Science and Technology 11
Forensics

Blackline Master

This blackline master package, which includes all section assignments, as well as selected worksheets, activities, and other materials for teachers to make their own overhead transparencies or photocopies, is designed to accompany Open School BC's *Forensics* module. The course and blackline master were developed by BC teachers, instructional designers, graphic artists, and multimedia experts.

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Section 1, Lesson B, Activity 1
Crime Scene Investigation Procedures

Organize the following crime scene procedures into the correct order. Put the number 1 beside the first event, 2 beside the second, and so on.

————	a. Life-saving measures (if required) are employed.
————	b. Photographs are taken of the crime scene.
————	c. The crime scene is taped off.
————	d. The police and other emergency personnel (first responders) are called to the crime scene.
————	e. The area is searched for evidence.
————	f. Evidence is collected and sent to the lab.
————	g. Crime scene investigators (identification officers) are called to the scene.

Direct vs. Circumstantial Evidence

Classify each piece of evidence as direct or circumstantial—*when it is first found at the crime scene.*

Evidence	Direct or Circumstantial
a. Shoeprint found at the scene of the crime.	
b. DNA evidence from skin.	
c. Cocaine found in the pocket of a known drug dealer.	
d. Bullet casing that matches a suspect's gun.	
e. Stolen diamonds found in suspect's purse.	
f. Blood of suspect found at crime scene.	
g. Witness statement putting the suspect at the crime scene.	

Section 1, Lesson C, Activity 1
Choose the Best Impression Technology

Select the best technology or technologies for collecting each of the following Impressions.

1. Shoeprint in soil

   a. lacquer and dental stone

   b. light, electrostatic lifter

   c. gelatin lifter

   d. lacquer and plaster of Paris

2. Tool mark in forced door

   a. silicone

   b. lacquer and dental stone

   c. photography

   d. gelatin lifter

3. Apple with a bite in it

   a. photography

   b. silicone

   c. chemicals

   d. dental stone

4. Dry footprint on a dusty linoleum floor

   a. light and electrostatic lifter

   b. lacquer and dental stone

   c. light and gelatin lifter

   d. superglue

5. Tire print in the snow

   a. foam

   b. snow print wax and dental stone

   c. snow print wax and plaster of Paris

   d. photography

Section 1, Lesson C, Activity 2
Class vs Accidental Characteristics

Identify each of the following tire characteristic as either class or accidental.

Tire Characteristic   **Class or Accidental**

a. Tire size   _____

b. Wear marks   _____

c. Embedded rocks/debris   _____

d. Tire pattern   _____

e. Cuts   _____

f. Tire shape   _____
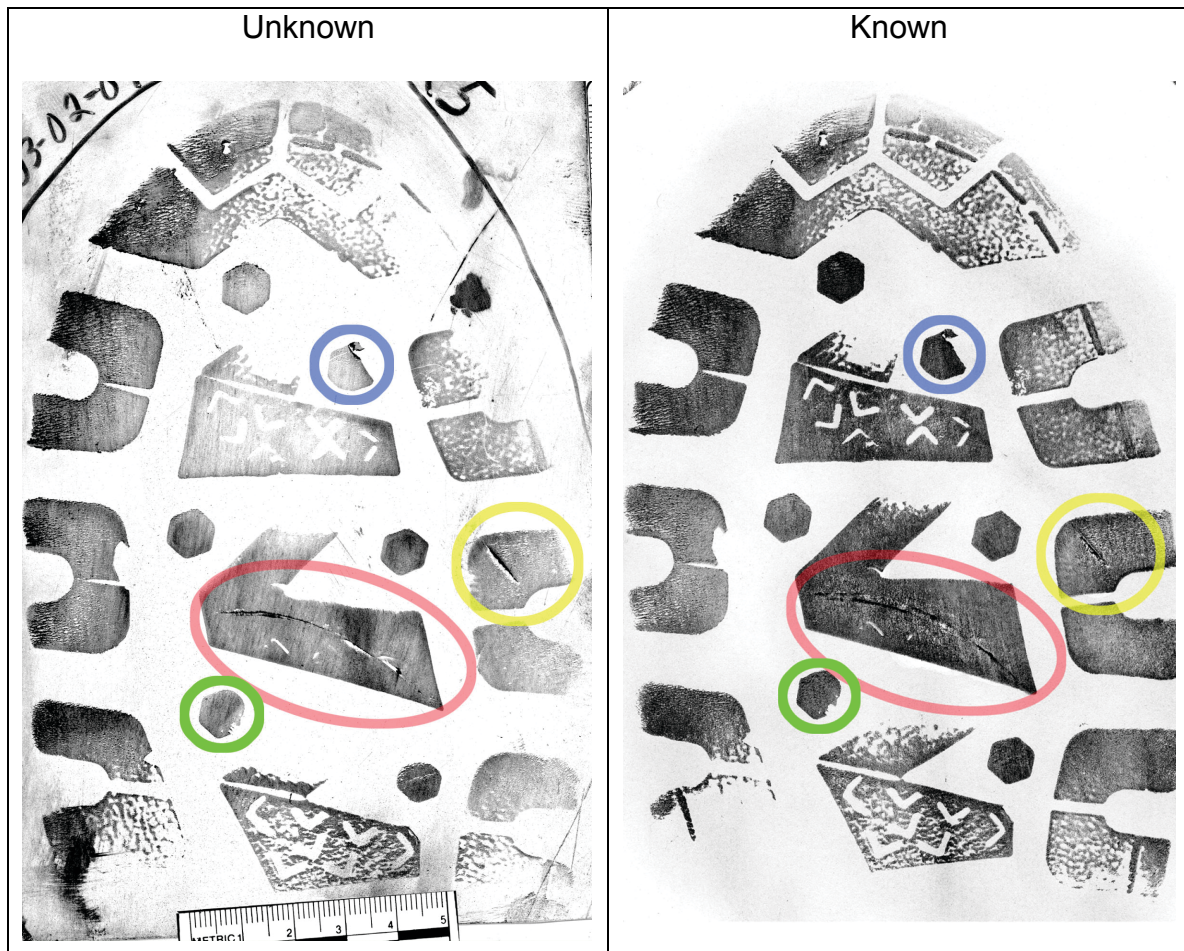
g. Tears   _____

Physical evidence found at a crime scene is marked with a numbered card.

