Crime Solving Insects

Forensic Entomology

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Grade Level	9th – 12th Grade	**Time Frame**	205
Subject	Science	**Duration**	4-5 periods
Course	Forensics		

Essential Question

How do insects aid in forensic investigations?

Summary

In this lesson, students explore the field of forensic entomology by engaging in hands-on, reflective activities. After reviewing the life cycle of flies, students will act as forensic investigators and work through authentic case studies. Students will have a deeper understanding of forensic entomology, its processes, and its real-world applications in solving crimes.

Snapshot

Engage

Students review and activate prior knowledge about forensic entomology using an ABC Graffiti poster.

Explore

Students recall the life cycle of flies with a Card Sort.

Explain

Students review key concepts, complete guided notes, and apply newly learned skills to solve a model case study.

Extend

Students solve forensic case studies by collecting, analyzing, and interpreting data and evidence.

Extend 2 (Optional)

Students watch an additional ICAP video highlighting another career path related to forensic entomology.

Evaluate

Students synthesize information learned and complete a reflection activity.

Standards

ACT College and Career Readiness Standards - Science (6-12)

IOD404: Perform a simple interpolation or simple extrapolation using data in a table or graph
IOD505: Analyze presented information when given new, simple information
IOD702: Analyze presented information when given new, complex information

Georgia Standards of Excellence: Forensic Science (Forensic Science)

SFS1: Obtain, evaluate, and communicate information to properly conduct a forensic investigation of a crime scene.
SFS1.d: Develop models to analyze and communicate information obtained from the crime scene.
SFS5: Obtain, evaluate, and communicate information to Medicolegal Death Investigations.
SFS5.b: Construct an argument based on evidence that pertains to the manner of death (natural, homicide, suicide, accidental, or undetermined).
SFS5.c: Use mathematics and computational thinking to explain post mortem changes used to determine post mortem interval (PMI):

- Rigor mortis
- Livor mortis
- Algor mortis
- Gastric contents

SFS5.d: Analyze and interpret entomological data to evaluate the role insects play in decomposition and determining PMI.

Attachments

- ABC Graffiti—Crime Solving Insects - Spanish.docx
- ABC Graffiti—Crime Solving Insects - Spanish.pdf
- ABC Graffiti—Crime Solving Insects.docx
- ABC Graffiti—Crime Solving Insects.pdf
- Case Cards—Crime Solving Insects - Spanish.docx
- Case Cards—Crime Solving Insects - Spanish.pdf
- Case Cards—Crime Solving Insects.docx
- Case Cards—Crime Solving Insects.pdf
- Case Resources—Crime Solving Insects - Spanish.docx
- Case Resources—Crime Solving Insects - Spanish.pdf
- Case Resources—Crime Solving Insects.docx
- Case Resources—Crime Solving Insects.pdf
- Designing the Case Folders—Crime Solving Insects.docx
- Designing the Case Folders—Crime Solving Insects.pdf
- Detective Notes—Crime Solving Insects - Spanish.docx
- Detective Notes—Crime Solving Insects - Spanish.pdf
- Detective Notes—Crime Solving Insects.docx
- Detective Notes—Crime Solving Insects.pdf
- Guided Notes—Crime Solving Insects - Spanish.docx
- Guided Notes—Crime Solving Insects - Spanish.pdf
- Guided Notes—Crime Solving Insects.docx
- Guided Notes—Crime Solving Insects.pdf
- Lesson Slides—Crime Solving Insects.pptx
- Life Cycle Cards—Crime Solving Insects - Spanish.docx
- Life Cycle Cards—Crime Solving Insects - Spanish.pdf
- Life Cycle Cards—Crime Solving Insects.docx
- Life Cycle Cards—Crime Solving Insects.pdf
- Life Cycle Map—Crime Solving Insects - Spanish.docx
- Life Cycle Map—Crime Solving Insects - Spanish.pdf

