

## CURRICULUM GUIDE: THE SCIENCE IN DISCOVERY



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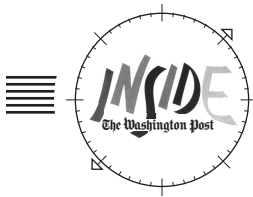
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## Iceman

*KidsPost Article: "Frozen in Time: Uncovering the 5,300-Year-Old Mysteries of the European Iceman"*

**Lesson:** An introduction to the scientific method

**Level:** Advanced

**Subjects:** Science, History

**Related Activity:** Reading

**Procedure**

**Assess Knowledge**

Conduct a pre-reading activity or skip to Discuss section. Ask students to prepare an "anticipation guide." This type of activity can improve students' comprehension and retention, especially those of very young students or lower skilled students.

**Knows:** Before reading, assess what the reader knows about the topic.

**Wants:** Before reading, determine what the reader wants to know about the topic.

**Learned:** After reading, express what the reader has learned about the topic.

**Application of KWL – Step One.**

**K:** Students list two or three things they know about Iceman from prior experience. Allow time for students to read the headline and to study the illustration. List two or three pieces of information they know about Iceman before reading the article.

**W:** Students write two to four questions they hope will be answered in the article about Iceman.

**L:** Students read the article, then record two to four interesting facts they learned about Iceman.

**Application of KWL – Step Two:** Evaluate what they gained through reading the article.

**K:** What information under K in Step One was confirmed in the article?

**W:** Which of the questions in Step One were answered in the article?

**L:** Students share one new piece of information they learned about Iceman. What new questions does each have?

## Iceman Resources

*On the Web and in Print*

### ON THE WEB

<http://dsc.discovery.com/stories/history/iceman/iceman.html>

**Iceman: Mummy From the Stone Age**

Definitely take the online trip into Otzi's world. Color photographs and Real Video available.

<http://www.pbs.org/wgbh/nova/icemummies/iceman.html>

**The Iceman's Last Meal**

Review this and other material provided for the November 1998 NOVA special "Ice Mummies." Educator video available: "Ice Mummies: Return of the Iceman."

<http://www.washingtonpost.com/wp-dyn/articles/A50879-2001Jul25.html>

Case Closed on the 'Iceman' Mystery. Keith Richburg reports on the July 2001 discovery of an arrowhead embedded in Otzi. Using computerized tomography, scientists ended speculation on how the Iceman died.

<http://www.digonsite.com/>

**Dig: The Archaeology Magazine for Kids**

A lively introduction to archaeology through articles, fantastic factoids, ask Dr. Dig and quizzes.

<http://museums.ncl.ac.uk/flint/menu.html>

**Flints and Stones: Real Life in Prehistory**

You are taken on an exhibit of the world of the late stone age hunter gatherers. This site was produced by The Museum of Antiquities of the University and Society of Antiquaries of Newcastle upon Tyne, UK.

<http://americanhistory.si.edu/hohr/springer/>

**You Be the Historian**

Students begin with the question, "In 2050, if historians visited your house...?" Suggestions are provided for teachers using this activity.

### IN PRINT

MacCauley, David. Motel of Mysteries. What an archaeologist in 3000 AD might learn from a 20th Century motel.



REUTERS

Scientists unpack the frozen remains of Iceman at a museum in Italy in 1998. He is housed inside a special refrigerator and kept at below freezing, viewable through a small window. Nicknamed "Oetzi," for the Oetz valley where he was found by tourists atop a glacier in 1991, scientists believe he is more than 5,000 years old.



FILE PHOTO—THE WASHINGTON POST

### Extension of KWL.

All unanswered questions and new questions could be compiled. Delete the ones that are duplicates or are not pertinent to the Iceman story. Assign selected unanswered questions as research topics for individuals or for groups.

### Discuss

The following questions are to be answered after reading "Frozen in Time."

1. Where and by whom was Otzi found?
2. Whom did the hikers think they had found?
3. You are a hiker who has found skeletal remains and a few items that had been frozen in a glacier. You carefully mark the spot so you can return to it with authorities. How do you mark the location? What are some of the questions racing through your mind as you descend to the nearest town?
4. How do scientists know the Iceman lived 5,300 years ago?
5. List six items found with the body. What do these items reveal about the Iceman? (If you can't think of six items, read the article again or look at the illustration.)
6. Why is Otzi back in the news ten years after his discovery?
7. What do scientists now believe is the cause of the Iceman's death?

