Pepper Farmer" (7 min 30 sec)

Teacher Will:

1) **Pose inquiry question**: Why do farmers need to be able to control the heat level in their chili peppers?
2) Show the YouTube video about the chili farm in Arizona. This will review the reasons why they have to control the heat level in their chilis. Ask review questions to check for understanding.
1. What does Ed Curry grow on his farm? (Chili peppers)
2. What is he trying to do to his peppers? (make them better; improve them)
3. What is one product his peppers are turned into? (chili powder, salsa, etc.)
4. How can salsa have a consistent heat level – Mild, Medium, Hot? (By breeding peppers with the right amount of heat)

Student Will:

1) Students will answer questions about the YouTube video.
2) Students will be able to explain the answer to the inquiry question (answer is given with question #4 under "Teacher Will")

Evaluate

Chili Pepper Activity, continued

Teacher Will:

1) After all groups have posted their DNA strands and chili pepper drawings, have them stand by their drawing.
2) Pose question:
   - How many different types of chili peppers could there be with only three traits?
3) Allow students a few minutes to walk around the room and look at all of the other chili peppers to determine the answer to the question.
4) Have students freeze. Explain that when we look at only three traits, that there are 27 different possibilities of chili peppers.
5) Ask them to consider all the different traits that are possible in every living organism.
6) "A set of instructions called "DNA" makes a recipe for traits in all organisms. Information in a DNA strand is grouped into small segments. Each segment is made of even smaller units. Differences in the DNA alphabet are what makes the difference in traits."

Student Will:

1) Students will guess how many types of chilis there can be.
2) Students will walk around the room and look at all the different types of chilis.
3) Students will listen to how DNA controls the combination of traits in chili peppers.

Closure

Index card or blank paper – knowledge transfer

Teacher Will:

1) Thinking about how Ed Curry uses genetic breeding to produce perfect peppers, think of some other products other than chilis that farmers use genetic selection to produce. Write down at least three other examples.
2) If students have a difficult time, they can discuss with a neighbor.
3) Have students randomly share their examples from around the room, ensuring that they are citing the traits that the farmer would want to control.

Student Will:

1) Students will think of other products besides chilis that farmers produce through genetic selection.
2) Students will share their examples when called upon by the teacher.

IDENTIFYING TRAITS - ORGANISM #1 – FRUIT FLY

Genetic Traits: Red eyes, Yellow body, Clear wings, Black bottom, Hairy

IDENTIFYING TRAITS - ORGANISM #2 – DOG

Genetic Traits: Black eyes, brown/black/white coloring, long floppy ears

IDENTIFYING TRAITS - ORGANISM #3 – CHILI PEPPER

Genetic Traits: Green leaves, Pointed leaves, Long slender peppers, Red peppers, Heat

CHILI PEPPER GENETICS
TEACHER DIRECTIONS

BEFORE CLASS PREPARATION:

STEP 1 – Determine how many groups of 2-3 students you would form for your class size. For our purposes, we will assume you will have 9 groups.

STEP 2 – Make 18 copies each (2 for each group) of DNA Strips A, B, and C. Each DNA Strip page should be on a different color (example: DNA Strips A on Blue, DNA Strips B on Green, and DNA Strips C on Yellow).

STEP 3 – Cut out the DNA Strips from each page, and place two DNA Strips of each color in an envelope (9 envelopes – one per group). Try and mix them up so there aren't two of the exact same strip in the envelope.

STEP 4 – Double check; you should now have 9 envelopes, each containing 2 blue strips, 2 green strips, and 2 yellow strips.

STEP 5 – Make 9 copies of the Chili Pepper Key (one for each group)

STEP 6 – Make enough copies of the drawing sheet for each student to have their own copy.

IN CLASS ACTIVITY:

STEP 7 – Split your class into groups of 2-3 (total of 9 groups)

STEP 8 – Pass out supplies to each group:

- One envelope of "Chili Pepper DNA"
- One "Chili Pepper Key"
- One drawing sheet per student

STEP 9 – Students will determine the first trait of their chili peppers (length) by randomly picking a piece of DNA out of their envelope (one of the blue strips).

STEP 10 – Students look at the symbols on the DNA strip, and match the pattern to one seen on the Chili Pepper Key for length. Circle the matching picture.

