If I am a forensic geologist...
I search for clues to solve crimes.

Experiment 10
Forensic Soil Analysis

You will need 4 stirrers (B), 4 pH test strips and pH color chart (E), magnifying lens (I), measuring cup (K), 4 foam cups (L), 4 soil samples (O), and distilled water.

Things To Know:

You are a Forensic Geologist who has been asked to analyze soil samples from a crime scene and 3 people who are suspects in the crime. Each of the suspects claims to be innocent of the crime. You will determine whether any of the soil samples from the shoes or vehicles of the suspects matches the soil sample from the crime scene.

Soils can be distinguished from each other by their unique physical and chemical properties.   Three types of soil are clay, silt and sand. The soil with the smallest particles and finest texture is clay.   When wet, clay sticks together and can be formed into pottery. Sand has the largest particles, retains the least amount of water, and has the lowest amount of plant life.   Silt is a sediment material with an intermediate size between sand and clay.

Loam is a mixture of soil types.   Loamy soil is ideal for most garden plants because it holds plenty of moisture but also drains well so that air can reach the roots.   Peat moss can be added to different soil types to help the soil maintain moisture and add nutrients. Peat moss is dark brown decaying material that is found in peat bogs.

The color of a soil indicates the chemicals present in the soil. White or gray soil may contain lime or calcium carbonate. Black or gray soil contains organic materials and/or moisture. Red, brown, or yellow soil usually contains iron compounds. Soils can also be distinguished based on chemical properties, such as acidity or alkalinity. The pH test strips and color chart measures the "power of the Hydrogen ions" in the soil. A pH below 7 is acidic, 7 is neutral, and above 7 is basic or alkaline.

What To Do:

1. There are four soil samples. Three soil samples were collected from the three suspects. The other soil sample was collected from the victim at the crime scene. Use the marker to label each foam cup: S1=suspect 1, S2=suspect 2, S3=suspect 3, and CS=crime scene.
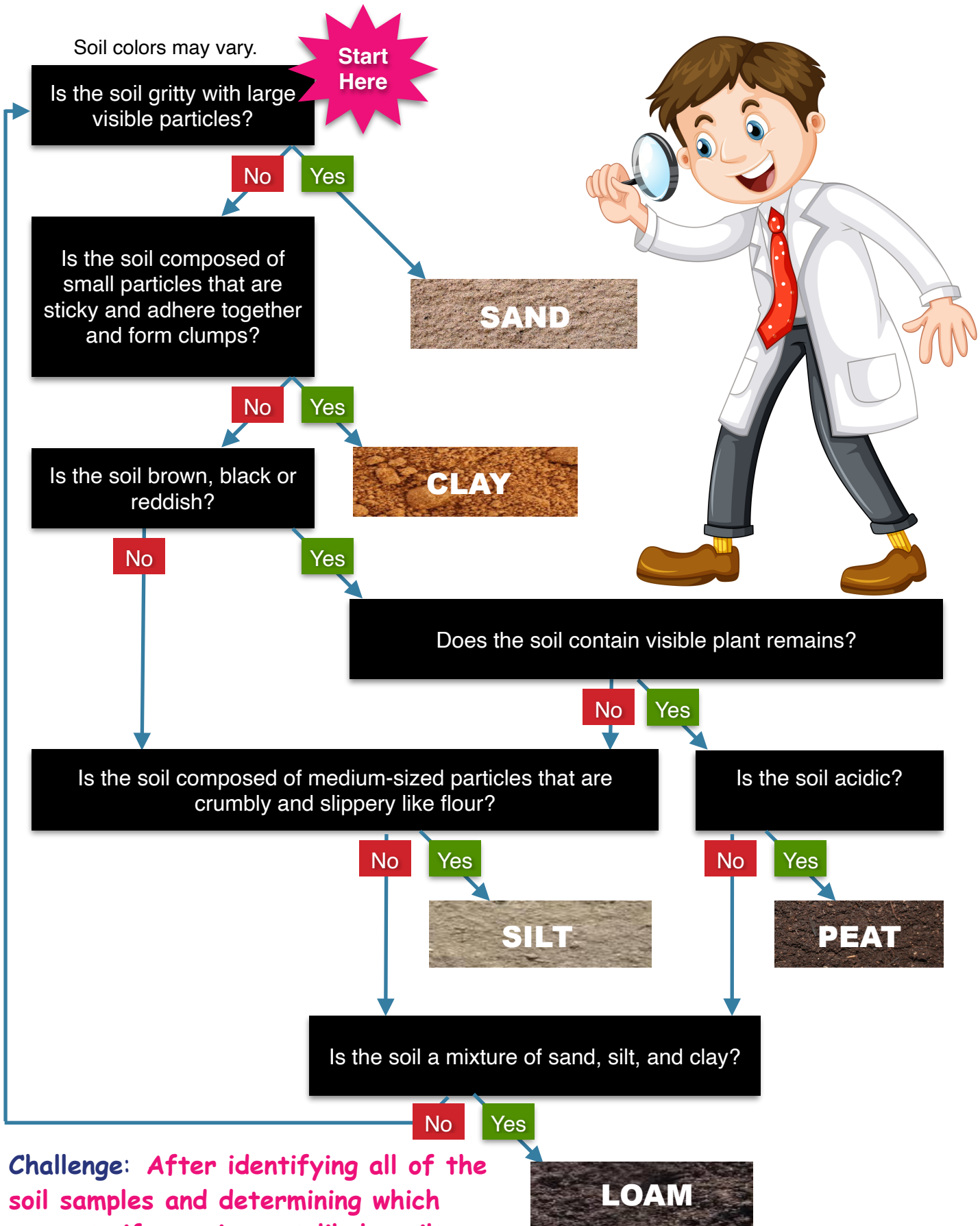