"Frozen in Time" can be found at  
<http://www.washingtonpost.com/wp-dyn/education/kidspost/archive/A6987-2001Sep1>

### Examine the Scientific Method

Hikers found prehistoric remains entombed in a glacier in 1991. During the next ten years, scientists speculated about the mummy, forming hypotheses and using the latest technology to learn more about the brown leathery corpse. Give students the "Basics of the Scientific Method" reproducible. Discuss the steps of and reasons for having a scientific method. After students have completed the activity, divide them into groups to share the examples they have found. Ask them to classify their examples into three groups: hypotheses that were supported, hypotheses that were modified, and hypotheses that were rejected.



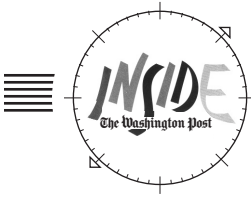


ILLUSTRATION BY JOHNSTON QUINAN—  
THE WASHINGTON POST

This drawing shows how Iceman, wearing a deerskin tunic, or coat, might have appeared when he was alive.

### Enrichment

#### 1. Careers in Science and Technology:

What scientists were involved in studying Iceman?

Research what scientists who study ancient civilizations do. How do they differ from one another? In what way did each type of scientist contribute to a more accurate understanding of Iceman?

- Archaeologist
- Conservationist
- Forensic scientist
- Isotope chemist
- Paleontologist
- Pathologist
- Radiologist

#### 2. Technology and Science:

According to glaciologists, dust was blown from North Africa into the Alps during a great storm in 1991. The dust darkened the snow cover, causing it to absorb more solar heat, resulting in more than usual amounts of snow to melt. This could be an answer to why the corpse was revealed after so many years. In what ways have advances in technology assisted scientists in understanding Iceman and his discovery?

#### 3. Cause and Effect:

Ask students to write a paragraph or create a visual (for example, a poster or an illustrated flow chart) to demonstrate the potential effect of what at first might have appeared to be an event with little or no immediate significance to the local community or the scientific community. Consider that the hikers who found the body initially thought, as did the police department, that it was the body of a modern person who might have died from exposure or had been murdered.



FILE PHOTO—THE WASHINGTON POST

This photo shows the shoulders of 5,300-year-old Iceman, the Bronze Age hunter whose frozen body was discovered a decade ago in the Alps. Scientists said they solved the mystery of what killed the Iceman: He was shot by an arrow, which was found under the iceman's left shoulder.

NAME \_\_\_\_\_

## A Snapshot of You

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"It's like a snapshot of a man in real life," one scientist said of the items found with Iceman.

The items that we own reflect how we live our lives and who we are. What tools did the Iceman appear to own? Why are scientists confident that Otzi was a hunter?

You are a student. What items classify you as a student? Pencils, a backpack and notebook? In our society, most students are assigned textbooks to read and lockers to store them. What do you keep in your locker at school that most other students also have in their lockers? What items make your locker special?

Prepare a Snapshot Box of yourself.

### STEP ONE

In a shoe box or other small box place items that represent you. They will let people know about you. They are a physical "snapshot in real life" of who you are. Listen as your teacher gives you special instructions about the box and the day it is due.

Inside of the box you will place three types of items:

Type 1. Two to three small items that reveal your interests, hobbies or special events. These can be the actual items or pictures of items too large to fit in the box.

Type 2. Items that reveal something

about your life in the D.C. metropolitan area and what interests you. Put these on one sheet of paper.

- a. List three items found in your bedroom that an archaeologist might unearth 200 years from now. Be descriptive so we can picture them.
- b. List your three favorite foods.
- c. List your favorite beverages.
- d. Draw a picture of an item of clothing or accessory that best reflects who you are.
- e. Write a paragraph about your favorite place to be in the D.C. metropolitan area. Tell us why you like to be there.

Fold the paper in half. Don't write your name on the paper.

Type 3. Inside an envelope put a picture that includes you. This picture can be a baby picture, a recent school picture, a family or group picture.

Give your teacher the Snapshot Box you have prepared. Your teacher will give each student another student's Snapshot Box.

### STEP TWO

Think like an archaeologist. You have just dug up this small box. Open it carefully. Just as scientists looked at items found near Otzi, you are to examine these items to determine something about the person who prepared this Snapshot Box.

1. You are not allowed to open the envelope.

2. Examine each item carefully. What do the two or three items reveal about the individual? Write a paragraph in which you speculate about the interests and hobbies of the person and activities in which the person may have been involved.

3. Unfold the sheet of paper. Do you learn something more about this person and his or her society? What do these items tell you about the individual? Do they support your first hypothesis about the person? Do you modify your view of the individual? Write a paragraph in which you tell about the person revealed through the items listed, the picture drawn and the paragraph written. Also include speculation about the society in which the person lived.

4. Share with the class your conclusions about the person and his or her society. Can you guess which classmate prepared the box?

