

Developmental Series Sample

Knowledge and Skills Statement

(2.4) Scientific processes: The student uses age-appropriate tools and models to verify that organisms and objects and parts of organisms and objects can be observed, described, and measured.

Student Expectation

(B) The student is expected to measure and compare organisms and objects and parts of organisms and objects, using standard and nonstandard units.

ACTIVITY

Measure Away

Materials

Digital or two-pan balance

For each lab station:

Metric ruler

Two-pan balance

Measure Away organism illustrations

Pencils, chalkboard eraser, paper clips

For each student:

Measure Away activity sheet

Background

Measuring objects or organisms using standard units may not always be possible during field lab exercises. Researchers will sometimes measure a property of something by comparing it to nonstandard units such as the length of a stick, the mass of a brick, or the temperature of ice water. Such comparisons communicate a general understanding of the physical properties of an organism or object and serve as temporary comparisons until accurate measurements can be made later.

Procedure

Demonstrate the use of nonstandard measurements by showing that an object is as wide as something else, such as one hand or one finger. Use a two-pan balance to show that an object has the same mass as something else, such as showing one new pencil has the same mass as two erasers. Show how a length of string can be used to measure the distance between two positions on a map.

Prepare sufficient lab stations to allow continuous work by groups of three or four students. Withhold metric rulers from the lab stations until the groups have made



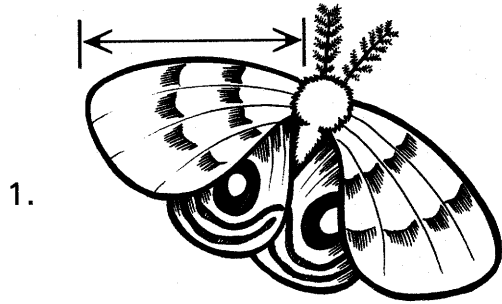
all of their nonstandard measurements. Distribute a *Measure Away* activity sheet to each student. Students work at lab stations, follow the lab procedure described on the activity sheet, and collect the requested nonstandard measurements. Students make and record their measurements for comparison with other group members during a subsequent part of the activity.

Lab groups raise hands when all group members have completed their nonstandard measurements. Supply a metric ruler to the group. Students make length measurements using the metric ruler. They record the measurements on their activity sheets.

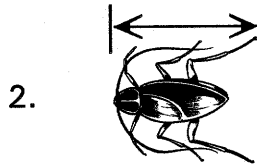
After completing the measurements made using the metric ruler, lab groups bring objects for which nonstandard mass has been determined to the teacher's desk. Use the balance to measure and record the mass in standard units. Lab groups work together to answer conclusion questions 1 and 2. Questions 3 and 4 are answered individually.



