

# The Traces We Leave: compare records and state the limit

RESPAWN · Period 6A-7B · Supplied classroom records

## Read me first: how this handout is organized

One individual D07 trace comparison sheet, Parts A–E.

1. **Part 1. Background and definitions.** Six short readings and the terms. Read R1 to R4 before you write, and R5 to R6 with the worked example.
2. **Part 2. Directions in plain English.** Five steps, one per part of the sheet, and the 80-minute plan.
3. **Part 3. Worked example.** The F1 workflow and MODEL-1, a finished comparison on a practice print that belongs to neither case.
4. **Part 4. Your work.** Your Case B records, then the response sheet for Parts A to E.

Start with Part 1, then follow the steps in Part 2. Everything you write goes on the one response sheet in Part 4.

Use the supplied classroom records for your case. This route is available to everyone. These are not observations you made. You do not need to locate a missing image or sample.

[Your Case B D07 assignment](#) · [Daily directions on the portal](#)

# Part 1. Reading R1 and R2

Everything on the sheet comes from these six readings. Part A quotes R3 and R4. Part B uses all six, with R2, R5 and R6 doing most of the work. Part C uses R3 and R4. Part D uses R1, R3 and R5. Part E sends you back to R1, R3 and R4.

## R1. Why comparisons need two sides

A questioned sample has an unknown source. A known sample, also called a reference or elimination sample, has a stated source and is used for comparison. A person's name by itself is not a reference sample. You need comparable features from both sides before deciding whether they are consistent.

Morphology means visible shape and structure. Hair descriptions may include color, thickness, curl, the medulla or central core, and root condition. List the supplied features first. Keeping the features ahead of a person's name helps reduce bias, which is allowing an expectation to influence a judgment.

## R2. A missing input is a real limit

In this packet, the questioned-hair descriptions are supplied, but the known-hair reference features are not. Record the provided features and the missing comparison input. You cannot name a matching or excluded hair source from these descriptions alone. A missing reference is not a mismatch and is not evidence that someone was absent.

Consistent means the compared features agree. Inconsistent means the compared features disagree. Inconclusive means the available information does not support a clear comparison conclusion. For these supplied hair records, explain the input limit instead of guessing a person's name.

# Part 1. Reading R3 and R4

## R3. Class features and source conclusions

Class features may be shared by many sources. Evidence showing only these shared features is class evidence. A blood type, hair color or fingerprint pattern family can be a class feature. A sedan is a useful analogy for a broad class: many cars are sedans. A license plate is the analogy for a particular source, but comparing classroom evidence is not as simple as reading a plate.

Individual evidence is the term used when discussing evidence that can support a particular-source conclusion. For fingerprints, detailed ridge features can support a source-identification conclusion when the analysis is sufficient; it does not automatically prove identity. Similar visible hair features can support a possible-source comparison; they do not identify the donor or establish that the person was at the scene.

## R4. What root information can support

Root shape and attached follicular tissue can provide clues about how a hair was removed. Follicular tissue is tissue from around the growing hair that remains attached. A visible root is not the same as attached tissue. These features do not establish when the hair reached the scene.

Attached follicular tissue may provide DNA for testing. Hairs without attached tissue can also contain DNA, but useful results depend on the sample and method. Appearance alone does not provide a DNA result. No DNA test result is supplied in this lesson, and no new test is required.

# Part 1. Reading R5 and R6

## R5. The 12-match rule for prints

Minutiae are small fingerprint ridge details, such as endings and splits. Pattern families include loops, whorls and arches. The records state how many details were readable, how many matched a specified card and how many mismatched. Use those supplied counts; do not claim that you counted a missing image.

The 12-match rule, for this classroom exercise only: a model “individual” call needs at least 12 matching minutiae and zero mismatching minutiae. The 12-match rule is a practice rule, not a real forensic identification standard. Under this simplified model, a mismatch gives an inconsistent comparison. With fewer than 12 matches and no mismatches, use an inconclusive call. Keep each call limited to this model.

A match in this classroom comparison supports a possible source under the 12-match rule; it does not by itself prove who touched the object, when, or why. A missing hair reference does not become an “individual” call because another row contains a fingerprint count.

## R6. Report a proportion, not a probability

Matching count divided by readable count, multiplied by 100, gives the percentage of readable features that match. Show the fraction and calculation before rounding. The percentage describes the matching features counted in this exercise. It is not the probability that a person is the source, touched the object or committed an act.

Keep your evidence number beside every case-record statement. Keep the separate worked model and the Part C hypothetical labeled as practice. Neither supplies a missing result for your case.