- Life Cycle Map—Crime Solving Insects.docx
- Life Cycle Map—Crime Solving Insects.pdf
- Reflect & Discuss—Crime Solving Insects - Spanish.docx
- Reflect & Discuss—Crime Solving Insects - Spanish.pdf
- Reflect & Discuss—Crime Solving Insects.docx
- Reflect & Discuss—Crime Solving Insects.pdf
- Slide Answers—Crime Solving Insects.docx
- Slide Answers—Crime Solving Insects.pdf

Materials

- ABC Graffiti handout (attached; one per group)
- Case Cards (attached; laminate sets for student use)
- Case Resources handout (attached; one set for group; see “Designing the Case Folders”)
- Detective Notes handout (attached; one per student)
- Designing the Case Folders handout (attached; teacher copy)
- Guided Notes handout (attached; one per student)
- Lesson Slides (attached)
- Life Cycle Map handout (attached; one per group; see “Preparing the Lesson”)
- Life Cycle Cards handout (attached; one set per group; see “Preparing the Lesson”)
- Reflect & Discuss handout (attached; one per student)
- Slide Answers (attached; teacher copy)
- Markers (a different color per group)
- Pen/Pencil
- Pipe cleaners (see “Preparing the Lesson”)
- Disposable gloves (optional)
- Ruler (one per group)
- Folders or large manila envelopes

