CSI: Wyoming

An interdisciplinary forensic science unit developed by the UW Science Posse.

Question: Who did it?

From the Bullet to the Bear (and Tree!)

Developed by: Sabrina L. Cales 01/13/08 04:02:58 PM

Grade Level: 7-8th **Estimated Time: 1-2 hours**

Topics Covered: Physics, Ballistics

Standards and Benchmarks:

1. CONCEPTS AND PROCESSES

In the context of unifying concepts and processes, students develop an understanding of scientific content through inquiry. Science is a dynamic process; concepts and content are best learned through inquiry and investigation.

EARTH, SPACE, AND PHYSICAL SYSTEMS

10. The Structure and Properties of Matter: Students identify characteristic properties of matter such as density, solubility, and boiling point and understand that elements are the basic components of matter.

11. Physical and Chemical Changes in Matter: Students evaluate chemical and physical changes, recognizing that chemical change forms compounds with different properties and that physical change alters the appearance but not the composition of a substance.

12. Forms and Uses of Energy: Students investigate energy as a property of substances in a variety of forms with a range of uses.

13. The Conservation of Matter and Energy: Students identify supporting evidence to explain conservation of matter and energy, indicating that matter or energy cannot be created or destroyed but is transferred from one object to another.

14. Effects of Motions and Forces: Students describe motion of an object by position, direction, and speed, and identify the effects of force and inertia on an object.

2. SCIENCE AS INQUIRY

Students demonstrate knowledge, skills, and habits of mind necessary to safely perform scientific inquiry. Inquiry is the foundation for the development of content, teaching students the use of processes of science that enable them to construct and develop their own knowledge. Inquiry requires appropriate field, classroom, and laboratory experiences with suitable facilities and equipment.

2. Students use inquiry to conduct scientific investigations.

- Ask questions that lead to conducting an investigation
- Collect, organize, and analyze and appropriately represent data.
- Draw conclusions based on evidence and make connections to applied scientific concepts.
- Clearly and accurately communicate the result of the investigation.

3. Students clearly and accurately communicate the result of their own work, as well as information obtained from other sources.

4. Students recognize the relationship between science and technology in meeting human needs.

5. Students properly use appropriate scientific and safety equipment, recognize hazards and safety symbols, and observe standard safety procedures.

CSI: Wyoming

An interdisciplinary forensic science unit developed by the UW Science Posse.

Question: Who did it?

From the Bullet to the Bear (and Tree!)

3. HISTORY AND NATURE OF SCIENCE IN PERSONAL AND SOCIAL DECISIONS

Students recognize the nature of science, its history, and its connections to personal, social, economic, and political decisions. Historically, scientific events have had significant impacts on our cultural heritage.

1. Students explore the nature and history of science.

A. Students explore how scientific knowledge changes and grows over time, and impacts personal and social decisions.

B. Students explore the historical use of scientific information to make personal and social decisions.

2. Students explore how scientific information is used to make decisions.

A. The role of science in solving personal, local, and national problems

B. Interdisciplinary connections of the sciences and connections to other subject areas and careers in science or technical fields

C. Origins and conservation of natural resources, including Wyoming examples.

Objectives (Enduring Ideas):

i) Science is able to match two bullets using the test fire method and comparing the bullets using a comparison microscope.

ii) The physics behind the bullets and weapon power determine lethality, i.e. more powerful ballistics results in a "bigger" kill.

iii) Range from the bear also determines lethality.

Vocabulary:

Ballistics - The science of mechanics that deals with the motion, behavior, and effects of projectiles (bullets, bombs, rockets).

Muzzle - The end of the barrel from which the projectile will exit.

Muzzle Energy - The kinetic energy of a bullet as it is expelled from the muzzle of a firearm.

Caliber - The diameter of the inside of the barrel of a firearm.

Trajectory - Path along which the bullet (projectile) follows.

Force - A measurement of impact equal to the mass of the bullet times the acceleration of the bullet.

Velocity - Speed of the bullet, used in determining the kinetic energy of the bullet.

