

Elizabethtown Area School District

Forensic Chemistry

Course Number:	352	Length of Course:	1 semester – 18 weeks
Grade Level:	11-12 Elective	Total Clock Hours:	120
Length of Period:	80 minutes	Date Written:	June 11, 2007
Periods/Week :	5 periods/week	Written By:	Scott Baylor
Credits (if app.):	1.0	Weighting:	1.0

Prerequisite: Chemistry

Course Description:

This course is a laboratory-oriented course designed for students who have already completed a chemistry course and enjoy investigating scientific processes that may be encountered during a forensic investigation. Forensic Science is the application of science to law in events subject to criminal or civil litigation and includes a number of different technical fields, including physics, chemistry, biology, engineering, psychology, and medicine. Experiments will be conducted that have been designed by the American Academy of Forensic Sciences. Topics will include sand and soil analysis; shoeprint casting; fingerprint identification; hair, fiber, blood, stomach content, and DNA analysis. This course should not be substituted for Physics.

Elizabethtown Area School District

I. Overall Course/Grade Level Standards

Students will KNOW and be able TO DO the following as a result of taking this course:

- A. The Scientific Method
- B. Various Forensic Careers
- C. The process of experimental design
- D. How to improve their estimation, problem solving, and calculation skills
- E. Organic molecule properties
- F. How to differentiate between presumptive and conclusive tests
- G. That scientific knowledge is a constantly changing and adapting body of scientific facts attempting to explain the world in which we live
- H. That scientific knowledge is not exact, but as accurate as human technology allows
- I. Perform scientific inquiry by observing phenomena, collecting data, and analyzing data
- J. The structure of hair and how it is analyzed
- K. The various types of fingerprints, footwear prints, and how to use them to identify a person
- L. The value of eyewitnesses and how to read body language
- M. The use of entomology in the determination of the time of death
- N. Serology and DNA fingerprinting for identification purposes
- O. Ballistics
- P. Design experiments
- Q. Analyze and synthesize several pieces of data to draw conclusions
- R. Use thermochemistry to identify unknown substances
- S. Improve estimation, problem solving and calculation skills
- T. Synthesize several pieces of information to determine the course of events
- U. Use the Bohr and quantum structure of the atom to understand flame tests
- V. Use catalytic processes to help speed up analytical tests
- W. Use enzyme functions to understand organic molecular properties
- X. Use chemical indicators properly
- Y. Analyze hair for forensics investigations
- Z. Differentiate between presumptive and conclusive tests

Elizabethtown Area School District

II. Content Major Areas of Study

<u>Unit</u>	<u>Estimated Time</u>	<u>Materials</u>
1. Introduction to Forensic Chemistry	1.5 weeks	Handouts, Whodunit Mystery; Riddle of the Romanovs; Backpack Mystery; Cloth, paper, Misc Items; unwashed worn sweater, shirt, clean socks; 20 various items; volunteer criminals; Bertillonage head Calipers
2. Identifying "Prints"	2.5 weeks	Handouts: 3.02, 3.04, 3.06, 7.01, 7.02, 7.04; Fingerprint types and ID, ridge Characteristics; Superglue fuming Odontology; Shoeprint casting; Crime involving prints. Fingerprint powder, brushes ink, paper, lifting tape; Magnifying glasses; superglue, shoeboxes, foil; styrofoam cups; plaster of paris, chicken wire and forms, baby powder, buckets to mix.
3. Identification of Substances	2 weeks	Handouts: 4.03, 4.04, 4.05, 4.06; ID white substances- talc, baking soda, NaCl, 10X Sugar, CaSO ₄ , cornstarch, Antacid pills, Iron pills, vit pills; ID liquids- HCl, NaOH, nitrates of Ba, Na, Li, K, Al, Pb, Cu, Ni (0.5M); wood splints, Bunsen Burners,
4. Serology and DNA Identification	1.5 weeks	Handouts: 4.01, 7.07, 3.08, 3.09, Renters Beware; Caf caper; raw liver; H ₂ O ₂ , Clear soda, blender, hotplates, test tubes, pipettes, large beaker, beaker tongs, distilled water, Biuret reagent, Benedict's sol'n, iodine, dextrose sol'n, sucrose sol'n, starch sol'n, gelatin sol'n. Blood typing kits
5. Hair and Fiber Analysis	1 week	Handouts: 5.02, animal and human hair of various colors, microscopes, slides, clear fingernail polish
6. Questioned Documents	1 weeks	Handouts: 9.01, 9.02, 9.03; paper samples, ink samples, rubbing alcohol, chrom paper, handwriting samples; It's Magic case
7. Ballistics	1.5 weeks	Handouts: Celebration; filter paper, Conc Sulfuric Acid, Diphenylamine, Na, Pb, Cu nitrates, sodium rhodizonate, acetic acid 15%
8. Entomology used in Forensics	2 weeks	Chicken parts; courtyard; camera, gloves Handouts: 6.02, 6.03, 6.04