30 minutes

Preparing the Lesson

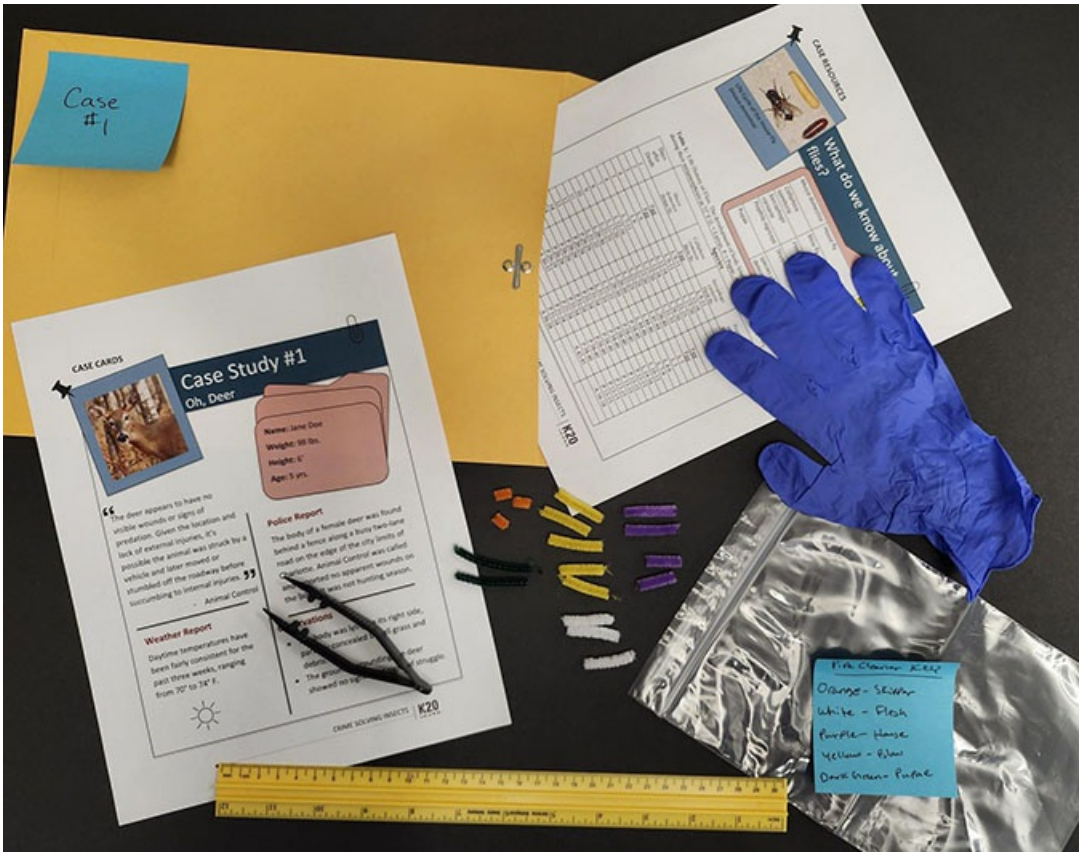
For the Explore

Print **Life Cycle Map** and **Life Cycle Cards** (one per group). Each page has two sets of cards; each group needs only one set.

1. Cut pipe cleaners to 16mm, 25mm, 31mm, and 34mm.
2. Laminate Map and Cards for durability (optional).
3. Store each set of Cards + cut pipe cleaners in a plastic bag per group.

For the Extend

Create the "Case Folders" by using the **Designing the Case Folders** handout as a reference. Make multiple copies of "Case 1," including one for yourself. Next, place one to two copies of each remaining case folder at three different stations around the room so that students can rotate through them.



15 minutes

Engage

Teacher's Note: Graphic Images Disclaimer

This forensic entomology lesson contains graphic images and videos. Teachers should assess student maturity and provide warnings or alternatives if needed.

Use **slides 2-4** to introduce the lesson title and state the objectives and the essential question. **Slide 5** introduces students to the ABC Graffiti strategy. Divide the students into small groups and distribute one marker and one ABC Graffiti poster per station. Use **slide 6** to focus the question and set each of the three one-minute timers for the three rounds. Groups are to fill in as many letters according to the prompt as they can before time is up. Then, they will take their marker and move as a group to the next poster and continue where the last group left off within the time allotted. Reset the timer on slide 6 each time the groups move to a new station.

25 minutes

Explore

Place students into small groups and pass out the **Life Cycle Map** handout, the prepared sets of **Life Cycle Cards** with the cut pipe cleaners, and a ruler to each group.

Explain the Card Sort activity, **slide 7**, students match the cards to the *life cycle stages* of the Blow Fly. Display **slide 8** and have students retrieve the pipe cleaners. Instruct students to measure and place the pipe cleaners (which represent a fly at each stage) on the space for "Size" and start the timer. Remind students that not all spaces will be filled. After the timer goes off, ask for some volunteers to make some guesses as to the size of some of the stages.

Display **slide 9**. Using the sizes and life cycle stages identified in the previous rounds, groups should infer the duration of each fly stage and place the "Round 3" cards in the "Time" space.

Once the timer goes off, pass out the **Guided Notes** handout to every student. Then, transition through **slides 10-13** to review the answers to "Rounds 2 and 3" while students continue filling in the Guided Notes handout. Encourage them to rearrange their maps as needed. When explaining how adult flies lay their eggs on a carcass on **slide 13**, be sure to highlight how these openings are the easiest point of entry, which will be important later for the case studies they attempt.

60 minutes

Explain

Slide 14 explains the role and responsibilities of a forensic entomologist. Students should continue to fill in their Guided Notes handout.

Move to **slide 15** and introduce the I Notice, I Wonder strategy. Explain to students that they should add their reflections while watching the following two video clips to their Guided Notes handout. Transition to **slide 16** and play the "Forensic Entomology" video clip. Next show **slide 17** "How Entomologists Use Insects to Solve Crimes."

Embedded video
https://youtube.com/watch?v=dntO3YANo18

In the video, Chism explains his career, which involves using Dermestid Beetles to clean skulls and carcasses, and describes how he entered this field. After the video, move to **slide 28** and review the educational pathways students can pursue to apply what they are learning about forensic entomology to the career highlighted in the video. Click the links to see program requirements at Oklahoma universities.

Slide 29 reviews insect succession. The table on **slide 30** depicts which insects appear at which stage of the body decomposition. Highlight that Blow Flies are the first to arrive, as this is relevant to the case studies. **Slides 31-32** review other factors that impact a PMI (postmortem index).

