

SOIL ANALYSIS TEAM

BACKGROUND:

Soil is anything but uniform. In many cases, two specimens of soil taken only centimeters apart may differ significantly in composition. This is because soil is a complex mixture of mineral, vegetable, and animal material, and may also contain plastic, glass, metal, and other manufactured materials. These differences mean that soil from any particular location has its own unique fingerprint. Common types of soil include:

- **Potting soil:** primarily used for growing plants. For this reason, this soil often contains ingredients (e.g. small beads/rocks) to make it less or more dense depending on the needs of the plant. The most obvious place to find potting soil is a garden.
- **Clay-based Soils:** found in very dry, desert regions. This soil is VERY dense and will clump up when wet or moistened. The most common use is for making pottery or sculptures.
- **Sandy/Rocky Soils:** range from microscopically fine grains to larger pebbles. Gardeners will often use this type of soil to pot cacti and other desert plants.
- **Mixed, Soft topsoil:** tends to be a mixture of all soils due to several years of runoff and high levels of moisture. This is the kind of soil commonly associated with forest vegetation that grows around bike and mud trails.

PART I: GATHERING EVIDENCE

As a team, your job is to carefully and thoroughly search your assigned area for traces of dirt, soil, or other organic materials that may have been left at the crime scene. Continue gathering evidence until your entire group has gathered **3 – 4 visually different** types of soil evidence. Be sure to diagram where the evidence was located and observe the following protocol:

- ✓ Wear gloves, lab coats, and shoe covers before entering the crime scene.
- ✓ When locating evidence, **carefully** remove the specimen and place it in an evidence bag (if possible).
- ✓ After locating evidence, note all details in your EVIDENCE LOG.
- ✓ Check the bottoms of your shoe covers for evidence that you may have accidentally stepped on or missed.

PART II: DETERMINE SOIL CHARACTERISTICS & DENSITY

Fill out the soil worksheet as you complete this lab.

OBSERVE & CATEGORIZE SOIL COLOR

1. Place **about 1/3** of each sample in its own test tube and, using the sample color cards, name and order each sample by color from lightest to darkest.
2. On your worksheet, put the name of the soil color (from the color cards) next to either A, B, C, or D.

EXAMINING SOIL SPECIMENS UNDER MAGNIFICATION

3. Starting with Specimen A, place a *small* amount of soil onto a slide and observe its composition under the microscope. Note any observations on your worksheet.
4. Repeat step 3 for all other specimens.

DETERMINING SOIL DENSITY

5. Add tap water until each beaker is nearly full then, add **one drop** of dishwashing liquid per test tube.
6. Using **one stirring rod per sample**, stir the contents in each test tube until any vegetable/light material floats to the top.

7. Allow the contents of each cup to settle for a few minutes then **carefully** pour off most of the excess liquid. Avoid pouring off any of the solid soil. Repeat for all specimens.
8. Pour each specimen into an individual pie plate and, with a sharpie, label the plate with the name or letter (A,B,C,D) of the specimen.
9. Using the hair dryer, take a few minutes to dry the sample as much as possible.
10. When the sample is dry enough, place a coffee filter on a scale and zero out the scale. Next, transfer around **25 g** of the sample from the pie plate to the coffee filter on the scale. Repeat for all specimens **using a NEW coffee filter** for each specimen (leave the specimen in the coffee filter after weighing). Record the mass in your worksheet.
11. Fill the empty soda bottle with tap water and a few drops of dishwashing liquid. Invert the bottle several times to mix the solution then fill the 50 mL graduated cylinder with **25 mL** of this solution. Record this initial volume in your worksheet.
12. Withdraw some of the liquid solution in the graduated cylinder into a pipette and set aside.
13. Transfer one specimen into the graduated cylinder and use **ALL** of the liquid in the pipette to prevent the soil from sticking to the sides of the graduated cylinder. Tap the side of the cylinder to eliminate any air bubbles and record this final volume in your worksheet.
14. Repeat steps 11-13, rinsing out the graduated cylinder for **each specimen**. When finished, dump the specimen back into its original pie plate.
15. Subtract the final volume from the initial volume and record this displaced volume in your worksheet. Repeat for all specimens.

16. Divide the mass by the displaced volume and record this as your density in your worksheet. Repeat for all specimens and answer all review questions.

SOIL WORKSHEET

Specimen	Color	Composition	Mass (g)	Initial Volume	Final Volume	Displacement	Density
A							
B							
C							
D							

REVIEW QUESTIONS

- a. Based on your results, list your specimens from least to most dense.

- b. Based on your microscopic observations, how well could you discriminate between unknown soil specimens?

- c. With what level of certainty can you determine the questioned specimens based on the descriptions in the background?

PART III: REVIEW THE POLICE REPORTS

Over the next few pages, your team will need to review the official police report of the crime as well as witness interviews. Some witness accounts will contradict others so it's your job to determine, based on your understanding of the evidence your team collected, who could be an innocent bystander and who could be a suspect.

DO NOT CONVERSE WITH OTHER ANALYSIS TEAMS AT THIS TIME!

You must form your own conclusions as a team first. If it helps, use the following analysis techniques:

- ✓ Note the WHO, WHAT, WHERE, and WHEN of the witness accounts.
- ✓ What are the relationships between witnesses?
- ✓ Create a timeline of where witnesses were at the time of the crime.

Use this space for notes and brainstorming...

PART IV: CONSULT YOUR PEERS

As a team, consult with **one** other analysis team that you feel may enhance your investigation (e.g. Hair and Fiber Analysis). Ask and answer the following questions:

Analysis team being consulted? _____

What physical evidence did this team gather? _____

What techniques did this team use to analyze their evidence?

What conclusions did this team arrive at? Why?

After consulting with the other analysis team, how does this change your original conclusions? Why?

PART V: CONCLUDING ANALYSIS

As soon as everyone has had a chance to converse with other investigative teams, we will all gather together and draw our final conclusions.