9. Famous Cases	On-going every Friday	Lap top computers w/access to Internet
10. Solving Crimes	5 weeks	Student developed crimes/ The Matchbox Case; The Case of the Missing Elephant, The Case of the Stolen Flag and The Case of the Missing Corngod

Elizabethtown Area School District

Name of Course: Forensic Chemistry
 Name of Unit : Introduction to Forensic Chemistry

Essential Question: What does it take to be a Forensic _____?

Unit Objectives/KQs	Priority	Aligned to Course Standard	Aligned to PA Standard
A. Research a Forensic Career from a provided list and report findings to class.	E	B	3.1.12.A, 3.2.10.A, 3.2.10.B, 3.2.12.C, 3.2.12.D
B. Read two mysteries and discuss possible solutions and how forensics could help the case.	I	G, H, I	3.1.12.A, 3.2.10.A, 3.2.10.B, 3.2.12.C, 3.2.12.D
C. Classify various items according to students own guidelines.	E	H, I	3.1.12.A, 3.2.10.A, 3.2.10.B, 3.2.12.C, 3.2.12.D
D. Using evidence collected from a worn shirt and socks worn in different locations, students will draw conclusions about the owner of the shirt and where they walked.	E	C, D, G, Q	3.1.12.A, 3.2.10.A, 3.2.10.B, 3.2.12.C, 3.2.12.D
E. Determine personal observation skills by remembering 20 items and watching a crime occur and reporting observations.	I	D, H, L, T	3.1.12.A, 3.2.10.A, 3.2.10.B, 3.2.12.C, 3.2.12.D
F. Observe physical characteristics and measurements of body dimensions.	C	I, Q	3.1.12.A, 3.2.10.A, 3.2.10.B, 3.2.12.C, 3.2.12.D 3.7.12.C

Elizabethtown Area School District

Name of Course: Forensic Chemistry
 Name of Unit : Identifying “Prints”
 Essential Question: How are “prints” used to identify a person?

Unit Objectives/KQs	Priority	Aligned to Course Standard	Aligned to PA Standard
A. Examine personal fingerprints and determine classification from ridge characteristics.	E	K, P, Y	3.1.12.A, 3.2.10.A, 3.2.10.B, 3.2.12.C, 3.2.12.D
B. Use appropriate techniques to take inked fingerprints and lift latent fingerprints.	E	K	3.1.12.A, 3.2.10.A, 3.2.10.B, 3.2.12.C, 3.2.12.D
C. Identify an unknown fingerprint from ridge characteristics of a known fingerprint.	E	H, P	3.1.12.A, 3.2.10.A, 3.2.10.B, 3.2.12.C, 3.2.12.D
D. Examine personal teeth “prints” (Odontology).	I	H	3.1.12.A, 3.2.10.A, 3.2.10.B, 3.2.12.C, 3.2.12.D
E. Identify an unknown set of teeth “prints” from a known sample.	I	H, P	3.1.12.A, 3.2.10.A, 3.2.10.B, 3.2.12.C, 3.2.12.D
F. Examine and classify footwear prints and determine appropriate methods to lift and preserve these prints.	E	K, I	3.1.12.A, 3.2.10.A, 3.2.10.B, 3.2.12.C, 3.2.12.D
G. Use techniques learned to solve a crime.	E	C, F, H, I, K, P, T, Q	3.1.12.A, 3.2.10.A, 3.2.10.B, 3.2.12.C, 3.2.12.D

Elizabethtown Area School District

Name of Course: Forensic Chemistry
 Name of Unit : Identification of Substances

Essential Question: How are unknown substances identified?

Unit Objectives/KQs	Priority	Aligned to Course Standard	Aligned to PA Standard
A. Use appropriate techniques to identify a white substance.	E	A, E, F, I, Q, R, W, X	3.1.12.A, 3.2.10.A, 3.2.10.B, 3.2.12.C, 3.2.12.D
B. Use appropriate techniques to identify a liquid.	E	A, E, F, I, Q, R, U, W, X	3.1.12.A, 3.2.10.A, 3.2.10.B, 3.2.12.C, 3.2.12.D
C. Use appropriate techniques to distinguish between an antacid, iron pill and vitamin pill.	I	A, E, F, I, Q, R, W, X	3.1.12.A, 3.2.10.A, 3.2.10.B, 3.2.12.C, 3.2.12.D
D. Use techniques learned so far to solve a crime.	E	A, C, H, I, P, Q, R, T, W, X, Z	3.1.12.A, 3.2.10.A, 3.2.10.B, 3.2.12.C, 3.2.12.D

Elizabethtown Area School District

Name of Course: Forensic Chemistry
 Name of Unit : Serology and DNA Identification

Essential Question: How can bodily fluids be used to identify a person?