# Part 1. Plain-English terms and the limit

Fourteen terms, one line each. Part D asks you to use four of them correctly: class evidence, individual evidence, morphology and minutiae.

**Questioned sample**

A sample whose source is unknown.

**Morphology**

Visible shape and structure.

**Bias**

An expectation influencing a judgment.

**Inconsistent**

The compared features disagree.

**Class evidence**

Evidence showing features shared by many sources.

**Follicular tissue**

Tissue from around the growing hair that remains attached.

**Pattern family**

A broad fingerprint pattern, such as a loop, whorl or arch.

**Known reference**

A sample with a stated source, used for comparison. A name alone is not a reference.

**Medulla**

The central core of a hair.

**Consistent**

The compared features agree.

**Inconclusive**

The available information does not support a clear comparison conclusion.

**Individual evidence**

Evidence that can support a particular-source conclusion when the analysis is sufficient.

**Minutiae**

Small fingerprint ridge details, such as endings and splits.

**Proportion**

The matching count divided by the readable count in this exercise.

## The limit that applies to everything today

These supplied records cannot establish a hair source without known-reference features, or prove who touched an object, when or why. The 12-match rule is a classroom model, not a real forensic identification standard. No DNA result is supplied.

This assignment reviews supplied records. It does not require handling specimens, collecting material or running a test. Practical work needs separate teacher direction and approved preparation.

## Part 2. Directions in plain English

Today you will read trace records, compare the information that is available and explain where a conclusion must stop.

You fill in one sheet with five parts, A to E. The five steps below match those five parts. Each step says what to do, what to use and where to find it.

1. Start in Part 1. Read R1 to R4, the four readings about hair and about what any comparison needs, then answer Part A on your sheet. A1 asks about R3 and A2 asks about R4. With each answer, copy the first three words of the reading sentence you used, so a reader can find it.
2. Now read R5 and R6, the two readings about fingerprints, and then the worked example in Part 3. MODEL-1 shows the whole process on a practice print that belongs to neither case: features first, then the 12-match rule, then the percentage, then the limit. Then go to Part 4 and complete Part B with your own case's records: one row for each hair record, giving its reported features and naming the missing known-reference input, and one row for each of the four print summaries, applying the 12-match rule from R5 to the supplied counts. Finish Part B with B2, one limit you can explain well, and B3, a separate calculation that uses its own numbers, not the model's.
3. Write Part C from the hypothetical facts in the prompt and nothing else. Give three things: the strongest statement those facts support, one stronger statement you may not make and why, and one extra kind of evidence that would be needed and what it would have to show. Do not invent a result, and do not bring in your case's records.
4. Write Part D: one or two sentences about today's records that use all four terms correctly, class evidence, individual evidence, morphology and minutiae. The definitions are in Part 1. A list of definitions on its own does not count.
5. Finish with Part E, then hand in. Answer E1, E2 and E3 from memory first, then check each one against the reading and fix it if you need to. Before you turn in, check that every row carries its evidence number, your case label and its limit. Turn in the one sheet and nothing else.

### The 80-minute plan

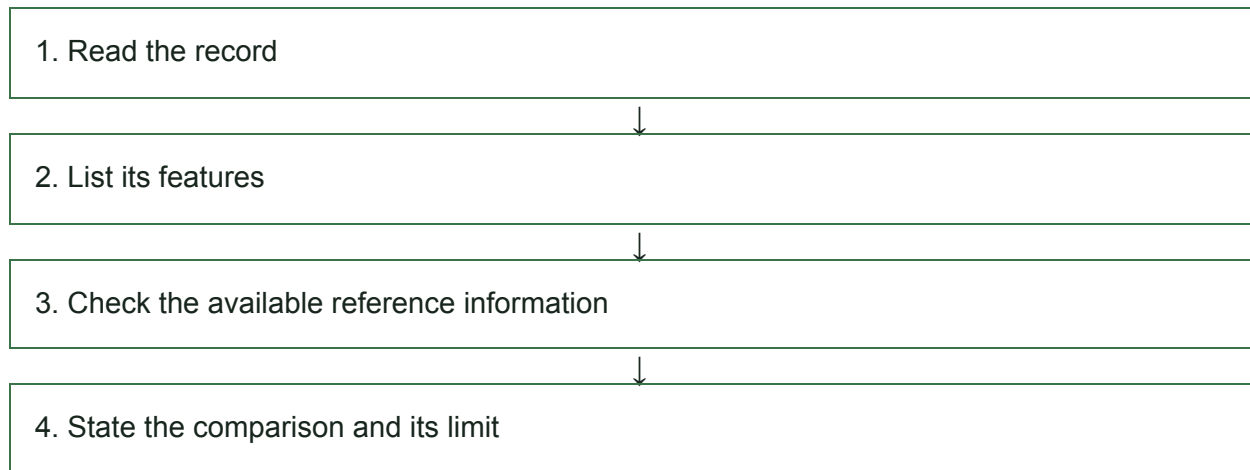
- **0–10 min:** Open your case handout. Label supplied records, read R1–R4 and answer A1–A2.
- **10–25 min:** Follow MODEL-1 and R5–R6. Find the 12-match rule and the percentage method.
- **25–40 min:** Complete your own-case hair rows. State the missing reference and needed comparison.
- **40–60 min:** Complete four print-summary rows, B2 and B3. Keep model and case numbers separate.
- **60–70 min:** Complete C1's three hypothetical components and D1's one or two sentences.
- **70–80 min:** Complete E1–E3, check evidence numbers and limits, then hand in one sheet.