Divide students into small groups and distribute "Case 1" folders (see the **Designing the Case Folders** handout). You will model "Case 1" for the class. Give each student a **Detective Notes** handout. Display **slide 33** and allow students time to review the materials. Then, invite students to place everything to the side or center of their group making sure to keep the bag of "evidence" still sealed closed. Next, lead a discussion using the 3-slide questions discussing the model case study. Instruct students to take notes on the Guided Notes handout. Next, have students find their **Case Resources** handout from the folder and advance to **slide 34**. Facilitate a class discussion using the questions:

- Using what we know, what can we learn from the table?
- How does this help us solve the case?

Display **slide 35** and have students read through the **Case Card** for "Case 1." Have the students measure their evidence. Let them work through the questions with their group before asking for volunteers to answer the questions. Facilitate a classroom discussion to clear up any misconceptions. Then move to **slide 36** and go over the answers.

Have students return all materials to their Case Folder and turn them in.

60 minutes

Extend

Place students in small groups and display **slide 37**. Explain that they will be assigned to their first station/case and that they are only to rotate to the next station when instructed to. If needed, unhide **slide 38** and provide more explicit reminders of how to use the Case Resources effectively. Move to **slide 39** and instruct students to use all available resources to solve the cases. Start the 10-minute timer. **Slide 40** introduces the second case, "Oh, Deer." **Slide 41** presents case #3, "Dandy's Death," and **slide 42** presents case #4, "Porky's Peril."

Teacher's Note: Facilitating the Case Studies

Ten minutes is recommended for each case, but you may adjust the timing based on your class's needs.

Students' pipe cleaner measurements will vary, reflecting differences in insect ages. Lead a brief class discussion to explore what may have caused these discrepancies.

When all groups have solved each of the remaining cases, transition through **slides 43-45** to review the answers. For Case 3, consider temperature (84–86°F) and oleandrin when assessing Blow Fly development. Only temperature affects House and Flesh Flies.

10 minutes

Extend 2 (Optional)

For students who are interested in careers in forensic science, particularly those involving skulls and bones, unhide **slide 46** and show the ICAP video "Crime Solving Insects with Ashley Meerschaert."

Embedded video
https://youtube.com/watch?v=MyJAvzPElW4

15 minutes

Evaluate

Go to **slide 47** and distribute the **Reflect and Discuss** handout. Students will answer questions individually, then share with an Elbow Partner, taking notes. After sharing, they can update responses if any changes have occurred. Invite volunteers to share reflections.

Optional Activity: Forensic Activities

Consider having students apply their forensic entomology knowledge and skills within a forensic case context. By stepping into the role of a forensic scientist, students can examine evidence, make comparisons, and draw conclusions using authentic investigative techniques. Of Maggots and Murder - Forensic Entomology Laboratory Kit and the Beginning Entomology Kit include cases and equipment that support this type of analysis and that reinforce a range of core skills essential to forensic science.

Resources

- fearlessaggie. (2008, September 26). *Forensic entomology*. YouTube. https://www.youtube.com/watch?v=dntO3YANo18
- Flinn Scientific. (n.d.). Beginning entomology and animal behavior laboratory kit for biology and life science. https://www.flinnsci.com/beginning-entomology-kit/fb1579/
- K20 Center. (2021). 2-minute timer. YouTube. [video]. https://www.youtube.com/watch?v=HcEEAnwOt2c
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- Tynan, P. (2020). Effects of body size on the rate of decomposition in the UK: Measuring total body score and percentage mass change in Sus scrofa. [pig image]. Research Gate. https://doi.org/10.13140/RG.2.2.31227.54561
- Wired. (2022, Oct. 21). *How entomologists use insects to solve crimes*. YouTube. [video]. https://youtu.be/j8PoWlQkduA?feature=shared