Kinetic Energy - $1/2mv^2$, a characterization of motion and mass.

Internal Ballistics- The study of the processes originally accelerating the projectile (the passage of the bullet through the barrel of a rifle)

External Ballistics - The study of the passage of the projectile through space or the air.

Terminal Ballistics - The study of the interaction of a projectile with its target.

CSI: Wyoming

An interdisciplinary forensic science unit developed by the UW Science Posse.

Question: Who did it?

From the Bullet to the Bear (and Tree!)

Forensic Ballistics - The science of analyzing firearm usage in crimes (analysis of bullets and bullet impacts to determine the type).

Cartridge - Or **round** packages the bullet, gunpowder and primer into a single metallic case precisely made to fit the firing chamber of a firearm.

Mechanics - Description and properties of motion of an object.

Ballistic fingerprinting - Sub-category of firearms examination, is a forensic method that is intended to help find the gun that was used in a crime by matching the bullet's striations (or *striae*) with the rifled barrel through which it was fired, or by matching marks on the cartridge case to marks in the chamber and breech. The technique is part of the science of forensic ballistics, and it is an application of toolmark identification.

Materials and Preparation:

1) History Flier/PPT (-In Lesson Plan)
2) Student Handout i, ii and iii (Clue i, ii and iii; In Appendix) and materials
   i) Provided by SP:
      -In Kit: Two bullets with tool marking/striations, one unfired bullet, Scale/Balance, Magnifying glass, Vernier calipers
   ii) Provided by SP:
      -In Lesson Plan: Ballistics Results Page for Remington Ammunition, 2007 Black Bear Hunting Seasons Regulations from Wyoming Game and Fish Commission
      Not Provided by SP: Scientific Calculator, Computer with web browser open to: http://www.ajdesigner.com/phpenergykenetic/kenetic_energy_equation.php
   iii) Provided by SP:
      -In Kit: Bear outline, Trunk piece with bullet hole, Laser pointer, Measuring tape
      -In Appendix: Ballistics Results page for Remington Ammunition, 2007 Black Bear Hunting Seasons Regulations from Wyoming Game and Fish Commission, Scene Reenactment Map
      Not Provided by SP: Scene reenactment (teacher uses provided Scene Reenactment Map to set up), step stool/small ladder, perch for trunk piece with bullet hole

Background Information: (for teacher)

• First See Vocabulary

CSI: Wyoming

An interdisciplinary forensic science unit developed by the UW Science Posse.

Question: Who did it?

From the Bullet to the Bear (and Tree!)

• Historical Content (Provided: History Brochure (or PPT) for Teacher Presentation or Student Study):

In the field of forensic science, forensic ballistics is the science of analyzing firearm usage in crimes. It involves analysis of bullets and bullet impacts to determine the type.

Rifling, which first made an appearance in the 15th century, is the process of making grooves in gun barrels that imparts a spin to the projectile for increased accuracy and range. Bullets fired from rifled weapons acquire a distinct signature of grooves, scratches, and indentations (striations) which are somewhat unique to the weapon used.

The first firearms evidence identification can be traced back to England in 1835 when the unique markings on a bullet taken from a victim were matched with a bullet mold belonging to the suspect. When confronted with the damning evidence, the suspect confessed to the crime.

The first court case involving firearms evidence took place in 1902 when a specific gun was proven to be the murder weapon. The expert in the case, Oliver Wendell Holmes, had read about firearm identification, and had a gunsmith test-fire the alleged murder weapon into a wad of cotton wool. A magnifying glass was used to match the bullet from the victim with the test bullet.

Calvin Goddard, physician and ex-army officer, acquired data from all known gun manufacturers in order to develop a comprehensive database. With his partner, Charles Waite, he catalogued the results of test-firings from every type of handgun made by 12 manufacturers. Waite also invented the comparison microscope. With this instrument, two bullets could be laid adjacent to one another for comparative examination.