Unit Objectives/KQs	Priority	Aligned to Course Standard	Aligned to PA Standard
A. Use appropriate techniques to identify a substance as blood or something else.	E	N, Q	3.1.12.A, 3.2.10.A, 3.2.10.B, 3.2.12.C, 3.2.12.D
B. Use appropriate techniques to distinguish between monosaccharides, disaccharides, polysaccharides, and proteins.	E	A, N, Q	3.1.12.A, 3.2.10.A, 3.2.10.B, 3.2.12.C, 3.2.12.D
C. Perform karyotype analysis of a gene sample.	I	A, F, G, H, I, N	3.1.12.A, 3.2.10.A, 3.2.10.B, 3.2.12.C, 3.2.12.D
D. Use techniques learned so far to solve a crime.	E	A, C, E, F, I, N, P, T, W, X,	3.1.12.A, 3.2.10.A, 3.2.10.B, 3.2.12.C, 3.2.12.D

Elizabethtown Area School District

Name of Course: Forensic Chemistry
 Name of Unit : Hair and Fiber Analysis
 Essential Question: How is hair used to identify someone?

Unit Objectives/KQs	Priority	Aligned to Course Standard	Aligned to PA Standard
A. Use appropriate techniques to make a fixed slide to show scales of a hair.	E	F, G, H, I, J, Y	3.1.12.A, 3.2.10.A, 3.2.10.B, 3.2.12.C, 3.2.12.D
B. Use appropriate techniques to mount hairs and fibers for examination under digital microscope.	E	F, G, H, I, J, Y	3.1.12.A, 3.2.10.A, 3.2.10.B, 3.2.12.C, 3.2.12.D
C. Use appropriate techniques to distinguish between a human hair, animal hair and synthetic fiber.	E	F, G, H, I, J, Y	3.1.12.A, 3.2.10.A, 3.2.10.B, 3.2.12.C, 3.2.12.D
D. Use techniques learned so far to solve a crime.	E	A, F, G, H, I, J, Y	3.1.12.A, 3.2.10.A, 3.2.10.B, 3.2.12.C, 3.2.12.D

Elizabethtown Area School District

Name of Course: Forensic Chemistry
 Name of Unit : Questioned Documents
 Essential Question: How are documents authenticated?

Unit Objectives/KQs	Priority	Aligned to Course Standard	Aligned to PA Standard
A. Use appropriate techniques to distinguish between various types of paper.	I	A, H, I, Q,	3.1.12.A, 3.2.10.A, 3.2.10.B, 3.2.12.C, 3.2.12.D
B. Use appropriate techniques to distinguish between various types of ink.	E	A, H, I, Q	3.1.12.A, 3.2.10.A, 3.2.10.B, 3.2.12.C, 3.2.12.D
C. Use appropriate techniques to distinguish between authentic and forged handwritings.	E	A, H, I, Q	3.1.12.A, 3.2.10.A, 3.2.10.B, 3.2.12.C, 3.2.12.D
D. Use techniques learned so far to solve a crime.	E	A, H, I, Q, T	3.1.12.A, 3.2.10.A, 3.2.10.B, 3.2.12.C, 3.2.12.D

Elizabethtown Area School District

Name of Course: Forensic Chemistry

Name of Unit : Ballistics

Essential Question: How can gunshot residue and bullet type be used as evidence?

Unit Objectives/KQs	Priority	Aligned to Course Standard	Aligned to PA Standard
A. Use appropriate techniques to perform a gun shot residue test.	E	A, H, I, O, X, Z	3.1.12.A, 3.2.10.A, 3.2.10.B, 3.2.12.C, 3.2.12.D
B. Use appropriate techniques to determine the type of bullet fired.	E	A, H, I, O, X, Z,	3.1.12.A, 3.2.10.A, 3.2.10.B, 3.2.12.C, 3.2.12.D
C. Use techniques learned so far to solve a crime.	E	A, H, I, O, Q, T, X, Z	3.1.12.A, 3.2.10.A, 3.2.10.B, 3.2.12.C, 3.2.12.D

Elizabethtown Area School District

Name of Course: Forensic Chemistry
 Name of Unit : Entomology used in Forensic Investigations
 Essential Question: How are insects used to determine time of death?