An identification officer searching a crime scene for evidence.

Photographing evidence at a crime scene.

A positive match: these shoes are from the same class and have the same accidental characteristics (circled).

Dental stone cast

Section 1 Assignment: Part 1
Definitions

Write the letter of the term in Column B beside its correct definition in
Column A. (10 marks)

	Column A	**Column B**
_____	1. Commonly used to make casts of footwear impressions.	A. Identification officer
_____	2. Analyzes non-biological evidence from crime scenes.	B. Physical evidence
_____	3. Searches for, documents, and collects evidence from crime scenes.	C. Accidental characteristics
_____	4. A written record of all evidence from a crime scene from the time of collection to its appearance in court.	D. Forensic
_____	5. An imprint or indentation	E. Chain of custody
_____	6. Proof or fact about a crime scene.	F Dental stone
_____	7. Something that can be applied to a legal situation.	G Impression
_____	8. Actual objects tied to a crime scene.	H. Locard's principle of exchange
_____	9. Something is always taken from and something left at any crime scene.	I. Direct evidence
_____	10. Features of a piece of evidence that can help tie that evidence to one person.	J. Forensic chemist

Section 1 Assignment: Part 2
Murder on Mayberry Street

1. Identify six procedural errors in the following scenario. (6 marks)

An identification officer is called to the scene of a murder at 231 Mayberry Street. As he pulls up, he realizes it's the home of his daughter's best friend. The officer rushes in and goes to her body. He checks her pulse, but she's dead. She's lying on her side, so he turns her over to see if there's any evidence on her. He notices that she has been shot in the neck. The officer covers her with a blanket, then proceeds to look around the room. He finds a bullet casing, but doesn't touch it. As he bends down to look at it, he notices a gun lying under the dining room table. Carefully, he puts a pen in the muzzle and lifts it up, making sure that he doesn't touch the gun with his fingers. The officer returns the gun to its original position then sits down on the couch to wait for his boss, who will likely be in charge of the investigation.

2. The identification officer discovers that the gun belongs to the victim's husband. Is this information circumstantial evidence or direct evidence? Explain your answer thoroughly. (2 marks)

3. A hair found at the scene of the crime is matched to the suspect. Is this direct or circumstantial evidence? Does it prove the suspect was guilty of the crime? Why or why not? (3 marks)

4. When collecting evidence from the Mayberry crime scene, it is extremely important that the chain of custody be maintained. What does this mean, and why is it important? (4 marks)

Section 1 Assignment: Part 3
Making Impressions

You're an identification officer working the night shift when you are called out to investigate a burglary. A wealthy couple, Harold and Kiran Ronson, had been out for the evening at the opera. Upon returning home, Kiran went upstairs while her husband stopped in the kitchen for a snack. As she entered her bathroom, Kiran surprised a burglar looking for jewels. The thief was dressed in black and had a mask on his face. The burglar saw the diamond necklace around Kiran's neck and grabbed for it. Kiran fought back, and in the struggle, bit the thief hard on the arm. The thief cried out in pain then ran out, knocking down Mr. Ronson in the process.

Later, you stand in the doorway and survey the crime scene. It's time to collect evidence and try to solve the case.

1.   The bathroom floor is made of linoleum. Which of these materials would you use to locate and collect shoeprints left on the floor? Why did you choose these materials, and how do you use them? (6 marks)

camera	electrostatic lifts	superglue
light source	plaster of Paris	aluminum powder
dental stone	gelatin lifters	cellophane tape
snow print wax	foam impression cast	silicone

2. You lift two different shoeprints from the linoleum floor. One is a from a high heel shoe, the other from a running shoe. Your next task is to try to identify who each of these prints belongs to. We can assume the high heel belongs to Mrs. Ronson, but the running shoe print most likely belongs to the suspect. So far your suspects include Allan the cook, Malik the gardener, and Henry the pool boy. You decide to collect shoeprint impressions from each of these suspects.

Shoeprints on bathroom floor		Shoeprints from known individuals		
Suspect	Mrs. Ronson	Allan (the Cook)	Malik (the gardener)	Henry (the pool boy)

a. Which of your three suspects can you rule out as the probable attacker? Why? (1 mark)

b. Look again at the shoeprints from your two remaining suspects. Based on what you now see, which of the two of them would you consider to be the likely attacker? Why? (2 marks)

c. Does the matching shoeprint constitute proof (i.e., direct evidence) that your prime suspect is guilty? Why or why not? Explain your answer. (2 marks)

3. a. Very important physical evidence can be found on the attacker. What is it? (Hint: think back to how Mrs. Ronson reacted.) (1 mark)

b. How would you collect this evidence (i.e., what materials and techniques would you use)? How could you use this evidence to prove the suspect's guilt? (3 marks)

The Body as a Witness

1. A body is discovered at a crime scene. It is warm and stiff. Approximately how long has the victim been dead?

Temperature of Body	Stiffness of Body	Time Since Death
Warm	Not stiff	Dead less than 3 hrs
Warm	Stiff	Dead 3–8 hrs
Cold	Stiff	Dead 8–36 hrs
Cold	Not stiff	Dead more than 36 hrs

   a. 0–3 hours
   b. 3–8 hours
   c. 8–36 hours
   d. More than 36 hours.

