

Museum Mystery: Teacher's Guide

Subject: Biology, Entomology

Grade Level: High School (adaptable to any grade level)

Case Summary

The museum is on lockdown! The American Civil War exhibit has been closed for weeks, but the head conservator has discovered a damaged textile. Security cameras have been checked and are clear. What could have caused the damage?

Credits

This case was written by Tiffany Smith (teacher, Cedar Grove High School).

This case was adapted using *Bug Activity* (Smith, Commander, Etre, & Stein, 2013).

Learning Objectives

1. Create a dichotomous key
2. Classify various insects based on external features
3. Define and describe binomial nomenclature
4. Identify characteristics common to all insects
5. Compare and contrast complete and incomplete metamorphosis

K-5th grade Science Georgia Performance Standards

SKL1. Students will sort living organisms and non-living materials into groups by observable physical attributes.

- b. Group animals according to their observable features such as appearance, size, motion, where it lives, etc. (Example: A green frog has four legs and hops. A rabbit also hops.)

SKL2. Students will compare the similarities and differences in groups of organisms.

- a. Explain the similarities and differences in animals. (color, size, appearance, etc.)

S2L1. Students will investigate the life cycles of different living organisms.

- a. Determine the sequence of the life cycle of common animals in your area: a mammal, such as a cat or dog or classroom pet, a bird such as a chicken, an amphibian such as a frog, and an insect such as a butterfly.

S5L1. Students will classify organisms into groups and relate how they determined the groups with how and why scientists use classification.

- a. Demonstrate how animals are sorted into groups (vertebrate and invertebrate) and how vertebrates are sorted into groups (fish, amphibian, reptile, bird, and mammal).

7th grade Science Georgia Performance Standards

S7L1. Students will investigate the diversity of living organisms and how they can be compared scientifically.

- a. Demonstrate the process for the development of a dichotomous key.
- b. Classify organisms based on physical characteristics using a dichotomous key of the six kingdom system (archaebacteria, eubacteria, protists, fungi, plants, and animals).

9-12th grade Science Georgia Performance Standards

SCSh3. Students will identify and investigate problems scientifically.

- a. Suggest reasonable hypotheses for identified problems.
- b. Develop procedures for solving scientific problems.
- c. Collect, organize and record appropriate data.
- d. Evaluate whether conclusions are reasonable by reviewing the process and checking against other available information.

SCSh6. Students will communicate scientific investigations and information clearly.

- e. Participate in group discussions of scientific investigation and current scientific issues.

SEN2. Students will investigate the reasons for insect success.

- a. Investigate the insect body plan and compare and contrast to other arthropods (e.g., Arachnida, Crustacea).
- b. Explain advantages of different insect life cycles (e.g., complete vs. incomplete).
- c. Use morphological characteristics (e.g., wing structure) to recognize major insect orders.
- d. Compare and contrast how insect structure and function are integrated and reflect evolved adaptations to different environments.

SB3. Students will derive the relationship between single-celled and multi-celled organisms and the increasing complexity of systems.

- a. Compare how structures and function vary between the six kingdoms (archaebacteria, eubacteria, protists, fungi, plants, and animals).
- b. Examine the evolutionary basis of modern classification systems.

Additional Materials

Box charts
Internet access
Pictures of textiles and other artifacts with bug damage
Create a Dichotomous Key sheet
Bug cards
Stereomicroscopes
Bug traps
Insect Investigative Report Notes sheet
Group Presentation Rubric

Assessments

- Scene One: Use the facilitator questions to evaluate the box chart
- Scene Two: Create a dichotomous key and correctly identify insects on the bug traps
- Scene Three: Each group will be given an insect to complete an oral report with a visual aid. The report can be no longer than five minutes. The report must include the scientific name of the insect, habitat, favorite food, life cycle (complete or incomplete metamorphosis), adult body structure, and detailed colored picture (PowerPoint, Prizzi, poster, or video).
- Students must narrow the list of insects to likely suspects based on their insect investigations.

Implementation Guide

Scene 1- 20 minutes

- Read scene one
- Brainstorm to fill in the box chart
- Allow students time to identify and research the learning issues using the internet

Scene 2- 40 minutes

- Read scene two
- In groups, use insect cards to create a dichotomous key
- Survey the photos of insect damaged textiles and other artifacts

Scene 3- 40 minutes

- Read scene 3
- Allow students to use a microscope to view bug traps
- Students use the dichotomous key they created to see if they can identify any of the bugs on the traps.

Facilitator Guide

Scene 1

- Where is the Michael C. Carlos Museum?
- What is a conservator?
- What are some examples of textiles?
- What are some ways an artifact could be damaged in a museum?

Scene 2

- Why did the conservator check the relative humidity meter and thermometer?
- Why did the conservator check the lighting on the blanket?
- Why did the conservator check for busted pipes and a leaky roof?
- What is a dichotomous key? What is it used for?

Scene 3

- What is binomial nomenclature?

Resources

Glencoe, *Biology, 2008*. The McGraw-Hill Companies, Inc., Columbus, OH

Hillyer, Lynda and Valerie Blyth, "Beating unwanted guest," *Conservational Journal*, Issue 10, January 1994.

Klein, Denise "Identifying Museum Insect Pest Damage," *Conserve O Gram* Number 3/11 (2008). National Park Service.

Pinniger, D. B. "Controlling Insect Pests: Alternatives To Pesticides," *Conserve O Gram* Number 3/8 (1998). National Park Service.

Pinniger, David "Pest Management in Museums", *Archives and Historical Houses*, Archetype Publications Ltd. London, 2001.

Zycherman, Lynda "A Guide to Museum Pest Control," *Foundation of the American Institute for Conservation of Historic and Artistic Works*, Washington, D.C., 1988.