STEP 11 – Students will set aside the DNA strip and repeat steps 4 and 5 for the next two traits on the key. (Heat = one of the green strips; Color = one of the yellow strips)

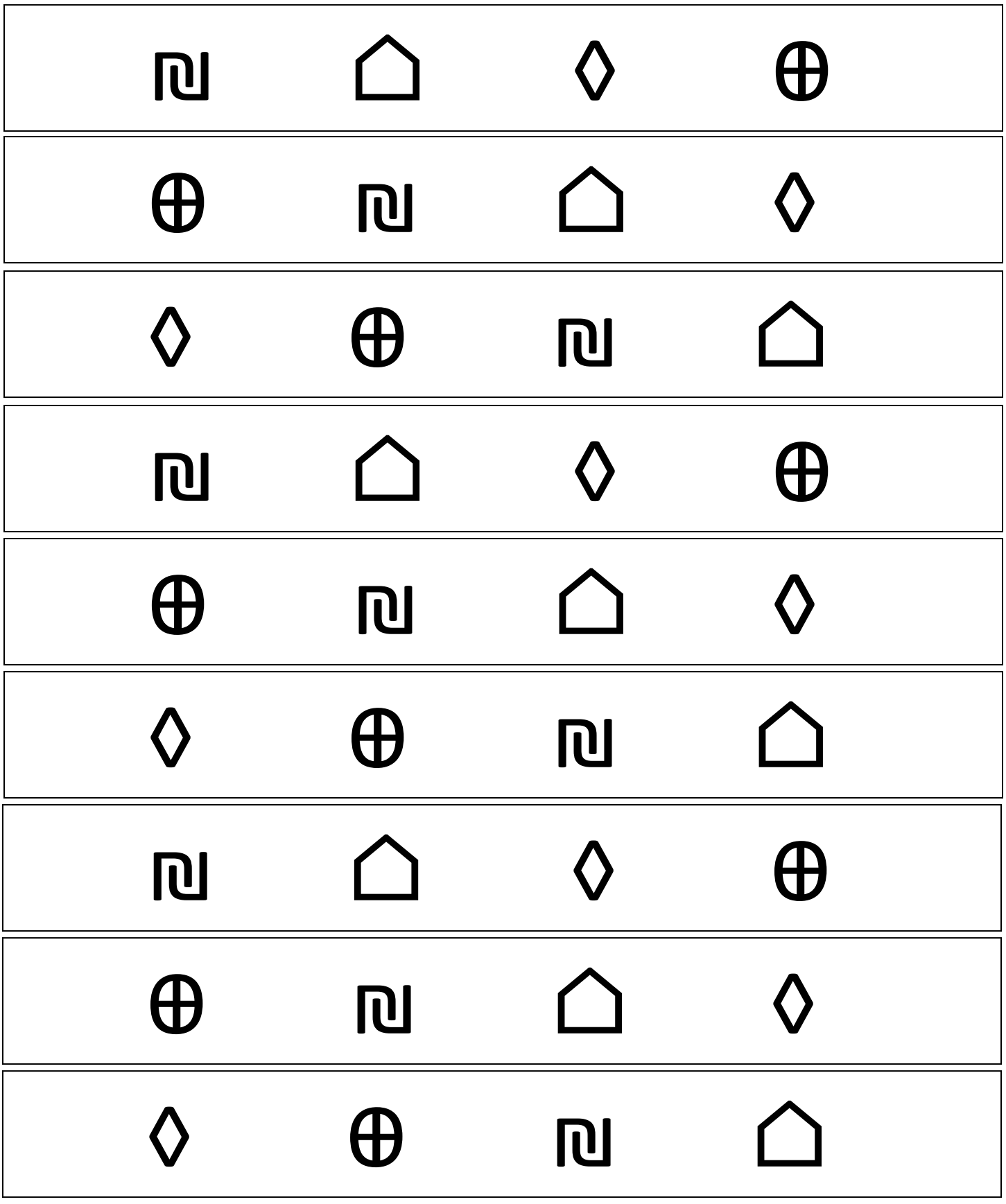
STEP 12 – After circling the matching pictures for all three traits, students will tape the three DNA strips together into one long strand to represent a strand of DNA.

STEP 13 – Students will then draw their chili pepper with all three traits (previously circled) on the provided drawing sheet. Students should attach their DNA strip to their picture.