2. Livor mortis is fully visible in the victim. Does this match the time of death estimate?

   a. Yes. Full livor mortis sets in at least 6–8 hours after death.
   b. No Full livor mortis sets in later than that.

3. Blood has pooled in the victim's feet and lower legs. This suggests the victim died:

   a. lying face down.
   b. in an upright position.
   c. on her back.
   d. on her side.

4. A second body is found in the woods nearby. The forensic entomologist finds 1st stage *Eucalliphora latifrons* on the body. The temperature is 23.3°C. Approximately how long has this second person been dead?

   a. 18.5 hours
   b. 42.5 hours
   c. 74 hours
   d. 78.2 hours

Section 2, Lesson B, Activity 1
Questioned Documents

1. Give three examples of documents that might be sent to a forensic anti-counterfeiting specialist like Brian Wainwright.

2. Why are unique identifying marks, like scratches, important clues for a forensic anti-counterfeiting specialist?

3. What are two ways to analyze ink on a document?

4. How can either of these techniques help spot a forged document?

Section 2, Lesson B, Activity 2
Find the Forger

1. Two of these samples are written by the same person but the third is not.
   Which one is the forgery? Sample A, Sample B, or Sample C.

Sample A

Sample B

Sample C

2. List three ways you can tell the sample is a forgery?

Section 2, Lesson B, Activity 3
Requested vs. Collected Handwriting Samples

1. What is the difference between a collected handwriting sample and a requested handwriting sample?

2. What do you think are the advantages and disadvantages of collected vs. requested handwriting samples?

Section 2, Lesson C, Activity 1
Find the Mystery Powder

You are a forensic chemist and an unknown substance from a crime scene has been sent to you for analysis. Use the table in this lesson to help determine what this substance is.

First you observe the substance's physical properties. You observe that it is a white powder with no detectable smell.

Next, you conduct some tests to determine the substance's chemical properties.

1. You put a small amount of the substance in a test tube and add 5 ml of water. The substance does not dissolve.

2. You add 2 drops of phenolphthalein to another sample of the substance. There is no colour change.

3. You mix another sample of the substance with acetic acid. The mixture fizzes violently.

4. You mix another sample with iodine. There is no reaction.

What is the substance? _____

Section 2, Lesson D, Activity 1
Hair Analysis

1. Give four characteristics that can be used to distinguish animal hair from human hair.

2. Why is hair analysis questionable in court?

3. Identify two other uses of hair evidence.

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Has this cheque been forged?

Gas chromatograph-mass spectrometer.
Photo courtesy of Anti-Doping Research Inc.

Section 2 Assignment: Part 1

Matching

Match the term in Column B to its correct description in Column A. Write the correct letter in the space provided. (10 marks)

Column A	Column B
_____ 1. A scientist who studies the insects on or near a dead body.	A. Autopsy
	B. Forensic entomologist
_____ 2. The examination of a body by a forensic pathologist.	C. Forgery
	D. Fourier transform spectrometer
_____ 3. The process by which a body turns blue and purple, based on the settling of blood after death.	E. Hypothesis
	F. Livor mortis
_____ 4. A false, or counterfeit, document.	G. Neutron activation analysis
_____ 5. A substance that is used to dissolve other substances.	H. Rigor mortis
_____ 6. A test used to determine if two inks are the same.	I. Scientific method
	J. Solvent
_____ 7. A suggested explanation for certain facts or observations.	K. Thin layer chromatography
	L. Trace evidence
_____ 8. The step-by-step process by which scientists observe phenomena, test hypotheses through experimentation, and draw conclusions.	
_____ 9. A technique used to determine the presence of chemicals in hair, paint, and metals.	
_____ 10. Small pieces of physical evidence either left at the crime scene or found on the suspect.	

Section 2 Assignment: Part 2
Estimating Time of Death

1. Why does a body start to cool immediately after death? (2 marks)

2. Identify three factors that may affect how quickly a body cools. (3 marks)

3. The body of a mature male has been found behind a dumpster.

   a. The body is cold and shows no sign of stiffness. Approximately how long ago did the person die? (1 mark)

   b. The air temperature is 23.3˚C. Using the table provided, which of the following insects would you expect to find on the body? Explain your choice(s).
   (2 marks)
      i. Stage 3 *Phormia Regina*
      ii. Stage 1 *Eucalliphora latifrons*
      iii. Stage 1 *Lucilia sericata*
      iv. Stage 2 *Eucalliphora latifrons*

Blowfly Species	Temperature (˚C)	Time to reach developmental stage (hrs)		
		Stage 1	Stage 2	Stage 3
Phormia regina	23	21.5	78.8	126.7
Lucilia sericata	23.3	21	45	77
Eucalliphora latifrons	23.3	18.5	42.5	74
Calliphora vicina	15.8	41.4	83	128
Calliphora vicina	23.3	21	45	77

4. A female body is found in the forest on May 7, at 6:00 pm. The temperature was 23˚C. Stage 1 *Phormia regina larvae* were found on the body. Use the table from question 3, above, to answer the following questions.

   a. How long ago did she die? (1 mark)

b. You identify the victim as April Gonzales, age 31. After questioning friends and neighbours, you find out that she had gone for dinner with a friend, Sally, at 5:00 pm the previous evening. Sally seems nervous, and you wonder if she's telling the truth. To check her story, you have the medical examiner examine April's stomach contents. The medical examiner finds out that digestion of her last meal stopped 2 hours after she ate. If April had dinner with Sally on Sunday at 5:00 pm, what time would she have died? (1 mark)

c. Was Sally telling the truth? Explain your answer. (2 marks)

Section 2 Assignment: Part 3
Did Someone Forge Uncle Joyless' Will?