In 1925 Goddard wrote an article for the *Army Ordnance* titled "Forensic Ballistics" in which he described the use of the comparison microscope regarding firearms investigations. He is generally credited with the conception of the term "forensic ballistics", though he later admitted it to be an inadequate name for the science.

In 1929 the St. Valentine's Day Massacre led to the opening of the first independent scientific crime detection laboratory in the United States.

The concept of "stopping power" appeared in the late 19th Century when colonial troops (American in the Philippines, British in New Zealand) engaged in close action with native tribesmen found that their pistols were not able to stop charging warriors. This led to larger caliber weapons being developed to stop opponents with a single round.

CSI: Wyoming

An interdisciplinary forensic science unit developed by the UW Science Posse.

Question: Who did it?

From the Bullet to the Bear (and Tree!)

In ballistics, energy is a function of velocity and weight. Generally speaking, bullets which impact a target with greater energy cause greater damage. A bullet with too little energy might not penetrate the target - although in the case of a living target they may suffer blunt force trauma, possibly resulting in internal injury solely through the force of the impact.

External ballistics is frequently associated with firearms, and deals with the behavior of the bullet after it exits the barrel and before it hits the target. When in flight, the main forces acting on the projectile are gravity and air resistance.

Gravity imparts a downward acceleration on the projectile, causing it to drop from the line of sight, and the air resistance decelerates the projectile with a force proportional to the square of the velocity (or cube, or even higher powers of *v*, depending on the speed of the projectile). Over long periods of flight, these forces have a major impact on the path of the projectile, and must be accounted for when predicting where the projectile will travel.

Target shooters must be very aware of the external ballistics of their bullets. When shooting at long ranges, bullet drop can be measured in tens of feet within the accurate range of many rifle cartridges, so knowledge of the flight characteristics of the bullet and the distance to the target are essential for accurate long range shooting.

• The Science Behind Each Enduring Idea (for teacher's knowledge)

i) Ballistic Fingerprinting - Match the caliber (weighing, measuring bullet diameter), metal and striations (using comparison microscope)
ii) Energy and Conservation of Momentum - Bullets which impact a target with greater energy cause greater damage
iii) Geometric Analysis, closer the target the higher the impact energy (since air resistance decelerates the projectile) thus greater chance of lethality

•Guided Questions (For teacher's knowledge)

i) How do we tell if a bullet we found came out of a certain gun? How can we match bullets?
ii) Can you kill a bear with a BB gun? *No*. So what is special about a 44 Magnum? What if I shoot the bear in the rump, will I still kill it?
iii) Does it matter how far away I am when I shoot the bear? Do we shoot from the floor? (the branch from the tree was actually 12ft high but since the average male would shoot from about 6ft we subtract six feet from the reenactment, thus the point on the floor is actually the point that the gun is shot from)

CSI: Wyoming

An interdisciplinary forensic science unit developed by the UW Science Posse.

Question: Who did it?

From the Bullet to the Bear (and Tree!)

5E Procedures:

I. Yellowstone Mystery - (Student should have a copy of the story (attatched) and other lesson plan 3x5 card summaries/synopsis made by students)

II. Engage - Yellowstone Mystery, History Flier, Lab Style worksheets

III. Explore - a) **After Engage and Explain** teacher will have students come up with a list of questions that they want answered with regard to ballistics (This is a discussion in which students should provide examples from the history in order to compile their question); b) Write all proposed questions on board (teacher might provide help to clarify questions), use guided questions to get students to ask the three questions that are going to be explored: i) Is the bullet found in the tree a match with a test bullet fired with the gun recovered from the suspects' house? ii) Is the gun/bullet powerful enough to kill a bear? iii) What is the trajectory of the bullet and is that range lethal?; c) **After Elaborate** have the students come up with how these questions should be explored (number ii. might be hard for students, this might be provided freely by the teacher) and follow using provided Student Handout i, ii and iii (Clue i, ii and iii): i) Match the bullet from the tree with the one that was test fired, ii) Using caliber of the bullet, make the necessary measurements for input into provided program to see weather or not the gun/bullet will kill the bear, iii) Follow the trajectory from the tree trunk/branch back to where a 5 to 6-ft man would fire from using the trunk and map of reenactment (this is the range that the bullet would have to have).