Museum Mystery: Scene 1

The Museum is on lockdown! The Conservator has discovered a damaged textile.

The conservator was reviewing the installation of Civil War uniforms before the grand opening. Everything was looking good when suddenly she noticed one uniform had small rips and holes. Debris was all over the bottom of the case!

“Security, seal off all exits!” shouts the conservator loudly over the walkie-talkie. “Something has damaged the museum objects!”

“I’ll check the security cameras immediately”, responded the head of security.

“The American exhibit has been relocated and had been closed to the public for several weeks. It’s been under lock and key the entire time. How could this have happened?” thought the conservator.

“Security cameras show no persons entering or leaving the exhibit area”, reports security.

The culprit must still be inside!

Museum Mystery Box Chart

Big Idea: What is the topic all about? What must I know and be able to communicate to others? What are the key concepts I need to know, understand, and apply?



Essential Question: What questions do I need to answer to help me understand the big idea and make connections to the real world? What questions will get me thinking about the key concepts and big idea of the lesson? How can I use my prior knowledge to answer questions?

Problem: What is the question you need to answer? What is the problem you want to solve? What are you trying to find out?



Hypothesis: What is your prediction about the problem? What do you think is going to happen?



Museum Mystery: Scene 2

The conservator knows that high humidity and light could cause damage to the uniform.

The conservator quickly checks the relative humidity meter and thermometers in the exhibit hall. They are at optimum levels. Next she checks the lighting on the uniform, it too seems to be in order. She sees no signs of a leaky roof or busted pipes. She knows that one more agent of deterioration could cause this damage.

She knows it is time to break out her dichotomous key!

Links to pictures of bug damaged textiles and artifacts.

http://www.carlisle.army.mil/ahec/VEC/Images/Conservation_5.jpg

<http://members.tripod.com/~papyri/artifacts/cartonnage1-back-lg-enh.jpg>

<http://alaskawhitestuffid.files.wordpress.com/2011/08/frass-shook-out-from-insect-damaged-wood.jpg>

http://www.virginiamemory.com/blogs/out_of_the_box/wp-content/uploads/2011/03/BugAccomack_IT.jpg

Create a Dichotomous Key

Scientists group organisms based on their characteristics. These groups are the basis for classification tools called dichotomous keys. They consist of a series of choices that lead the user to the correct identification of an organism.

1. Each group will be given a set of insect cards.
2. To begin your key, write a question that will divide the insects into two distinct groups based on a single characteristic.
3. Focusing on ONE of your two groups, write another question for a different characteristic so you end up with two smaller groups.
4. Continue dividing the insects into subgroups and adding questions to your key until there is only one insect in each group

Dichotomous Key Rubric

Item	Points
Statements are paired	15 points
Statements are opposite	15 points
Statements incorporate scientific vocabulary	10 points
Key can be used by classmates to identify an insect	50 points
Key is neat and legible	10 points

Georgia Department of Education Kathy Cox, State Superintendent of Schools SCIENCE_GRADE 7_ARTHROPOD
DICHOTOMOUS KEY JULY 2008_Copyright 2008 © All Rights Reserved

Museum Mystery: Scene 3

It was time to identify the suspect's binomial nomenclature. The conservator reached down behind the uniform display and retrieved the bug trap. She took the trap to the lab to get a closer look.

Insect Investigation

Each group will report on one insect to the class. Each member of the group must report (speak) on at least one of the following 4 items.

Scientific name of the insect

- Life cycle
- Habitat (what time of year are they most active)
- Favorite food (larvae and adult)
- Adult body structures (detailed description & picture)

Choose from one of the following suspects; Powder Post Beetle, Black Carpet Beetle, Silverfish, Firebrat, American Cockroach, Mold Beetle, Booklice, or Varied Carpet Beetle.

Visual presentation must include all of the above information and can be a PowerPoint, a Prizzi, a video, or a poster. An additional option is to make a model of the insect's lifecycle.

Insect Investigative Report Notes

American Cockroach
Black Carpet Beetle
Booklice
Firebrat
Mold Beetle
Powder Post Beetle
Silverfish
Varied Carpet Beetle

Group Presentation Rubric

CATEGORY	4	3	2	1
	EXCELLENT	GOOD	FAIR	POOR
Content	Shows a full understanding of the topic	Shows a good understanding of the topic	Shows a good understanding of parts of the topic	Does not seem to understand the topic very well
Posture & Eye Contact	Stands up straight, looks relaxed and confident. Establishes eye contact with everyone in the room	Stands up straight and establishes eye contact with everyone in the room	Sometimes stands up straight and establishes eye contact	Slouches and/or does not look at people during the presentation
Collaboration with Peers	Almost always listens to, shares with, and supports the efforts of others in the group	Usually listens to, shares with, and supports the efforts of others in the group	Often listens to, shares with, and supports the efforts of others in the group	Rarely listens to, shares with, and supports the efforts of others in the group
Volume	Volume is loud enough to be heard by all throughout the presentation	Volume is loud enough to be heard by all at least 90% of the time	Volume is loud enough to be heard by all at least 80% of the time	Volume is often too soft to be heard by all
Stays on Topic	Stays on topic 100% of the time	Stays on topic most (99-90%) of the time	Stays on topic some (89-75%) of the time	It was hard to tell what the topic was
Visual Aid	Clear, easy to read/understand. Accurate. Visual enhanced presentation and understanding. Visual in color.	Mostly clear and accurate. Visual somewhat enhanced presentation, but clearer choices could have been made. Visual in color	Not particularly easy to read or understand. Little thought was put into choice of visual. "Last minute attempt"	Added little to presentation or to the understanding of the topic
Time	Presentation met time requirement (between 5-10 minutes)		Presentation was too long or too short	