2. Using the measuring cup, add 30 cubic centimeters (1 mL = 1 cubic centimeter) of the soil sample to the cup that is labeled with the sample name.
3. Beginning with sample S1, use the flow chart on page 39 to identify the soil sample by answering the questions and matching the characteristics of the soil.
4. Record the type of the soil as sand, clay, silt, peat, or loam in the table on the student sheet.
5. Repeat steps 3-4 until the type of soil for each sample has been identified.
6. Use the measuring cup to add 30 mL of distilled water to each of the soil samples in the foam cups (S1, S2, S3, and CS)

7. Each cup should have its own stirrer. Mix the distilled water and the soil. For best results, let the soil solutions sit for 20 minutes before testing.

Do steps 8–11 with only one sample at a time.

8. Beginning with sample S1, briefly mix the solution again and wait 15-30 seconds for the soil to settle.
9. Hold a new pH test strip in the solution for 3 seconds.
10. Remove the pH test strip and shake it to remove any dirt on the colored squares. Wait one minute for the soil solution to fully react with the pH test strip.
11. Match the colors of the squares on the pH test strip with the color chart.   Record the pH of the sample in the table on the student sheet.
12. Repeat steps 8-11 until all samples have been tested.
13. Analyze the results to determine which, if any, of the suspect's soil samples (S1, S2, or S3) matches the victim's soil sample (CS).
14. Complete the questions on the student sheet.

Soil colors may vary.

Start Here

Is the soil gritty with large visible particles?

No — Yes

SAND

Is the soil composed of small particles that are sticky and adhere together and form clumps?

No — Yes

CLAY

Is the soil brown, black or reddish?

No — Yes

Does the soil contain visible plant remains?

No — Yes

Is the soil composed of medium-sized particles that are crumbly and slippery like flour?

Is the soil acidic?

No — Yes

SILT

No — Yes

PEAT

Is the soil a mixture of sand, silt, and clay?

No — Yes

LOAM

Challenge: **After identifying all of the soil samples and determining which suspect, if any, is most likely guilty, write a short story about the crime.**

Name _____ Date _____

Experiment 10: Forensic Soil Analysis

Analyze the physical and chemical properties of the soil samples to find which suspect is guilty of the crime.

Soil Sample	Type of Soil (sand, clay, slit, peat, loam)	pH
Suspect 1		
Suspect 2		
Suspect 3		
Crime Scene		

1. Use the results of your tests to determine which of the suspects, if any, are guilty of the crime. Explain your reasoning.

2. Discuss possible source of errors in determining which suspect committed the crime.

3. Discuss how to improve the design of this experiment.