IV. Explain - History Flier

V. Elaborate - History Flier, Student Handouts (Clue i, ii and iii)

VI. Evaluate - (rough rubric) Have the students answer the questions and explain why they think so: i) What is it? (They probably already know this from earlier synopsis), ii) How did it die?, iii) Who committed the crime? Although the bear was shot and the information from this unit leads to the conclusion that the bear was shot, kudos to the students who realize that the bullet has yet to be found in necropsy (also location of bullet and it's lethality and other causes of death need to be determined). Students receive full marks for a conclusion of the bear being shot for the following reasons: i) The bullets match, ii) The bullet/gun is powerful enough to kill the bear, iii) The trajectory provides a range that is close enough to kill the bear (with one shot).

CSI: Wyoming

An interdisciplinary forensic science unit developed by the UW Science Posse.

Question: Who did it?

From the Bullet to the Bear (and Tree!)

VII. Mystery Section Synopsis - Mostly from above. (Have students write their conclusions from this unit as their synopsis on the 3x5 card) (i) The bullets match, ii) The bullet/gun is powerful enough to kill the bear, iii) The trajectory provides a range that is close enough to kill the bear (with one shot?). But, the ending is open since there is still one/two vital pieces of evidence not having been yet considered and that is the fact that we need to know if there really is a bullet found in the bear during necropsy and if so does that mean it killed the bear (blood and bruising not found, location of the bullet).

Step-by-Step:

Before class...

1. Before class make sure each Clue (Student Handouts i, ii and iii) is set up. (The activity from Student Handout iii (Clue iii) will need to be trial ran/set-up at least a couple of days in advance.)
2. Set up Clues i and ii by collecting the materials cited in Student Handouts i and ii (Clue i and ii) and placing them at a lab station.
3. Set up Clue iii using the Scene Reenactment Map and the materials cited in Student Handout iii (Clue iii).

Classtime...

4. Engage - By recapping the Yellowstone mystery with a special emphasis on the ballistics aspect of the crime. You might even ask the students what they think are important ballistic aspects of the mystery and write those down (black board).
5. Explain and Elaborate on the History of Ballistics - Briefly go through/question students about vocabulary (they most likely will have some idea what each term means). Have students study the History of Ballistics Brochure/Go through PPT.
6. Explore and Elaborate - By investigating the physics of ballistics (follow III. Explore of the 5E Procedures).
7. Evaluate - A simple way to see what the students learn is to simply ask them what their conclusion is based on the three Student Handouts (Clues). Then follow VI. Evaluate of the 5E Procedures.
8. Lastly have the students write down their synopsis on a 3x5 card to take with them to their next station. (See VII. Mystery Section Synopsis)

CSI: Wyoming

An interdisciplinary forensic science unit developed by the UW Science Posse.

Question: Who did it?

From the Bullet to the Bear (and Tree!)

References:

Communications with Dan Tyson and Dan Rule (Ballistics experts)
http://gf.state.wy.us/admin/regulations/index.asp
http://www.remington.com/products/ammunition/ballistics/comparative_ballistics_results.aspx?data=R44MG2*R44MG3*RH44MGA
http://www.yellowstone-bearman.com/bears.html
Wikipedia (Forensic Ballistics, Ballistics, Bullet, .44 Magnum, Caliber, External Ballistics, Muzzle Energy, Physics of Ballistics)

Appendix:

Document **Page**

CSI: Wyoming

An interdisciplinary forensic science unit developed by the UW Science Posse.

Question: Who did it?

From the Bullet to the Bear (and Tree!)

Clue i

Problem:

Do the two bullets (one found in the tree and the other test fired from the suspect's gun) match?

Materials/Equipment:

Provided by SP: Two bullets with tool marking/striations, one unfired bullet, scales, magnifying glass, vernier calipers

Background:

Bullets from the same gun will have the same (or close to the same) characteristics; caliber (size), weight, metal, load (powder charge), type (hollow, solid)...