Guided notes and extra help are optional support, not another submission. You may discuss your thinking with a partner, but write your own responses.

Turn in only the completed Parts A–E sheet. No extra CER, tracker, specimen image, microscope drawing or notebook upload is required.

## Part 3. F1, the workflow, and the MODEL-1 inputs

This example uses a locker print that belongs to neither case. Its counts are supplied; nobody recounted an image. Read it for the order of the work, because Part B asks you to repeat that order with your own case: features first, then the 12-match rule, then the percentage, then the limit.



F1. A comparison workflow, not a specimen image.

Begin with the evidence number and source label. Copy the reported features. Check whether the necessary comparison information is actually present. Use the supplied counts or approved reference features only. End with a conclusion no stronger than those inputs support.

### The supplied inputs

|                          |                            |
|--------------------------|----------------------------|
| <b>Pattern family</b>    | Right loop                 |
| <b>Readable minutiae</b> | 16                         |
| <b>Card 1</b>            | 13 matching, 0 mismatching |
| <b>Card 2</b>            | 5 matching, 3 mismatching  |

The 12-match rule, from R5: a model-individual call needs at least 12 matching minutiae and zero mismatching minutiae. Any mismatch makes the comparison inconsistent. Fewer than 12 matches with no mismatch is inconclusive. Every print call today uses this one rule.

## Part 3. MODEL-1, the five moves and the finished entry

### The five moves, in order

1. List the features before considering the card's identity: right loop and 16 readable ridge details. A pattern family is a class feature.
2. Compare card 1's supplied count with the 12-match rule: 13 is at least 12, and the record reports zero mismatches. Under this exercise model, this supports the model's "individual" call, consistent with card 1. It is not automatic proof of identity or an action.
3. Compare card 2's supplied count with the same model. The record includes three mismatches. Under the 12-match rule, the comparison is inconsistent with card 2. This is an exercise conclusion, not a real forensic exclusion based only on counts.
4. Show the card 1 proportion:  $13 \div 16 \times 100 = 81.25\%$ , or about 81% to the nearest whole percent. This percentage describes matching features in the record, not the probability that card 1's source touched the locker.
5. Keep the limit beside the comparison. A match in this classroom comparison supports a possible source under the 12-match rule; it does not by itself prove who touched the object, when, or why.

### What the finished entry looks like

MODEL-1 reports a right loop with 16 readable minutiae. Card 1 has 13 matches and zero mismatches, meeting the 12-match rule; 13 of 16 is about 81%. Card 2 has five matches and three mismatches, giving an inconsistent comparison under that same model. These practice counts support bounded comparisons, not proof of who touched the locker or when.

### A counterfactual, for practice only

The original model also asks you to imagine nine of 16 matching details with zero mismatches. That gives 56.25%, about 56%, and is below the classroom model's 12-match requirement. This counterfactual is practice only. Do not copy its numbers into B3, which supplies its own values.

**Do not copy the model's numbers.** B3 supplies its own: 14 readable, 9 matching and 0 mismatching. The model's 81% belongs to the model.

## Part 4. Your Case B hair records

Everything from here on is yours to write. These records are the only inputs for Part B. The frame each item came out of is in your evidence folder; the record says what was reported about it.

Supplied classroom simulation records, not observations made by the student

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### **E7-H1: storeroom floor hair**

Light brown; fine; slight wave; interrupted medulla; root with TISSUE ATTACHED.

Known-reference features: not supplied. State this input limit.