Unit Objectives/KQs	Priority	Aligned to Course Standard	Aligned to PA Standard
A. Observe a decaying piece of meat noting bugs and stages of life cycle.	I	A, C, G, H, M	3.1.12.A, 3.2.10.A, 3.2.10.B, 3.2.12.C, 3.2.12.D
B. Study the life cycle of various bugs and investigate how these are used in determining the time of death.	I	A, C, G, H, M	3.1.12.A, 3.2.10.A, 3.2.10.B, 3.2.12.C, 3.2.12.D
C. Investigate other bugs that are living on our skin and around us.	C	A, C, G, H, M	3.1.12.A, 3.2.10.A, 3.2.10.B, 3.2.12.C, 3.2.12.D
D. Use techniques learned so far to solve a crime.	I	A, C, G, H, I, M, P, Q, T,	3.1.12.A, 3.2.10.A, 3.2.10.B, 3.2.12.C, 3.2.12.D

Elizabethtown Area School District

Name of Course: Forensic Chemistry

Name of Unit : Famous Cases

Essential Question: How has Forensic Science been used to solve high profile cases?

Unit Objectives/EQs	Priority	Aligned to Course Standard	Aligned to PA Standard
A. Research famous criminal cases and determine how forensics was used to solve the case and how modern forensics could be used.	E	G, H	3.1.12.A, 3.2.10.A, 3.2.10.B, 3.2.12.C, 3.2.12.D

Elizabethtown Area School District

Name of Course: Forensic Chemistry

Name of Unit : Solving Crimes

Essential Question: How are the basic forensic techniques used to solve a crime?

Unit Objectives/KQs	Priority	Aligned to Course Standard	Aligned to PA Standard
A. Use techniques learned so far to solve various crimes designed by students and the instructor.	E	A - Z	3.1.12.A, 3.2.10.A, 3.2.10.B, 3.2.12.C, 3.2.12.D

Elizabethtown Area School District

III. Course Assessments

Check types of assessments to be used in the teaching of the course.
(Provide examples of each type.)

- | | |
|--|---|
| <input checked="" type="checkbox"/> Objective Tests/Quizzes
<input type="checkbox"/> Constructed Responses
<input type="checkbox"/> Essays
<input checked="" type="checkbox"/> Reports
<input checked="" type="checkbox"/> Projects
<input type="checkbox"/> Portfolios
<input checked="" type="checkbox"/> Presentations
<input checked="" type="checkbox"/> Performance tasks
<input checked="" type="checkbox"/> Lab Activities | <input type="checkbox"/> Response Journals
<input type="checkbox"/> Logs
<input checked="" type="checkbox"/> Computer Simulations
<input type="checkbox"/> Research Papers
<input checked="" type="checkbox"/> Class Participation
<input type="checkbox"/> Notetaking
<input type="checkbox"/> Daily Assignments
<input type="checkbox"/> Writing Samples
<input type="checkbox"/> _____ |
|--|---|

Provide copies of common assessments that will be utilized for all students taking this course. Overall course/grade level standards will be measured by a common course assessment. Unit objectives will be measured on an ongoing basis as needed by the classroom teacher to assess learning and plan for instruction. List common assessments below and recommended date/time frame for administration (at least quarterly).

<u>Name of Assessment</u>	<u>When given?</u>
1. Unit Tests	At the conclusion of each major unit
2. Final Exam	At the conclusion of the semester
3. Lab Reports	At the conclusion of a lab
4. Crime Scene Reports	At the conclusion of solving a case

Elizabethtown Area School District

IV. Expected levels of achievement

Current grading scale:

A ⁺	98 – 100
A	95 – 97
A ⁻	92 – 94
B ⁺	89 – 91
B	86 – 88
B ⁻	83 – 85
C ⁺	80 – 82
C	77 – 79
C ⁻	74 – 76
D ⁺	71 – 73
D	68 – 70
D ⁻	65 – 67
F	64 – 0

PA Proficiency Levels
Advanced Proficient
Basic Below Basic

Attach rubrics, checklists, or other documentation noting how levels of proficiency will be determined for common assessments. The following scoring documents have been developed for this

course:

CRIME SCENE GRADE

NAME _____

Assessment	Points earned	Points possible
Collection of evidence		70 pts.
All evidence collected		10 pts
Clues analyzed and explained 5pts / clue		20 pts
Quality of evidence – preservation, log, chain of custody		10 pts
Identifying / Testing		
Fingerprints – 10 labeled characteristics		10 pts
Hair – identify using digital microscope taking 2 matching pictures		10pts
Questioned documents –ink analysis		10pts
Use of warrants		5 pts
Self report		10 pts
Crime report with evidence log		40 pts
TOTAL		125PTS