Forensic scientists use ballistic fingerprinting to match a found bullet to a suspect's gun. Each gun's muzzle imparts it's own unique marks on a bullet fired from the gun, a fingerprint, if you will. Thus, any two bullets fired from the same gun will have certain striations (linear corkscrew-like markings) on the bullet. This means that if we fire a test round and recover that bullet, it will match a bullet found at the crime scene if and only if the bullet was fired from the same gun.

Measurements/Activities:

A. Qualitative

Comparatively describe the bullets in terms of size, shape, weight, type, color, tool marking/striation...

Sketch a diagram of the two bullets side by side.

Question: Who did it?

From the Bullet to the Bear (and Tree!)

Clue i (con't)

B. Quantitative

Weigh the bullets and write the results here:

Bullet 1 (Bullet from tree): _____g

Bullet 2 (Bullet test fired from suspect's gun): _____g

Use the vernier calipers to find the diameter of the bullets and write the results here:

Bullet 1 (Bullet from tree): _____"

Bullet 2 (Bullet test fired from suspect's gun): _____"

Analysis and Conclusion(s)/Questions:

From your quantitative and qualitative measurements what do you conclude about the two bullets? Why do you believe this to be the case?

CSI: Wyoming

An interdisciplinary forensic science unit developed by the UW Science Posse.

Question: Who did it?

From the Bullet to the Bear (and Tree!)

Clue ii

Problem:

Is the gun/bullet powerful enough to kill a bear?

Materials/Equipment/Information:

Provided by SP: Ballistics Results Page for Remington Ammunition, 2007 Black Bear Hunting Seasons Regulations from Wyoming Game and Fish Commission

Not Provided: Scientific Calculator, Computer with web browser open to:
http://www.ajdesigner.com/phpenergykenetic/kenetic_energy_equation.php

Background:

Big or trophy game animals may only be taken following certain guidelines (target location on body and impact energy). This is to ensure that the kill is quick and that the animal does not suffer.

Measurements/Activities:

Quantitative

What is the necessary Impact Energy to kill a black bear according to the "2007 Black Bear Hunting Seasons Regulations provided by Wyoming Game and Fish Commission?"_____ft-lbs

Enter the necessary information from the Ballistics Results page for Remington Ammunition into the Kinetic Energy calculator (online) to find the Muzzle Energy of the bullet: _____ft-lbs

CSI: Wyoming

An interdisciplinary forensic science unit developed by the UW Science Posse.

Question: Who did it?

From the Bullet to the Bear (and Tree!)

Clue ii (con't)

The equation for Muzzle Energy is KE = ½ mv^2. Is the Kinetic Energy calculator correct?

How about the Ballistics Results page for Remington Ammunition is their Muzzle Energy the same as your calculation and the Kinetic Energy calculator's?

Analysis and Conclusion(s)/Questions:

Compare your quantitative and qualitative results. Would the Muzzle Energy of the bullet be high enough to kill the bear? What also must be done in order to make sure the shot is lethal?

CSI: Wyoming

An interdisciplinary forensic science unit developed by the UW Science Posse.

Question: Who did it?

From the Bullet to the Bear (and Tree!)

Clue iii

Problem:

What is the trajectory of the bullet and is that range lethal?

Materials/Equipment/Information:

Provided by SP: Scene Reenactment materials (bear outline, trunk with bullet hole, laser pointer, measuring tape), Ballistics Results page for Remington Ammunition, Measuring Tape, 2007 Black Bear Hunting Seasons Regulations provided by Wyoming Game and Fish Commission

Not Provided: step stool/small ladder

Background:

Calculating the trajectories or path of the bullets can help police and detectives determine what happened at the crime scene. Trajectories can be calculated in a number of ways. In its simplest form and in a relatively enclosed space, a straight line can be drawn (using a string or laser beam) along the bullet's projected flight path from the place where the bullet was found to where the gun was fired, providing the position and alignment of the gun.

