ChemMatters®
Demystifying Everyday Chemistry

Teacher's Guide

Illegal Logging

April 2026

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Name: _____

Anticipation Guide

Directions: ***Before reading the article*****,** in the first column, write "A" or "D," indicating your **A**greement or **D**isagreement with each statement. Complete the activity in the box.

As you read, compare your opinions with information from the article. In the space under each statement, cite information from the article that supports or refutes your original ideas.

Me	Text	Statement
		1. Illegal logging is extremely profitable.
		2. There are at least 70,000 tree species worldwide.
		3. Cellulose and lignin polymers are different for each tree species.
		4. The DART-MS mass spectrometer can be used outside the lab.
		5. Prior to using the DART-MS, a chemical sample must be separated into its components.
		6. All species of rosewood are endangered.
		7. The harvesting location can be determined by analyzing isotopes of Oxygen-16 and Oxygen-18 in the wood sample.
		8. Illegal logging can disrupt entire ecosystems.
		9. Illegal logging contributes to climate change.
		10. Wood forensics is interdisciplinary, involving scientists from many different disciplines.

Student Reading Comprehension Questions

Name: _____

Directions: Use the article to answer the questions below.

1. What is illegal logging?
2. Why is illegal logging considered a major environmental crime?
3. What is wood forensics?
4. What two main questions do forensic scientists try to answer about wood samples?
5. Why is it difficult to identify processed wood visually?
6. What are metabolites?
7. What is metabolomics?
8. How can metabolomics help identify wood species?
9. What analytical technique is commonly used in wood forensics?
10. What does a mass spectrum show?
11. What is DART-MS?
12. Why is illegal logging harmful to ecosystems?
13. What example species discussed in the article illustrates ecosystem impact?
14. How can stable isotope analysis help identify where a tree grew?
15. Why is wood forensics considered interdisciplinary science?

Graphic Organizer

Name: _____

Directions: As you read, complete the graphic organizer below to describe two important tools used by forensic scientists.

	Dart-MS	Metabolomics
What is it? **How does it work?**		
What does it identify?		
What are some limitations?		
How has it been used to catch illegal loggers? Give examples from the article. Include why the wood in your example is valuable.		

Summary: On the back of this paper, describe three challenges faced by scientists who study wood forensics.

Answers to Reading Comprehension Questions & Graphic Organizer Rubric

1. What is illegal logging?
   Illegal logging occurs when trees are harvested, transported, or sold in violation of laws protecting forests or regulating timber trade.

2. Why is illegal logging considered a major environmental crime?
   The illegal timber trade generates billions of dollars each year and contributes to deforestation, habitat destruction, and organized crime.

3. What is wood forensics?
   Wood forensics is the scientific study used to identify wood species and sometimes determine where the tree grew.

4. What two main questions do forensic scientists try to answer about wood samples?
   They determine what species the wood is and where the tree grew.

5. Why is it difficult to identify processed wood visually?
   Once trees are cut and processed, features such as leaves, bark, and growth patterns are removed.

6. What are metabolites?
   Metabolites are small molecules produced by living organisms as part of their normal metabolism.

7. What is metabolomics?
   Metabolomics is the study of the complete set of metabolites produced by an organism.

8. How can metabolomics help identify wood species?
   Different species produce different mixtures of metabolites, creating chemical fingerprints that can identify the tree species.

9. What analytical technique is commonly used in wood forensics?
   Mass spectrometry is used to measure molecular masses and detect chemical fingerprints.

10. What does a mass spectrum show?
    A mass spectrum is a graph of peaks representing molecules with specific masses detected during analysis.

11. What is DART-MS?
    Direct Analysis in Real Time Mass Spectrometry is a method that allows scientists to analyze samples quickly with minimal preparation.

12. Why is illegal logging harmful to ecosystems?
    Removing key tree species disrupts food webs and can cause population declines in animals that depend on those trees.

13. What example species discussed in the article illustrates ecosystem impact?
    Mongolian oak trees support Siberian boars, which are prey for endangered Amur tigers.

14. How can stable isotope analysis help identify where a tree grew?
    Isotope ratios vary by geography and climate, allowing scientists to trace wood to specific regions.

15. Why is wood forensics considered interdisciplinary science?
    It combines chemistry, biology, genetics, statistics, and environmental science.

Graphic Organizer Rubric

If you use the Graphic Organizer to evaluate student performance, you may want to develop a grading rubric such as the one below.

Score	Description	Evidence
4	Excellent	Complete; details provided; demonstrates deep understanding.
3	Good	Complete; few details provided; demonstrates some understanding.
2	Fair	Incomplete; few details provided; some misconceptions evident.
1	Poor	Very incomplete; no details provided; many misconceptions evident.
0	Not acceptable	So incomplete that no judgment can be made about student understanding

Additional Resources and Teaching Strategies

Classroom Activities

Wood Identification Resources – U.S. Forest Service

Explains how scientists identify tree species using wood structure and chemistry.

https://research.fs.usda.gov/fpl/identification

The Wood Database – Wood Identification Guide

A student-friendly guide explaining how wood species are identified using grain patterns and structure.

https://www.wood-database.com/wood-articles/wood-identification-guide/

Videos

Mass Spectrometry Explained (Introductory Chemistry Video)

Animation explaining how molecules are ionized and separated by mass-to-charge ratio.

https://www.youtube.com/watch?v=myolF-h1kKI

How Technology Tracks Illegal Logging – Global Forest Watch

Shows how scientists monitor forests and detect illegal logging using satellite data.

https://www.youtube.com/watch?v=fjp0Ikw3gNQ

Interactive Data

Global Forest Watch Map (Real Deforestation Data)

Students can explore satellite data showing forest loss around the world.

https://www.globalforestwatch.org/map

Teaching Strategies

Consider the following tips and strategies for incorporating this article into your classroom:

- **Alternative to Anticipation Guide:** Before reading, ask students how they might use chemistry to find wood that was logged illegally. Ask why it is important to find illegal logging activities. Their initial ideas can be collected electronically via digital whiteboards or similar technology. As they read, students can find information to confirm or refute their original ideas.
- After students have read and discussed the article, ask students what they learned about how chemistry is important in wood forensics.

Chemistry Concepts and Standards

Connections to Chemistry Concepts

The following chemistry concepts are highlighted in this article:

- Molecular structure
- Forensics
- Instrumentation

Correlations to Next Generation Science Standards

This article relates to the following performance expectations and dimensions of the NGSS:

HS-LS2-2. Use mathematical representations to support and revise explanations based on evidence about factors affecting biodiversity and populations in ecosystems of different scales.

HS-ETS1-3. Evaluate a solution to a complex real-world problem based on prioritized criteria and tradeoffs that account for a range of constraints, including cost, safety, reliability, and aesthetics, as well as possible social, cultural, and environmental impacts.

Disciplinary Core Ideas:

- LS2.A: Interdependent relations in ecosystems
- ETS1.B: Developing possible solutions

Crosscutting Concepts:

- Patterns
- Cause and effect
- Systems and system models

Science and Engineering Practices:

- Asking questions and defining problems
- Planning and carrying out investigations
- Analyzing and interpreting data

Nature of Science:

- Scientific knowledge is based on empirical evidence.

See how *ChemMatters* correlates to the **Common Core State Standards** online.