Cranky old Uncle Joyless recently passed away after choking on a chicken bone. In his handwritten will he left everything to his twenty-one-year old girlfriend who he met last month in Las Vegas. The family is angry and very suspicious. Did someone tamper with his will? Was it forged to cut the family out of the inheritance and give everything to the "gold-digger" girlfriend?

The family hires you, a well-known document examiner, to study Uncle Joyless' will in detail. Describe two techniques you might use to check if the will has been forged. Describe the advantages and disadvantages of each technique.
(8 marks)

Section 2 Assignment: Part 4
Skipping School

Jessica was absent last class and has brought you a sick note from her mother.
You suspect the note is forged and that Jessica or one of her two friends in the
class, Sandy or Leanne, wrote it. You've just asked your students to hand in their
homework, so you have samples of the girls' handwriting to compare against the
note.

1. The handwriting on the girls' homework are your known handwriting samples.
   Would these be called requested or collected handwriting samples? Explain
   your answer. (1 mark)

2. What would be the advantage of using these samples instead of asking the
   students to write something out for you? (2 marks)

3. What would be the disadvantage of using these samples? (2 marks)

4. You find an old note written by Jessica's mother, filed in the school office.
   Compare the handwriting in this note with the note handed in by Jessica. You
   decide the new note is a forgery. Identify three differences between the notes
   that make you think this. (3 marks)

Forged note

Old note

5. Compare each of these handwriting samples to the forged note from June 26th.

> 3. Our sun is an intermediate mass star.
> 4. A supernova is the explosion of a high mass star.
> 5. After an extremely high mass star collapses on itself, it can become an extremely dense object known as a black hole.
> 6. A star's spectrum is the pattern of light the star emits once it has been split by a spectroscope.

Sandy's homework

> 3. Our Sun is an intermediate mass star
> 4. A supernova is the explosion of a high mass star
> 5. After an extremley high mass star collapses on itself, it can become an extremely dense object known as a black hole.
> 6. A star's spectrum is the pattern of light the star emits once it has been split by a spectroscope

Leanne's homework

> 3. Our sun isar intermediate mass star.
> 4. A supernova is the explosion of a high mass star.
> 5. After an extremely high mass star collapses on itself, it can become an extremely dense object known as a black hole.
> 6. A star's spectrum is the pattern of light the star emits once it has been split by a spectroscope.

Jessica's homework

a. Who wrote the note? (1 mark)

b. Support your decision by pinpointing three characteristics that are common between the sick note and the samples. Give specific examples that are NOT present in the other samples. Use the samples from your lesson as guidance. (1 mark for each valid characteristic for a total of 3)

Section 2 Assignment: Part 5
Chemical Signatures

The local RCMP receives a tip that drugs area being sold out of a downtown bakery. They stake out the business and catch a man coming out with a large package full of white powder. The police arrest him and seize the package as evidence. The package is then sent to the lab for analysis.

1. At the lab, a forensic chemist runs a series of tests to determine what the white powder inside the package is. Here are the results:

   • No odour
   • No reaction to water
   • No reaction to acetic acid
   • No reaction to phenolphthalein
   • No reaction to iodine.
   • Turns blue when exposed to cobalt thiocyanate

   Using the table provided, identify the mystery powder inside the package. (1 mark)

Substance	Physical Properties			Chemical Properties				
	Colour	State	Odour	Reaction to water	Reaction to acetic acid	Reaction to phenol phthalein	Reaction to Iodine	Reaction to cobalt thiocyanate
ASA (aspirin)	white	solid powder	none	bubbles violently	none	turns pink	none	none
baking powder	white	solid powder	none	none	fizzes violently	none	none	none
cornstarch	white	solid powder	none	none	none	none	turns purple	none
Tri-sodium phosphate	white	solid powder	soapy	none	fizzes	turns pink	none	none
Cocaine	white	solid powder	none	none	none	none	none	turns blue

Type of powder: _____

2. Fine white powder is also found on the outside of the package. This is also tested. Here are the results:

- Soapy odour
- No reaction to water
- Fizzes in acetic acid
- Turns pink in phenopthalein
- No reaction to iodine

Using the table provided at the beginning of this assignment, identify the mystery powder *outside* the package. (1 mark)

Mystery powder: _____

3. After all the customers and employees have been interviewed, you narrow your list of suspects down to four. Your job is to try to establish which of the four suspects was involved in the drug operation. You decide to collect trace evidence from the suspects themselves to see if you turn up any clues. When you're done, you send these samples to the forensic chemists at the lab for analysis.

Evidence collected from Stuart Miller, owner and baker

a. white powder from hands: white, solid powder; no odour, does not dissolve, fizzes violently in acetic acid; does not react to either phenolpthalein or iodine.

This powder is: _____

b. white powder from apron: white; powder; no odour; no reaction to water, acetic acid or phenopthalein; turns purple with iodine.

This powder is: _____

Evidence collected from Lucinda Lee, Front Till Manager

c. Powder from her jacket: white; solid powder; no odour; does not dissolve; fizzes violently in acetic acid; does not react to either phenolpthalein or iodine.

This powder is: _____

Evidence collected from Oscar Meyers, cleaner/worker:

 d. Powder on his hands: white; powder; soapy odour; no reaction to water; fizzes in acetic acid; turns pink in phenopthalein; no reaction to iodine.

This powder is: _____

Evidence collected from Sharon Bell, Health Inspector:

 e. Trace amounts of white power on her hands: white; powder; no odour; bubbles violently in water; no reaction to acetic acid; turns pink in phenolpthalein; no reaction to iodine.