Measurements/Activities:

Quantitative

Using the scene reenactment, measure the distance between the bears' outline and the point the laser makes on the floor. Write the distance down here: _____ft_____in. What does the point the laser makes on the floor signify?

What is the necessary Impact Energy to kill a black bear according to the "2007 Black Bear Hunting Seasons Regulations provided by Wyoming Game and Fish Commission"_____ft-lbs?

CSI: Wyoming

An interdisciplinary forensic science unit developed by the UW Science Posse.

Question: Who did it?

From the Bullet to the Bear (and Tree!)

Clue iii (con't)

What does the Ballistics Results page for Remington Ammunition say the energy would be at this location?

Analysis and Conclusion(s)/Questions:

At this location from the bear would the shot still be lethal? HINT: Compare the energies...

CSI: Wyoming

An interdisciplinary forensic science unit developed by the UW Science Posse.

Question: Who did it?

From the Bullet to the Bear (and Tree!)

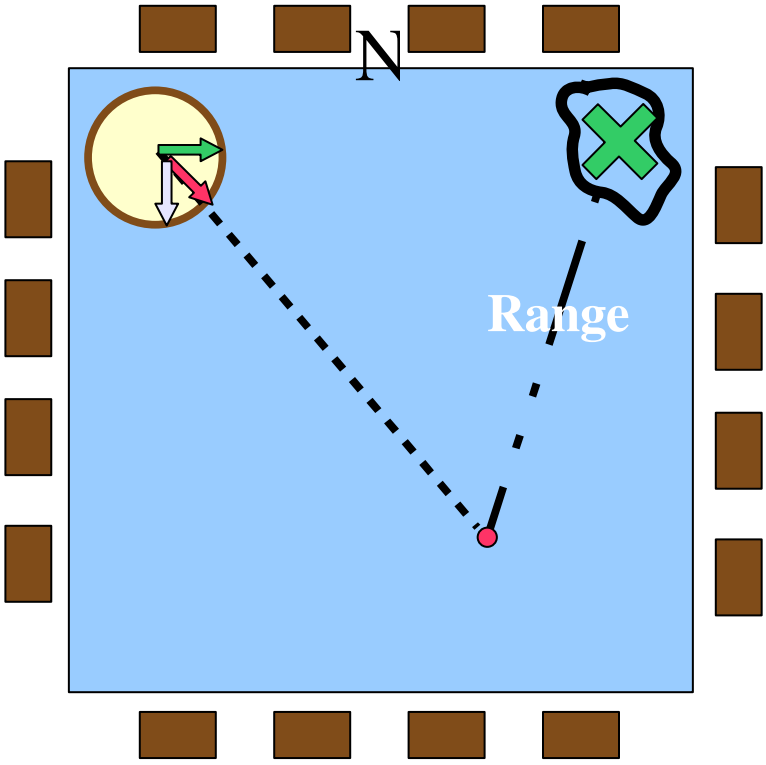
Scene Reenactment Map (For Clue iii)

Materials: Bear outline, trunk with bullet hole, laser pointer, measuring tape, step stool/small ladder (not provided)

Set-up:

1. This activity will require about a 12'x12' space and a tall cabinet (or something else to situate the tree trunk on top of. Make sure the set up is done before class. For most classrooms I find it might work best to move all desks to the outer edge of the classroom so that they face the center of the classroom (where the reenactment will take place).
2. Mark your 12'x12' space boundary with masking tape. Mark the northern boundary line with an N.
3. Place the piece of tree trunk (red arrow side up) on top of a tall cabinet (or something else at least 5ft high) in the north-western corner of the square.
4. Place the bear outline in the north-eastern corner of the square. Rotate the trunk until the red arrow points directly at the red X on the bear outline.
5. Place the laser pointer in the hole (turn it on only when students are ready to make their measurements).

Map:



CSI: Wyoming

An interdisciplinary forensic science unit developed by the UW Science Posse.

Question: Who did it?

From the Bullet to the Bear (and Tree!)

