FORENSIC SCIENCE: FINAL EXAM REVIEW

There will be ~60 multiple choice for seniors (~100 for undergrads). As mentioned at the start of the year, this exam is NOT open note. However, it will cover basic understanding of the material. If you can successfully answer the questions below, you should be fine for the exam. Spring Semester ONLY can be completed for 10 points toward your final exam (you should still have everything from the midterm!)

The following topics are covered:

Intro to Forensic Science and History
Laws in Forensic Science
Observation
The Crime Scene
Physical Evidence
Impressions
Forensic Pathology
Forensic Entomology
Forensic Anthropology
Explosives
Arson
Ballistics
Document Examination
Hairs/Fibers
Serology
Rape Evidence
Heredity/DNA
Forensic Chemistry/Toxicology

Fall: (should have completed at that time; I've eliminated items that I cannot test on due to time limitations; guaranteed topics from the Fall have been put into bold. That doesn't mean the other items will not be tested on, but you WILL have questions on those in bold)

Unit 1: Intro to FS and History, Law

1. What is Forensic Science?
2. ~~Criminalistics vs. Criminology~~
3. Know the contributions of each to the history of Forensic Science:
    a. Calvin Goddard
    b. Francis Galton
    c. Mathieu Orfila
    d. Alphonse Bertillon
    e. ~~Sherlock Holmes and Sir Arthur Conan Doyle~~
    f. Locard
    g. Karl Landsteiner
    h. Sir Alex Jeffrys
    i. ~~Leone Lattes~~
    j. ~~Yi Yu Ji~~
4. Why did anthropometry fail? What was it replaced with?
5. How and why is the scientific method used in Forensic Science?
6. Know how to apply Locard's Exchange Principle
7. What is the CSI effect?
8. ~~What types of evidence do the crime labs at the DEA, ATF, USPS, FBI examine? Do they specialize?~~
9. Know the responsibilities (types of evidence they study) of the different Forensic units: Physical Science, Biology,Firearms, Questioned Document, Photography, Toxicology, Latent Fingerprint, Polygraph Unit, Voice Print, CSI, Forensic psychiatry, odontology, entomology, pathology, engineering, anthropology and computer/digital analysis.

Laws

10. ~~What is the constitution?~~
11. What is the difference between civil and criminal laws?
12. ~~What are administrative, equity, statutory, and common laws?~~
13. ~~What is double jeopardy?~~
14. ~~What happened in *Miranda v Arizona* and what was the impact on Forensic Science? What amendments were involved?~~
15. ~~Why do Forensic Scientists even need to know about laws?~~
16. ~~What is the difference between a felony and misdemeanor?~~
17. ~~What is an arraignment?~~
18. ~~What are the facets of guilt? (MMO)~~
19. What is an expert witness? How do they different from a lay witness?
20. What does it mean when something is probative? Material?
21. How did the Frye Standard affect admissibility of evidence?
22. How did the Daubert Ruling affect admissibility of evidence?
23. How did the *Kumo Tire v Carmichael* affect admissibility of evidence?
24. How did the *Copollino v State* affect admissibility of evidence?
25. ~~What are the three elements needed in order for something to be ruled a crime (and thus, something that is prosecutable?)~~
26. Who is the prosecutor/prosecution? Who is the defendant/defense?

Observation

27. What is observation?
28. What is an inference?
29. What is a lay witness? What can affect what they remember?
30. Are lay witnesses accurate? Why?
31. What is the Innocence Project?
32. What is the Cross Race Effect?
33. ~~How does face recognition work? Make sure you understand what the numbers mean from the facial recognition lab.~~

Unit 2: Crime Scene Investigation

34. What are the differences between circumstantial, demonstrative, direct, physical evidence?
35. What are transient, pattern, conditional, transfer, associative evidence? Be able to recognize examples.
36. How is evidence classified by nature?
37. What is the difference between individual and class evidence? (know individual and class characteristics of EVERY type of evidence we've covered)
38. Know how to use the product rule. What is its purpose?
39. Why does class evidence have any value?
40. Know the 7 Ss (recording the scene of a crime: note taking, photos (what to photo and how), sketches: what to include, etc) and what happens at each stage.
41. Responsibilities of the first officer on the scene
42. When can you search without a warrant?