This powder is: _____

4. Based on the chemical evidence you have gathered, describe why or why not each of these people is still a suspect in this case. (4 marks)

 a. Stewart Miller
 b. Lucinda Lee
 c. Oscar Meyers
 d. Sharon Bell

 e. Based on all of the above, your most likely suspect is: (1 mark)

 f. Is this enough to convict the suspect of the crime? Why or why not? (3 marks)

Section 2 Assignment; Part 6
Comparing Fibre Evidence

As a forensic chemist, Rob Groves is called upon to compare fibres found on a victim's clothing (questioned fibres) with those taken from the suspect's clothing (known fibres). Rob will perform several tests to see if the fibres match. For example, he will examine the cross section of the fibres to see if they are the same shape and pattern. Rob will also shine ultraviolet light on the fibres to see if they absorb then re-emit light in the same way.

Go to your Science and Technology 11 *Forensics* Media CD now. Click on *Fibre Analysis* and watch *Comparing Fibres.* In this video clip, Rob Groves explains two additional tests he performs to determine if the questioned and known fibres are the same. Answer the following questions in your own words, based on what you've learned.

1. Rob will also extract the dye from each fibre and analyze it. How does he do this and what do the results tell him? (3 marks)

2. If a questioned fibre from the victim's clothing is still in every way identical to the control sample from the suspect's clothing, Rob will perform one final test. This test is called Thin Layer Chromatography (TLC). Describe in your own words how Rob performs this test and what the results tell him.
   (4 marks)

3. If, after all the testing, the questioned fibre from the victim's clothing still matches the known fibre from the suspect's clothing, what can Rob conclude? Does this prove the suspect committed the crime? Why or why not? (3 marks)

Section 3, Lesson A, Activity 1
Identifying Fingerprints

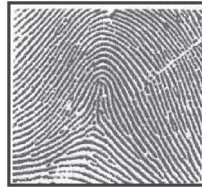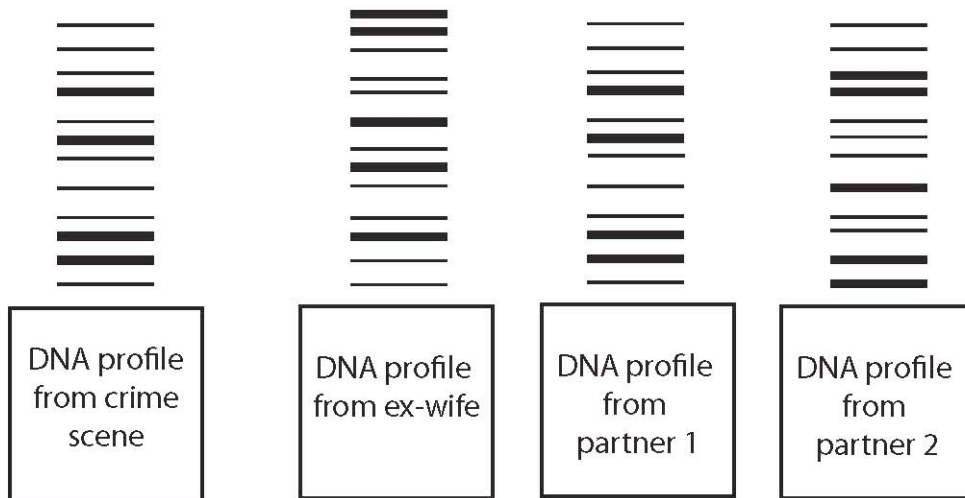Identify the correct class for each of these fingerprints.

a.

b.

_____   _____

c.

d.

_____   _____

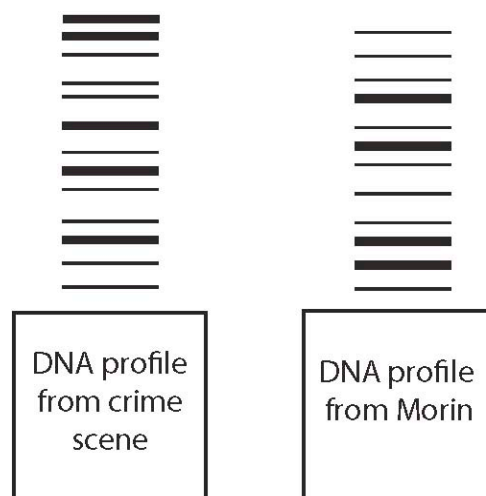Section 3, Lesson B, Activity 1
Match the DNA Profiles

Case #1:

1. An extremely wealthy businessman is found murdered in his hotel room. His ex-wife and two of his business partners are considered suspects. You collect a DNA sample from each of them and compare it with one from the murder weapon. Who is the killer?
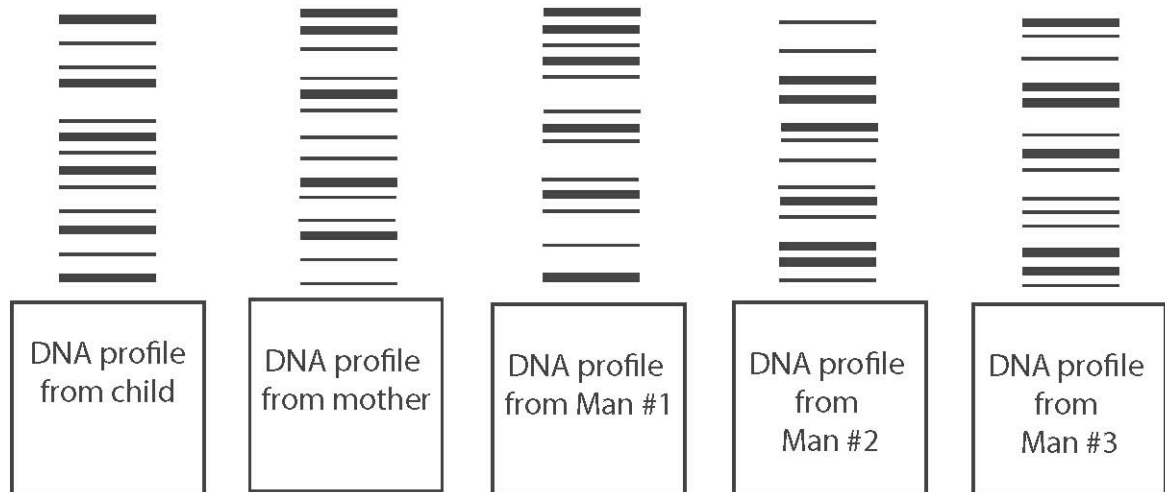