Yellowstone Mystery

It was a beautiful Saturday morning in Yellowstone Park. The sun's bright shimmer fought the autumn chill, warming the rolling gold meadows and creeping into the coolness of pine forests. Wisps and swirls of steam rose from the numerous geysers peppered throughout the landscape.

In the southern end of the park, a Wyoming family pulled into the parking area for Swan Creek Trail. The two teenage children, Cheyenne and Tim, scrambled out of the van and changed into hiking boots. Tim fiddled with his fishing pole and Cheyenne inspected her new camera. The father packed a large lunch while the mother double-checked the map to the Twin Lakes. Thirty minutes later, they had climbed halfway up a mountain and entered a deep forest with little visibility. Suddenly several gunshots erupted overhead and echoed around them. Then came the sound of distant but loud arguing. The father knew guns were illegal in the park and, fearing for the safety of his family, decided they best hike back to the trailhead and report the incident.

Back at the trailhead, Cheyenne and Tim waited in the car while their parents searched for a park ranger. Cheyenne started taking some practice pictures with her camera when she noticed two tall people dressed in wool shirts dragging something heavy in a burlap sack across the ground to their truck. They heaved the big sack onto the flatbed. Feeling suspicious, Cheyenne decided to play amateur detective and snapped several pictures of the scene. In her rush she didn't catch a picture of the men but did get a clear shot of the license plate and truck as they were driving away. Tim had sensed what Cheyenne was up to and, putting his face close to the window, caught a few glimpses of one of their faces. Their parents came back with information on a ranger station a few miles down the road near their lodge. Tim and Cheyenne burst into a quick report of the strange event they witnessed.

When they reported the events to the park ranger, they were amazed to hear of another mysterious event that morning. Another group of hikers had reported coming across a dead body, possibly human, on a parallel trail leading to the twin lakes. What did the gunshots and arguing mean? Was there a murder in the park? The park ranger interviewed Tim and Cheyenne carefully, downloaded Cheyenne's pictures to his laptop, then thanked them for their time and diligence.

After a few phone calls and preparations, three park rangers and a game warden met at Swan Creek Trailhead. They traced the steps of the previous hikers. Two miles up the mountain they discovered a body lying near the trail. It looked human. There were blood stains and dark hairs next to it. Further testing would be necessary. Gunshots had also been reported nearby, so they surveyed the scene and discovered a bullet embedded in a tree ten yards away. They packed up the evidence and headed back to start working on the case. How can you help solve this crime?

CSI: Wyoming

An interdisciplinary forensic science unit developed by the UW Science Posse.

Question: Who did it?

From the Bullet to the Bear (and Tree!)

Unit Outline

Questions the Game Wardens (students) need to answer by gathering evidence, conducting investigations, and drawing conclusions (guided inquiry):

1. **What is it?** (Liz)
    1. Morphology
    2. Bear Ecology- ecology
    3. Park Legal Issues- hand out?

It's a black bear, not a human.

2. **How did it die?**
    1. Necropsy- Anatomy and Physiology (Shawna)
    2. Animal condition, medical entomology- physiology (Eric)
    3. Toxicology (Lekan)

The bear died of starvation and poisoning (not by a gunshot wound). The crime is skinning a bear and taking its pelt, and carrying and firing a gun in a National Park.

3. **Who committed the crime?**
    1. Eye witness accounts- psychology (Maggie)
    2. Ballistics- physics (Sabrina)
    3. DNA- genetics (Sherry and Jacque)

Cheyenne's picture of the vehicle and license plate number lead authorities to the right house. Even with a faulty testimony from Tim, the game warden had enough probable cause to obtain a search warrant and enter Cody and Kris's house. They found a bear skin and head in a large freezer in the garage. After all the testing they matched the skinned body, blood, and hair to the bear skin. Cody and Kris committed the crime.

CSI: Wyoming

An interdisciplinary forensic science unit developed by the UW Science Posse.

Question: Who did it?

From the Bullet to the Bear (and Tree!)