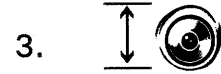
Measure Away Organism Illustrations



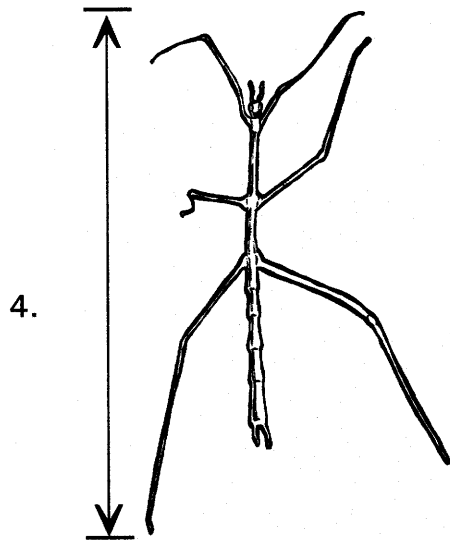
moth's wing



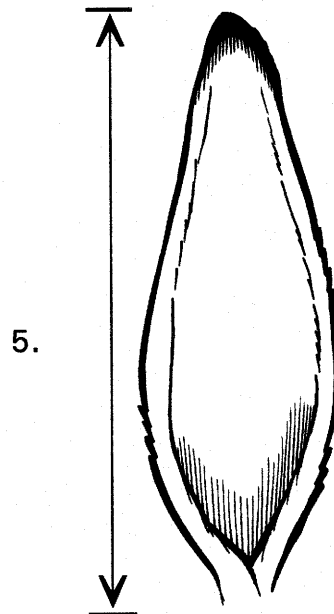
cockroach



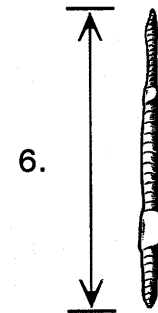
fish eye



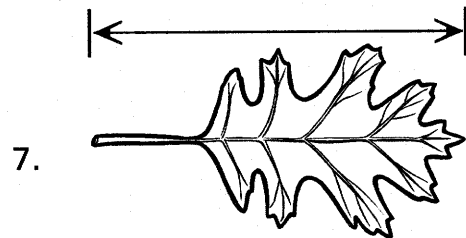
walking stick



rabbit's ear



earthworm



oak leaf



Measure Away Activity Sheet

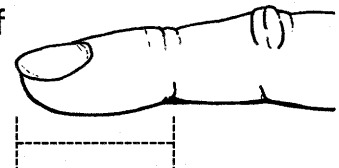
Backgrounds

Scientists working away from their lab may not have a ruler to measure length. They may not have a scale to measure mass. They can get an idea of length or mass by measuring with nonstandard units. A nonstandard unit can be "as long as an index finger" or "the same mass as a large marble." Nonstandard units are helpful when we compare things with one another.

Procedure

Part 1

Look at the organism drawings. Use the first part of your finger to measure the marked distance on each organism, from one point of the arrow to the other point. Measure each numbered item in turn, and record your nonstandard units in the length data table. The first item has been completed for you. You will measure and record the numbered items with a metric ruler later in the activity.



Length Data

Number	Nonstandard Unit	Standard Unit (to the nearest centimeter)
1	as long as a part, or phalange, on my finger	3 cm
2		
3		
4		
5		
6		
7		



Procedure

Part 2

1. Place the two-pan balance in front of yourself.
2. Place the chalkboard eraser in one pan.
3. Add pencils to the empty pan until the balance pans are even, or balanced.
4. Record the number of pencils that equal the mass of the eraser in the nonstandard unit column of the mass data table.
5. Remove the chalkboard eraser from the balance pan. Keep one pencil in the second balance pan.
6. Add paper clips to the empty pan until the balance pans are even, or balanced.
7. Record the number of paper clips that equal the mass of the pencil in the nonstandard unit column of the mass data table.
8. Empty both balance pans. Place the ruler in one balance pan.
9. Add paper clips to the empty pan until the balance pans are even, or balanced.
10. Record the number of paper clips that equal the mass of the ruler in the nonstandard unit column of the mass data table.
11. Choose one more item. Record its name in the blank item space on the data table.
12. Measure its mass with pencils or paper clips, and record the measurement in the nonstandard unit column of the mass data table. Remember to name the unit of measurement that you choose.

Mass Data

Item	Nonstandard Unit	Standard Unit (to the nearest gram)
chalkboard eraser	number of pencils =	
pencil	number of paper clips =	
ruler	number of paper clips =	



Procedure

Part 3

1. Raise your hand, and ask for a metric ruler.
2. Measure the length to the closest centimeter of each numbered organism or part.
3. Record each measurement in the standard unit column of the length data table.
4. Raise your hand, and wait for a turn to use the scale.
5. Measure the mass of the chalkboard eraser, one pencil, ruler, and the object chosen by your group to the nearest gram.
6. Record each measurement in the standard unit column of the mass data table. Remember to name the unit of measurement.

Conclusion

Work with your lab group to answer questions 1 and 2.