Known-hair reference features are not supplied. Record the reported features and the missing comparison input. Do not name a matching or excluded source. A missing reference is not a mismatch or evidence of absence.

## Part 4. Your Case B print records 1 and 2

Supplied classroom summaries. Apply the stated counts without claiming an independent image count.

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### **E8-L1: blender lift**

whorl; 16 readable minutiae; 14 matching and 0 mismatching with Nguyen's card.

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### **E8-L2: blender lift**

right loop; 13 readable minutiae; 12 matching and 0 mismatching with victim's card.

Use the 12-match rule from R5 and nothing else. A call based on this model does not establish a real forensic identification or prove who touched an object, when or why.

## Part 4. Your Case B print records 3 and 4

Supplied classroom summaries. Apply the stated counts without claiming an independent image count.

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### **E8-L3: container lid lift**

right loop; 13 readable minutiae; 12 matching and 0 mismatching with victim's card. Reported feature: Broad, ridgeless smears lie OVER the ridge detail.

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### **E8-L4: container lid lift**

whorl; 14 readable minutiae; 12 matching and 0 mismatching with Nguyen's card. Reported feature: Same ridgeless smears lie OVER this print too.

Use the 12-match rule from R5 and nothing else. A call based on this model does not establish a real forensic identification or prove who touched an object, when or why.

## Part 4. Response sheet, Part A: use the reading

Case B, RESPAWN, Period 6A-7B. Investigator code, not name:

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Source label: supplied classroom records, or complete teacher-approved actual classroom records.

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Date: September 15, 2026

Two short answers that quote the reading. A1 uses R3 and A2 uses R4. Copy the first three words of the sentence you used.

**A1** PBS-U1-D07-A1

In R3, which part of the sedan and license-plate analogy represents class evidence, and which represents a particular source? Copy the first three words of the reading sentence you used.

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**A2** PBS-U1-D07-A2

According to R4, what clues can root shape and attached tissue provide, and what can they not establish? Copy the first three words of the reading sentence you used.

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## Part 4. Response sheet, Part B1: comparison rows 1 to 2 of 5

One row per record from the pages before this. Same order as MODEL-1: features, reference or missing input, bounded conclusion, evidence level and limit.

Complete one comparison row for every supplied questioned item in your case. List its reported features first. For hair, state the missing known-reference input and the comparison you would need; do not name a matching or excluded source. For prints, use the supplied card label and counts to apply the classroom model. Identify class features. Label a model-individual print call only when the 12-match rule allows it; otherwise label the inconclusive or inconsistent comparison. State the limit and keep the evidence number on every row.

Same product: include all continuation pages with this sheet. Copy this page if teacher-approved actual records require more rows.

### Row 1 of 5

Evidence number and item

Reported features or counts

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Available reference information or missing input

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Bounded call or input-limited conclusion

Evidence level and limit

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### Row 2 of 5

Evidence number and item

Reported features or counts

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Available reference information or missing input

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Bounded call or input-limited conclusion

Evidence level and limit

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## Part 4. Response sheet, Part B1: comparison rows 3 to 4 of 5

Complete one comparison row for every supplied questioned item in your case. List its reported features first. For hair, state the missing known-reference input and the comparison you would need; do not name a matching or excluded source. For prints, use the supplied card label and counts to apply the classroom model. Identify class features. Label a model-individual print call only when the 12-match rule allows it; otherwise label the inconclusive or inconsistent comparison. State the limit and keep the evidence number on every row.

Same product: include all continuation pages with this sheet. Copy this page if teacher-approved actual records require more rows.

### Row 3 of 5

Evidence number and item

Reported features or counts

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Available reference information or missing input

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Bounded call or input-limited conclusion

Evidence level and limit

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### Row 4 of 5

Evidence number and item

Reported features or counts

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Available reference information or missing input

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Bounded call or input-limited conclusion

Evidence level and limit

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## Part 4. Response sheet, Part B1: comparison rows 5 to 5 of 5

Complete one comparison row for every supplied questioned item in your case. List its reported features first. For hair, state the missing known-reference input and the comparison you would need; do not name a matching or excluded source. For prints, use the supplied card label and counts to apply the classroom model. Identify class features. Label a model-individual print call only when the 12-match rule allows it; otherwise label the inconclusive or inconsistent comparison. State the limit and keep the evidence number on every row.

Same product: include all continuation pages with this sheet. Copy this page if teacher-approved actual records require more rows.