Case #2

2. In 1984   Canadian Guy Paul Morin was convicted of murder. Based on these two DNA profiles, was Morin wrongfully convicted?

Case #3:

3. Which of these three men is the father of the child? (Hint: Half of the child's DNA profile matches the mother. The other half matches one of the three men.)

| DNA profile from child | DNA profile from mother | DNA profile from Man #1 | DNA profile from Man #2 | DNA profile from Man #3 |

Section 3, Lesson C, Activity 1
Your Bones Tell a Story

As you have learned, an expert like Brenda Clark can play a very important role in determining the identity of an unknown skeleton. Select the correct answer.

1. One way Brenda can estimate the age of a skeleton is to look at the _____ of bones.

   a. shape

   b. fusion

   c. colour

   d. width

2. As people get older the rib bones become _____. This is another clue about a person's age.

   a. hollow

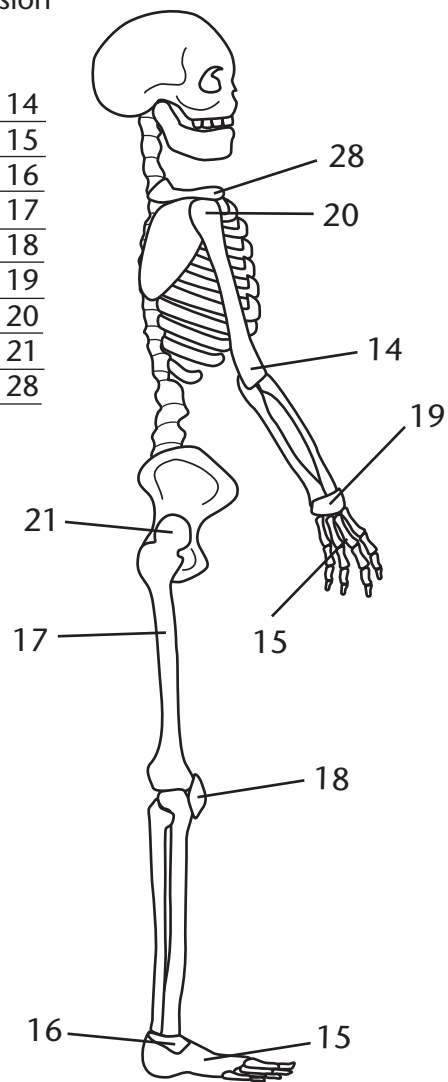   b. smoother

   c. more jagged

   d. straight

3. A third clue about age is the degree of _____.

   a. bone density

   b. bone loss

   c. bone strength

   d. bone length

4. To determine the sex of a skeleton, the width of the _____ is extremely important.

   a. jaw

   b. femur

   c. rib cage

   d. pelvis

5. This area tends to be wider in

    a. females.
    b. males.

6. The skull tends to be _____ and _____ in females than males.

    a. smoother, rounder
    b. shorter, wider
    c. smaller, heavier
    d. lighter, denser

7. Areas of muscle attachment are more noticeable in

    a. females.
    b. males.

8. Which of these does NOT provide information about a victim's lifestyle?

    a. Size of bones on left vs. right side of body
    b. Healed fractures
    c. Osteoporosis
    d. Bone length

The age of bone fusion
in years:

elbow	14
hands and feet	15
ankle	16
thigh (femur)	17
knee	18
wrist	19
shoulder	20
hip (ilium)	21
clavicle	28

The approximate age of fusion for different bones
in the human body.