1. Do all members of your lab group have the same nonstandard length measurement for number 4, the walking stick? _____

Explain why they are or are not the same. _____

2. Do all members of your lab group have the same nonstandard mass measurement for the chalkboard eraser? _____

Explain why they are or are not the same. _____



Answer questions 3 and 4 on your own.

3. An angelfish is as long as your index finger. You measure the angelfish with a metric ruler and find that it is 8 centimeters long.

How long is your index finger in standard units? _____

4. A pencil has the same mass as 4 small paper clips. A paper clip has a mass of 1 gram. What is the mass of the pencil in grams?



Developmental Series Sample

Knowledge and Skills Statement

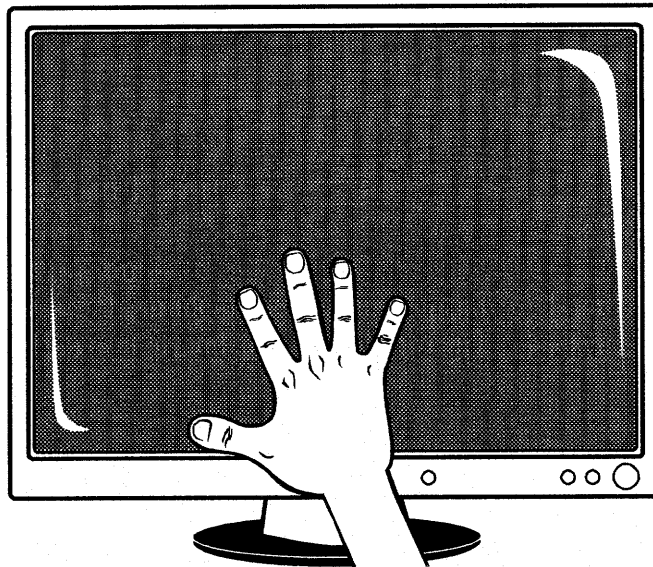
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Student Expectation

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(Questions 1-2 of 4)

- 1 A person holds a hand up to the screen of a computer monitor.

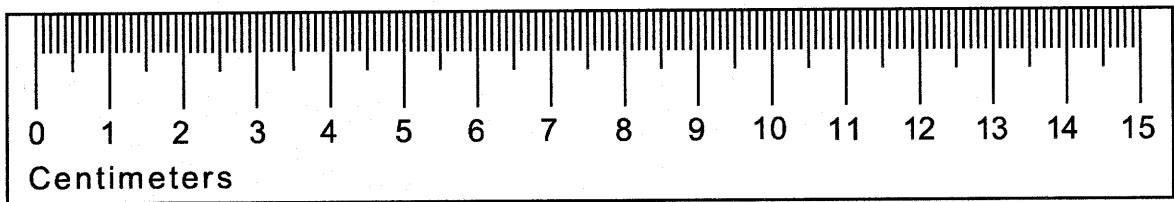
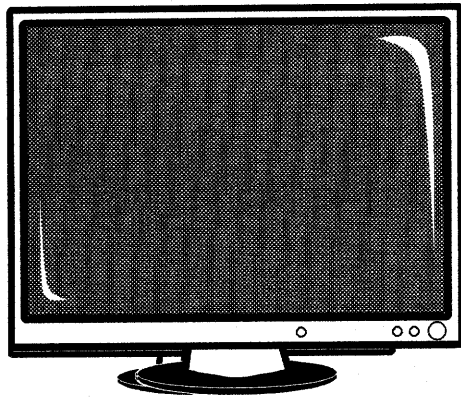


How many hands high is the screen of the computer monitor?

- A 4 hands
- B 3 hands
- C 2 hands
- D 1 hand



- 2 A drawing of the same computer monitor is measured with a metric ruler.



How wide is the screen on the computer monitor drawing in standard units?

- A 5 cm
- B 6 cm
- C 7 cm
- D 8 cm