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### Row 5 of 5

Evidence number and item

Reported features or counts

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Available reference information or missing input

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Bounded call or input-limited conclusion

Evidence level and limit

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## Part 4. Response sheet, B2 and B3: one limit and one separate calculation

### **B2** PBS-U1-D07-B2

Choose your weakest supported comparison or a documented input limit. Give its evidence number and explain exactly what prevents a stronger conclusion. Why is reporting that limit useful?

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### **B3** PBS-U1-D07-B3

Separate practice: a questioned print has 14 readable minutiae, 9 matching and 0 mismatching. Show the fraction matching and calculate the percentage. What call does our classroom model allow, and what could you honestly say instead of identifying a person?

Fraction and calculation:

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Classroom call and qualified explanation:

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## Part 4. Response sheet, Part C: a separate hypothetical

### C1 PBS-U1-D07-C1

Separate hypothetical: suppose a hair is consistent with one known reference and has attached root tissue. Write a three-part practice matrix note: the strongest statement those facts support; a stronger statement you are not allowed to make and why; and one additional type of evidence that could support a more specific source comparison. State what that additional evidence would need to show. No additional test result is supplied or required.

#### 1. Strongest supported statement

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#### 2. Stronger statement not allowed, and why

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#### 3. Additional evidence and what it would need to show

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## Part 4. Response sheet, Parts D and E: vocabulary, then check yourself

D1 uses four terms from Part 1. E1 to E3 are answered from memory first, then checked against the reading and fixed if needed.

### **D1** PBS-U1-D07-D1

Use class evidence, individual evidence, morphology and minutiae correctly in one or two sentences about today's records. A list of definitions alone does not count.

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### **E1** PBS-U1-D07-E1

Blood type B at a scene: class or individual evidence? Answer in one line from memory, then check R3.

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### **E2** PBS-U1-D07-E2

What clues can root features provide, and what can they not establish? Answer in one line from memory, then check R4.

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### **E3** PBS-U1-D07-E3

Why list features before considering a person's name? Answer in one line from memory, then check R1.

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The reading remains available for checking. This self-check is part of the same sheet, not another exit-ticket submission.

# Optional notebook support

Keep notebook pages in your notebook. They are not an additional submission.

Use this template only if helpful. It does not replace a required response or add another product.

## One matrix row

Evidence number

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Supplied record statement

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What this supports

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Limit or missing input

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## Cornell cues

1. What information is supplied?
2. What reference is available or missing?
3. What can the comparison support?
4. What can it not support?

Write a brief reminder of how to keep a comparison within its evidence.

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# Turn in, help, PLTW and sources

Complete your D07 trace comparison sheet during class. Hand the paper sheet to me before leaving, or submit one PDF to this Schoology assignment by Tuesday, September 15, at 11:59 p.m. Submit once. Keep notebook pages in your notebook.

Turn in only the completed Parts A–E sheet. No extra CER, tracker, specimen image, microscope drawing or notebook upload is required.

Keep your source-labeled comparison and its limits for the next class on Thursday, September 17. Your notebook pages stay in your notebook.

## Help when you need it

Find your next unanswered task ID. For hair, use R1–R4. For prints and percentages, use R5–R6 and MODEL-1. Check that each conclusion includes its evidence number and limit.

Your teacher may offer an actual classroom-record route only when complete, approved questioned and reference inputs are available. Follow the preparation requirements for that route. Finishing this record exercise does not give a practical-lab pass or mark an official PLTW activity complete.

## PLTW

Related PLTW reference: Activity 1.1.3, The Traces We Leave Behind, in Lesson 1.1, Investigating the Scene. This John Hay classroom adaptation practices describing evidence, comparing available information and explaining limits.

This sheet does not replace or certify completion of the official activity. If assigned, open the matching activity through your existing myPLTW account or section hub.

[Case B D07 assignment](#) · [Official PLTW section hub](#)

## Sources and optional background

Everything needed is in the reading, records, model and task prompts. Opening these sources is optional background, not another assignment.

- [S1. FBI Handbook of Forensic Services](#)  
limits of hair comparison.
- [S2. NIST: follicular tag](#)  
attached follicular tissue.
- [S3. NIJ-supported research on rootless hair DNA](#)  
why appearance alone cannot decide DNA-test usefulness.
- [S4. Department of Justice: latent print testimony and reporting](#)  
limits on source conclusions.
- [S5. NIJ Fingerprint Sourcebook](#)  
fingerprint comparison background. The 12-match rule above is a teaching model.

These supplied records cannot establish a hair source without known-reference features, or prove who touched an object, when or why. The 12-match rule is a classroom model, not a real forensic identification standard. No DNA result is supplied.