5. After everyone in the class has told about the person and society revealed in a box, you may open the envelope to see if you were correct. Did you guess the right classmate? If the picture is of your classmate when he or she was very young, do you need some additional help? Use your observation skills.

NAME \_\_\_\_\_

## Basics of Scientific Method

In 1991 hikers discovered a body entombed in a glacier. During the next ten years, scientists speculated about the mummy, forming hypotheses and using the latest technology to learn more about the brown leathery corpse. Hypotheses were changed or discarded, and conclusions were corrected based on better evidence. This is how the scientific method works:

### 1. OBSERVE

On that warm September day in 1991, authorities did not think the corpse that the hikers had discovered was very old. Who did they think he was?

Then scientists observed more carefully the items collected near the corpse. For example, a copper-headed ax was found near the Iceman. Why is this a significant item?

Those who discovered Otzi had observed the awkward position of his left arm. It was draped across the front of his neck. Write a question about this observation.

### 2. FORM A HYPOTHESIS

Scientists began to form hypotheses or working assumptions about this man. State one hypothesis that might be true based upon items found near the corpse.

### 3. PERFORM TESTS

Next scientists performed tests on the corpse and items. What is carbon-14? Why has carbon-14 been important in dating animals and people?

### 4. COLLECT DATA FROM OBSERVATIONS AND TESTS. COMPARE DATA TO HYPOTHESIS. INFER WHAT MIGHT BE TRUE.

Scientists made conclusions based upon those tests. What did the scientists conclude based upon observations and tests? Select three items and fill in the chart.

Item	Observation and/or Test	Conclusion
1.		
2.		
3.		

### 5. BE PREPARED FOR BETTER EVIDENCE AND MORE ACCURATE TESTS

Technology improved. Scientists ran more tests using computerized tomography, a new kind of x-ray, and made a discovery. What did scientists discover in Italy in July 2001?

NAME \_\_\_\_\_

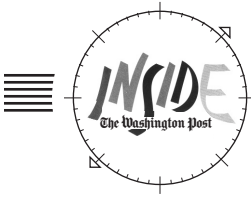
# Lost and Found in a Glacier

Two hikers found Otzi and items near him in the snow. Can you find the following items? Find and circle the items listed. Words run left to right, right to left, top to bottom, bottom to top and diagonally.

- Ax
- Canister
- Dagger
- Ice
- Quiver
- Tunic
- Backpack
- Cape
- Deerskin
- Needle
- Rope
- Yew
- Bow
- Copper
- Flint
- Pouch
- Thongs

N	S	B	T	W	E	P	O	R	S	S
I	N	A	T	N	N	L	F	Y	U	N
K	T	C	A	N	I	S	T	E	R	O
S	U	K	X	E	N	L	W	W	X	W
R	N	P	P	W	D	S	N	O	W	Q
E	I	A	S	F	O	A	S	N	O	U
E	C	C	T	H	O	N	G	S	N	I
D	B	K	S	B	O	W	S	G	S	V
P	O	U	C	H	I	R	O	F	E	E
O	S	N	O	W	C	O	P	P	E	R
N	S	N	O	N	E	E	D	L	E	S





## Word Study: A look at mummy

When the hikers discovered Otzi, they found more than a corpse. They found a mummy.

Usually you would think of a mummy being a dead body that had been embalmed and prepared for burial by ancient Egyptians. This didn't happen to Otzi. He lived long before the first pyramids were built.

Otzi was mummified by nature. The snow and ice that covered him also preserved him. Iceman was freeze-dried so well his pores and eyeballs can be seen.

Mummies are mummies because their bodies did not decompose or rot. A body can mummify by embalming or drying. Natural elements cause the body to shrivel and dry up. Very well preserved mummies have been found in the peat bogs of northern Europe.

A mummy can be produced in a very hot climate. Sylvester, the desert mummy, is exhibited in Seattle. He is an example of natural dehydration preventing decomposition.

"Mummy" is derived from the Arabic mumiya which means body preserved by wax. We get our spelling from Middle English, mummie, the word for medicinal material from embalmed corpses.

Remember, the Iceman is no ordinary corpse.

Definitions are from The American Heritage Dictionary

### MORE MUMMIES

<http://www.akhet.co.uk/clikmumm.htm>

Akhet Egyptology

A clickable mummy reveals the mummification process.

<http://www.nationalgeographic.com/tv/mummy/>

How to Make a Mummy

Learn how to embalm from National Geographic.

<http://www.uke.uni-hamburg.de/institute/imdm/idv/forschung/mumie/index.en.html>

The Virtual Mummy: Unwrapping a Mummy by Mouse Click The Institute of Mathematics and Computer Science in Medicine at the University of Hamburg, Germany, uses the computer to create virtual mummies in order to explain the non-destructive examination of mummies. Quick Time will allow you to unwrap the mummy's head. It will help you to explain to students how scientists discovered the arrowhead that killed Otzi.