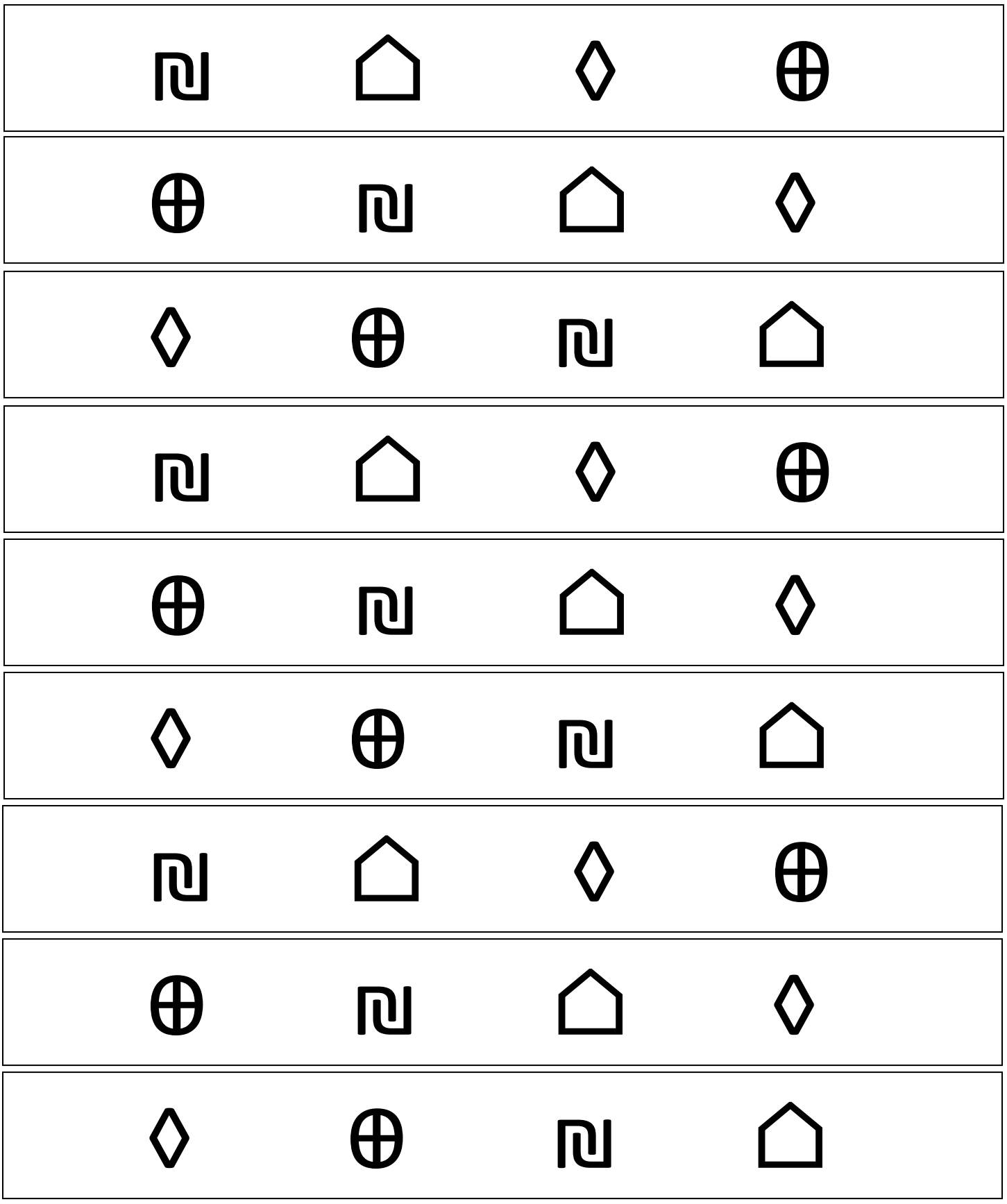
STEP 14 – Instruct your class where to hang up their picture/DNA strip in the class.

STEP 15 – Have them clean up.