Synopsis

Earlier that morning, Cody and Kris were hiking up Swan Creek Trail. Cody feared grizzlies, doubted the effectiveness of pepper spray, and was a huge fan of Dirty Harry movies. He had ignored park rules and snuck in his .44 magnum handgun. As they came into a small clearing, they discovered a large bear lying on the trail. Was it dead or simply sleeping? Cody didn't want to take any chances. He took out his gun and fired a few shots in the air, then prepared to shoot the bear if it jumped up and attacked them. When it didn't move they approached it for a closer look. They poked it a few times with a stick. It became obvious the bear was dead **(tongue hanging out of mouth, cold and stiff, ?…)**. The bear's coat still looked thick and healthy, so Cody decided it would be cool to skin the bear and make a rug out of the pelt. I could tell my friends a heroic story, he thought, of how a bear surprised and charged us but I made a quick, Herculean kill. Kris, however, felt very upset by the whole scene…the dead bear, firing the gun, and now Cody wanting to skin the animal. She also wasn't sure if this was legal, so they got into a heated argument. Meaner and more aggressive, Cody finally won, and started skinning the bear. Cody had brought a large burlap sack--just in case they found cool stuff they could take from the park--and it worked well to hold the head and skin. They headed down the mountain and back to their truck, Cody dragging the sack and whistling.

Ballistics Results (Clues ii and iii)

Back to Ammunition Ballistics

Cartridge Information

Index Number	Cartridge Type	Weight (grs.)	Bullet Style	Primer No.	Ballistic Coefficient
R44MG2	Remington® Express®	240	Soft Point	2 1/2	0.166
R44MG3	Remington® Express®	240	Semi-Jacketed Hollow Point	2 1/2	0.166
RH44MGA	Remington® Express®	275	JHP Core-LoktÂ®	2 1/2	0.199

Velocity (ft/sec)

Cartridge Type	Bullet	Muzzle	100	200	300	400	500
Remington® Express®	240 SP	1760	1380	1114	970	878	806
Remington® Express®	240 SJ HP	1760	1380	1114	970	878	806
Remington® Express®	275 JHP CL	1580	1293	1093	976	896	832

Energy (ft-lbs)

Cartridge Type	Bullet	Muzzle	100	200	300	400	500
Remington® Express®	240 SP	1650	1015	661	501	411	346
Remington® Express®	240 SJ HP	1650	1015	661	501	411	346
Remington® Express®	275 JHP CL	1524	1020	730	582	490	422

Short-Range Trajectory

Cartridge Type	Bullet	50	100	150	200	250	300
Remington® Express®	240 SP	zero	-2.1	-8.7	-21.2	-40.6	-67.7
Remington® Express®	240 SJ HP	zero	-2.1	-8.7	-21.2	-40.6	-67.7
Remington® Express®	275 JHP CL	1.4	zero	-6.6	-19.4	-39.2	-67.5

Long-Range Trajectory

Cartridge Type	Bullet	100	150	200	250	300	400	500
Remington® Express®	240 SP	zero	-5.6	-17.0	-35.4	-61.4	-143.0	-269.9
Remington® Express®	240 SJ HP	zero	-5.6	-17.0	-35.4	-61.4	-143.0	-269.9
Remington® Express®	275 JHP CL	zero	-6.6	-19.4	-39.2	-67.5	-210.8	-280.8

Note: These ballistics reflected a test barrel length of 24" except those for 30 Carbine and 44 Remington Magnum which are 20" barrels. Specifications are nominal. Ballistics figures established in test barrels. Individual rifles may vary from test barrel results. "zero" indicates yardage at which rifle was sighted in.

* Inches above or below line of sight. Hold low for positive numbers, high for negative numbers.

1 Bullet does not rise more than 1" above line of sight from muzzle to sighting-in range.

2 Bullet does not rise more than 3" above line of sight from muzzle to sighting-in range.

† 280 Remington and 7mm Express Remington are interchangeable.

‡ 6mm Remington and 244 Remington are interchangeable.