Loops

Radial Loop

Ulnar Loop

Whorl
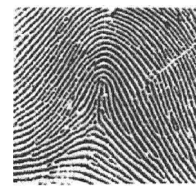

Plain Whorl

Central Pocket
Loop

Double Loop

Accidental

Arches

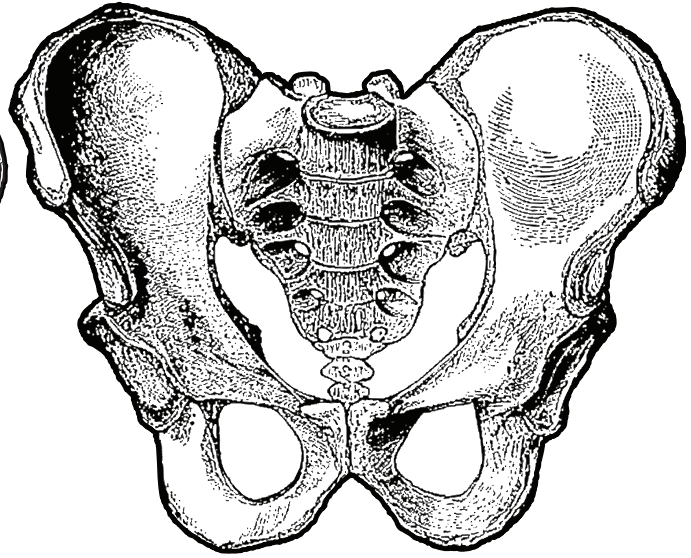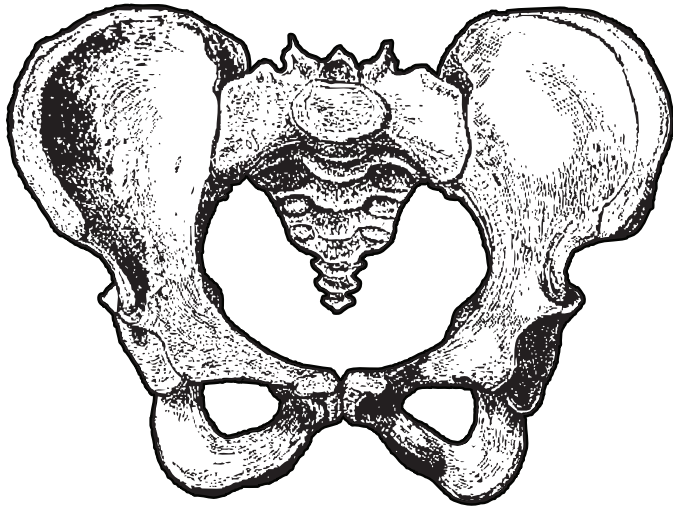Plain Arch

Tented Arch

Classes of fingerprints

Swabbing a sample for DNA testing.
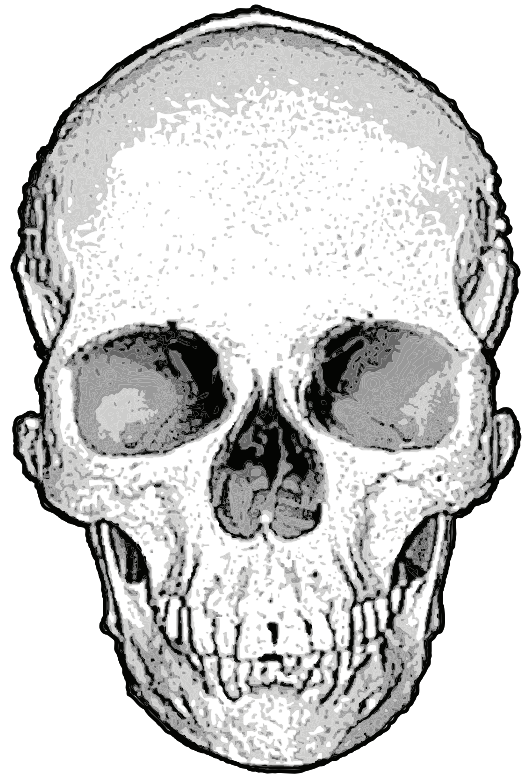
Collecting fingerprints

Male Skill   Female Skull

Section 3 Assignment: Part 1
Matching

Match the term in Column B to its correct description in Column A. Write the correct letter in the space provided. (10 marks)

	Column A	Column B
_____	1. Someone who studies physical evidence from a crime scene, such as blood and saliva.	A. CODIS
_____	2. Fingerprints that are invisible to the naked eye.	B. DFO
_____	3. Raised lines on the fingertips and toes that are used for gripping.	C. DNA
_____	4. A surface that is impenetrable to water or air (e.g., glass, metal, or plastic).	D. DNA profile
_____	5. A chemical inside our cells that determines what we look like.	E. Forensic anthropologist
_____	6. A person's unique sequence of DNA base pairs, which can be isolated in a lab procedure.	F. Forensic biologist
_____	7. The process by which DNA is replicated in the laboratory.	G. Friction ridges
_____	8. The unique, repeated sequences in our DNA.	H. Latent prints
_____	9. An integrated database containing the DNA fingerprints of convicted criminals.	I. Non-porous
_____	10. Someone who studies a dead person's bones to determine things such as age, sex, race, height, lifestyle, and possibly the cause of death.	J. Polymerase chain reaction
		K. Short tandem repeat

Section 3 Assignment: Part 2
Fingerprints

Last night a thief smashed the front window of Huckabilly's Mini Mart and made off with hundreds of dollars in scratch and win lottery tickets and chocolate bars. As an identification officer, you've been called into the crime scene to check for evidence. This includes fingerprints.

1. Identify one fingerprinting technique you could use to collect prints from each of these surfaces at the crime scene. Describe how you would use this technique.

    a. Glass display case (2 marks)

    b. Lottery tickets still in the display case (2 marks)

2. You find a clear fingerprint on the display case. What class of fingerprint is this? Refer back to the examples in Lesson A if you need to. (1 mark)

3. You return to the crime lab and enter the print into the fingerprint database. This narrows your list down to four people who all have the same print type. Examine the four prints carefully.

Sharma Dhaliwal	David Wan	Jamie Warchowsk	Stephan Saunders

    a. Whose fingerprint matches the one at the crime scene? (1 mark)

    b. Circle two points of similarity between the unknown sample from the scene and the known sample from the database. (2 marks)

Section 3 Assignment: Part 3
DNA Profiles

As you've learned, every person on Earth (except for individuals with an identical twin, triplet, etc.) has a unique DNA profile. This profile can link a person to biological evidence left at a crime scene, or prove that person is related to someone else.

Go to your Science and Technology 11 *Forensics* Media CD. Click on *DNA* and watch the following video clips: *Collecting DNA* and *Creating a DNA Profile*. Use this information, plus what you learned in your DNA lesson, to answer the questions provided. Answer each question in your own words. (10 marks).