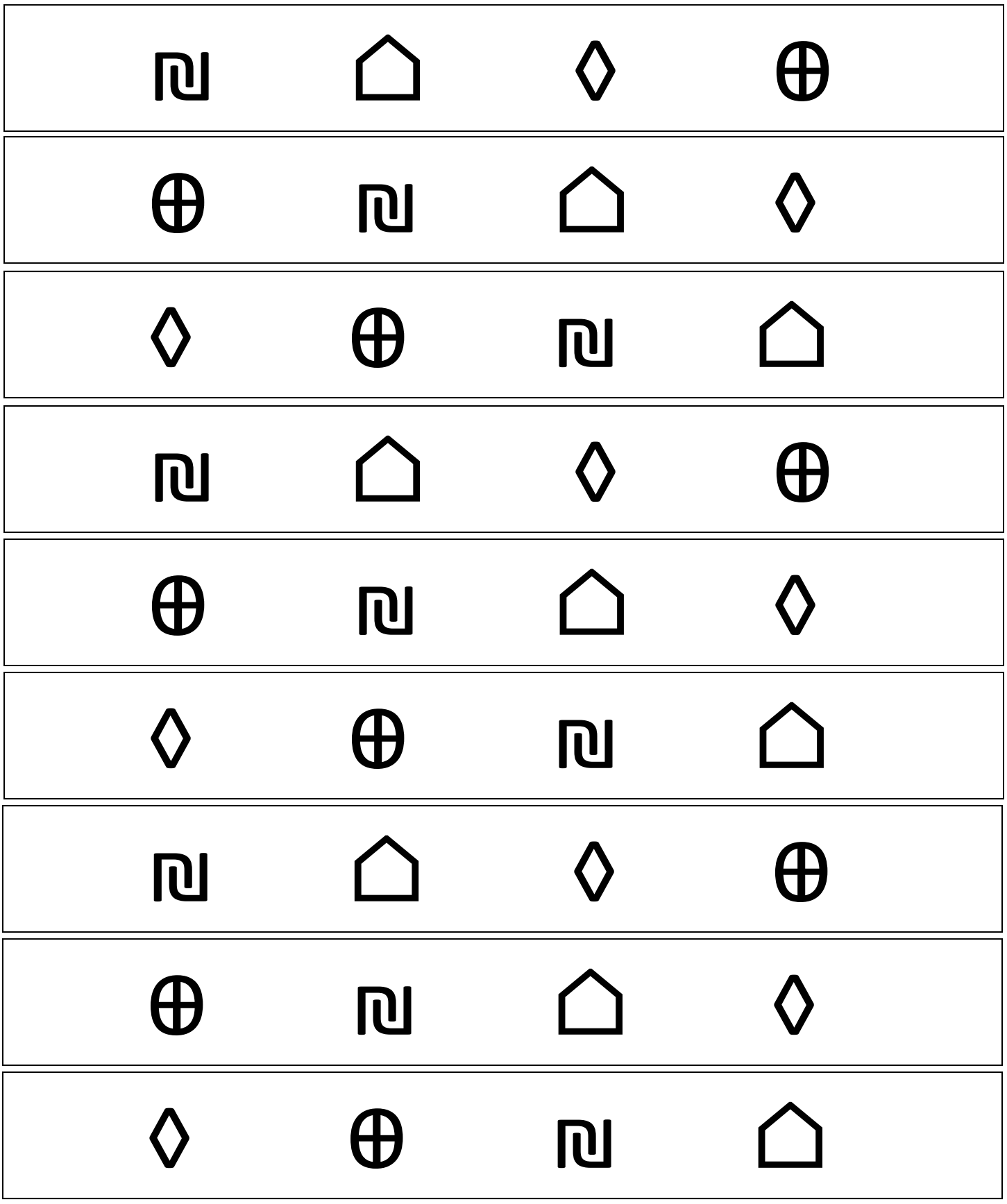
DNA Strips A – Make 2 copies onto blue paper



DNA Strips B – Make 2 copies onto green paper



DNA Strips C – Make 2 copies onto yellow paper



CHILI PEPPER KEY

TRAIT #1 – LENGTH

SHORT

MEDIUM

LONG

TRAIT #2 – HEAT

TRAIT #3 – COLOR

YELLOW

ORANGE

RED

DRAWING SHEET

Instructions: Once you have determined your chili pepper's traits using the Chili Pepper Key, draw your chili pepper on this page showing the correct length, heat, and color.