<http://www.cmi.k12.il.us/Urbana/projects/cyber-mummy/mummyhome.html>

Cyber Mummy

The University of Illinois in Urbana uses a supercomputer, medical imagery and an archeologist to examine a mummy in their World Heritage Museum.

<http://www.umich.edu/~kelseydb/Exhibits/Karanis83/KaranisExcavation/temple2.html>

The Temples and the Gods

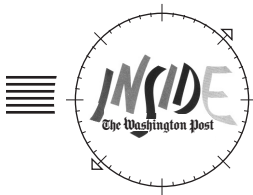
The Kelsey Museum, University of Michigan, online exhibit reveals that crocodiles were mummies too.

<http://www.roadsideamerica.com/attract/WVPHImum.html>

Mummies of the Insane

A less academic site that tells the tale of two West Virginians that were mummified. Just another of America's roadside attractions.





## Academic Content Standards

*This lesson addresses academic content standards of Maryland, Virginia and the District of Columbia. Among those that apply are:*

**The main lesson addresses these academic content standards of:**

### Maryland

#### Science

Skills and Processes (1.0): Students will demonstrate the thinking and acting inherent in the practice of science. Scientific Inquiry, 1.5.1: By the end of grade 5, students know and are able to access and process information from readings, investigations, and/or oral communications. 1.5.2: ask questions that can be answered through a scientific investigation. 1.5.3: use observations and select appropriate scientific information to form predictions and hypotheses. By the end of grade 8, students know and are able to 1.8.4: recognize/develop well-designed procedures that identify the independent and dependent variables, the need for control when testing a factor, the importance of multiple trials, the selection of appropriate materials/equipment, and the development of clear, logical directions within an investigation. 1.8.9: interpret and communicate findings (i.e., speaking, writing, and drawing) in a form suited to the purpose and audience, using developmentally appropriate methods including technology tools and telecommunications.

#### Social Studies

Social Studies, World History (3.0): 3.2.8.1 In the context of world history through the Middle Ages, and in contemporary world geography, at the end of grade 8, students know and are able to analyze the criteria anthropologists and archeologists use to define civilizations, such as social hierarchy, government, writing systems, and long distance trade.

A complete list of State Content Standards of Maryland can be found at <http://www.mdk12.org/mspp/standards/>.

### Virginia

#### Science

Scientific Investigation, Reasoning, and Logic, Grade 3, Virginia Studies 3.1: The student will plan and conduct investigations in which

- questions are developed to formulate hypotheses;
- predictions and observations are made;
- data are gathered, charted, and graphed;
- objects with similar characteristics are classified into at least two sets and two subsets;
- inferences are made and conclusions are drawn;
- natural events are sequenced chronologically;

#### History/Social Studies

History, Grade 3, Virginia Studies 3.1: The student will explain the term "civilization" and describe the ancient civilizations of Greece and Rome, in terms of geographic features, government, agriculture, architecture, music, art, religion, sports, and roles of men, women, and children. World History to 1000 AD, Grade 8, Virginia Studies 8.1: The student will describe early physical and cultural development of mankind from the Paleolithic Era to the revolution of agriculture, with emphasis on

- the impact of geography on hunter-gatherer societies;
- characteristics of hunter-gatherer societies;
- toolmaking and use of fire;
- technological and social advancements that gave rise to stable communities; and
- how archeological discoveries are changing our knowledge of early peoples.

A complete list of Standards of Learning of Virginia can be found on the Web at <http://www.pen.k12.va.us/>.

### Washington, D.C.

#### Science

Scientific Inquiry, Content Standard 1: Understand and develop abilities to do scientific inquiry by asking questions based on current knowledge, performing investigations and devising logical explanations. By the end of grade 3, the student will state that scientific investigations may take many different forms, including observing what things are like or what is happening somewhere, collecting specimens for analysis, and doing experiments. By the end of grade 5, the student will compare results of scientific investigations with others to know results are seldom exactly the same, but if the differences are large, it is important to try to figure out why; know that scientists' explanations about what happens in the world come partly from what they observe, partly from what they think; evaluate claims, and arguments based on data just as scientists — claims are backed up with evidence that can be confirmed and with a logical argument.

#### History

Chronology and Space in Human History, Content Standard 2: Students understand how economic, political, and social processes interact to shape patterns of human population, interdependence, cooperation, competition, compromise and conflict in controlling the Earth's surface. Grade 6: The student examines human-land adaptation in difficult environments.

A complete list of Standards for Teaching and Learning of the District of Columbia Public Schools can be found at <http://www.k12.dc.us/dcps/>.