1. The first video shows one method for collecting a DNA sample from a suspect. What equipment is used and how is the sample collected?
   (2 marks)

2. Refer back to your DNA lesson. What other technique might an identification officer use to collect biological evidence for DNA testing? (1 mark)

3. What is a DNA profile and how is it created? Refer to the DNA lesson and the second video clip when answering this question. Be sure to define *polymerase chain reaction* and *electrophoresis* in your answer.
   (4 marks)

4. Using the information from your lesson, describe three uses of DNA profiles.
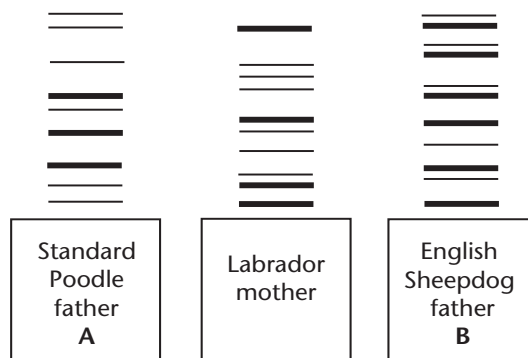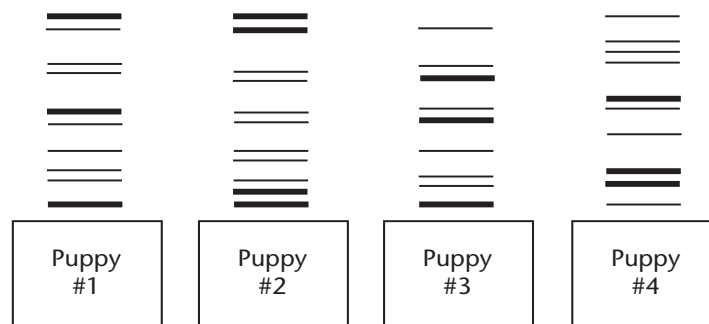   (3 marks)

Section 3 Assignment: Part 4
Doggone It!

Lately, certain breeds of dogs have been crossed to produce offspring that carry desirable traits from both parents. The resulting puppies are quite valuable. You have decided to cash in on this, and bought yourself a Labrador female. You breed this female to a male Standard Poodle (the big ones) in hopes of producing some Labradoodles. You do this, but unfortunately, your dog gets out and mates with the neighbour's English Sheepdog. A few months later, your dog presents you with four puppies. However, you cannot be sure who their father is. Since a Labradoodle puppy is worth about 10 times as much as a Labrador Sheepdog cross, it is important that you establish who the real father is. To make things even more complicated, puppies from the same litter can have different fathers!

Given below are the DNA profiles of the parent dogs and the four puppies. Compare the profiles of the puppies to each of the fathers then decide which dog was the father for each of the puppies.

DNA Fingerprints of Parents

| Standard Poodle father A | Labrador mother | English Sheepdog father B |

DNA Fingerprints of Puppies

| Puppy #1 | Puppy #2 | Puppy #3 | Puppy #4 |

Father:

Puppy #1: _____

Puppy #2: _____

Puppy #3: _____

Puppy #4: _____

Old Bones Tell a Story

Last summer, a construction company was called in to repair the foundation of a 90-year-old house. While removing the debris, the workers found some bones. Initially they thought that they were from an animal, but they soon realized that they had likely found human skeletal remains. A forensic specialist is called in to examine the bones. Here are some of the things she finds:

- The pelvis and sacrum are wide

- The skull is small with a rounded jaw

- The skull is 21 cm long

- There appears to be a healed fracture in the left humerus (upper arm)

- The end of the left femur has fused

- The clavicle has fused

- The rib bones are smooth and regular

Meanwhile, an investigating officer goes through the Missing Person's reports from exactly 90 years ago (when the house was built). Since the bones were found under the foundation, it seems likely the person died
at that time. Five people were reported missing that year and never found. Read each Missing Person Report carefully.

Missing Person Report #1

Name: Tre Crenal
Missing since: November 6, 1918
Sex: Male
Age: 28
Description:
- 190 cm tall
- 70 kg
- Short black hair neatly parted on the left side
- Unusually small/squinty brown eyes
- Last seen wearing an oversized black woolen waist length jacket, blue trousers, and brown shoes
- Was once stabbed in the upper arm during a drunken brawl
- Was last seen singing at a local bar

Missing Person Report #2

Name: Marion Inglewood

Missing since: December 16, 1918

Sex: Female

Age: 17

Description:
- 140 cm tall
- 50 kg
- Curly black hair, blue eyes
- Last seen wearing a black dress
- Once broke her left arm during a school square dance competition
- Lost her left pinky finger in a farm accident

Missing Person Report #3

Name: Eleanor Shodle

Date: July 3, 1918

Sex: Female

Age: 71 years old

Description:
- 168 cm tall
- 60 kg
- Long grey curly hair, brown eyes
- Last seen in a long yellow summer dress, with white sandals and a straw hat holding a red bathroom towel
- Cloud shaped birthmark underneath chin

Missing Person Report #4

Name: Abigail Eine

Date: May 20, 1918

Sex: Female

Age: 25 years old

Description:
- 170 cm tall
- 55 kg
- Blonde hair, green eyes
- Last seen wearing a blue cotton dress and hand woven shawl
- Broke upper left leg at the age of 9 when she fell out of a tree
- Unusually large front teeth

Missing Person Report #5

Name: Amy Henricks
Date: August 23, 1918
Sex: Female
Age: 22 years old
Description:

- 166 cm tall
- 62 kg
- Last seen wearing a green cotton dress with a matching bonnet
- Fell off a horse when she was 10 and broke her left upper arm (humerus)
- Large birthmark on left shoulder

1. Whose missing person's bones do you have? Explain your choice, and why you eliminated the other four missing persons. (10 marks)