Physical Evidence

43. physical evidence vs eyewitness testimony
44. chain of custody – what is it and why is it necessary

45. Proper collection techniques including personal protective gear, forceps, and packaging for specific types of evidence (bindle, paper vs plastic, arson, biological samples, etc.)
46. Experimental controls: positive and negative controls, substrate controls, known standards, etc.

Unit 3: Death: Pathology, Entomology and Anthropology

47. What is death?
48. livor mortis –including time line and how it's used to show foul play
49. rigor mortis – including time line and why it disappears
50. algor mortis – including time line and calculation
51. eye – changes and time line
52. How are stomach contents used to determine time of death? - know time line
53. PMI: define and how to determine age using maggots. How are they used to determine foul play?
54. Forensic anthropology – what is it. When is it used?
55. How to tell age with a skeleton – what other information can you get from bones? Know how to use the tables to determine height.
56. 5 manners of death (Remember SHAUN the sheep)
57. Cause of death
58. Mechanisms of death
59. what influences the rate of a cooling dead body
60. autopsy
61. Stages of decomposition– know basics of what happens in each stage.

Unit 4: Fingerprints and other Impressions:

62. Categories of prints (latent, patent, plastic)
63. What are impressions? What are the different types of impressions?
64. What unit is responsible for examining the following evidence…fabric impressions? Tire impressions? Lip prints? Dental impressions? Foot prints?
65. What makes a fingerprint? Why do we leave prints behind?
66. What are ridges/valleys? Minutiae?
67. Be able to identify a print and classify its shape (central pocket whorl, tented arch, etc)
68. What about a fingerprint is class? Individual?
69. What are the techniques for isolating patent and plastic fingerprints?
70. What are the techniques for isolating latent fingerprints? What do they interact with within the print?
71. How are fingerprints unique to everyone?
72. What is ELD? Briefly describe how a forensic scientists would use this technique.
73. What is the first step to collecting a foot (or any) visible print?
74. Briefly describe how a forensic scientists collects: a bloody footprint, a tire print in snow, a dusty impression on a granite floor.
75. What relationship exists between shoe size, foot length, and height? (we've used the basic premise elsewhere)
76. What information can forensic scientists obtain from a shoe print? Why are they often overlooked?
77. What class evidence can you get from shoe prints? What can individualize a shoe print?
78. When comparing evidence, what information do you need?
79. What database do you need to look for shoe prints?
80. Know how to predict someone's height from their shoe size.
81. What is the difference between a suspect tire and an elimination tire?
82. What class evidence can you get from tire prints? What can individualize a tire print?

83. What is cheiloscopy?
84. What are the basic lip patterns?
85. Are lip prints individual or class evidence?
86. How can TLC be used when examining a lip print?
87. What information can you obtain from a bite mark?
88. How can bite marks be individualized?
89. Why do bite marks on either extreme (i.e. just bruising on one end and lacerated skin on the other) provide low forensic value?

Unit 5: Arson, Explosives, Ballistics

90. What is fire?
91. Describe the various burn indicators (color of flame, color of smoke, chimney effect, V-pattern, burn pattern, heat shadow, glass)
92. What is a point of origin? How is determined?
93. Define accelerant, fire triangle (and each component), substrate control, ignition device, plant
94. How do fire investigators differentiate between accident and arson?
95. How is arson evidence packaged?
96. How are the following techniques used in arson investigations: gas chromatography, infrared spectrophotometry, ultraviolet fluorescence
97. How does an explosion differ from a fire?
98. Define: shock wave, low explosive, high explosive, primary explosive, secondary explosive.
99. How are the following techniques used in explosion investigations: Greiss reagents, TLC, infrared spectrophotometer, gas chromatography/mass spectroscopy
100. What are the difference between fission and fusion nuclear weapons?
101. What causes a bullet to be propelled by a gun?
102. What are the components of a cartridge?
103. What is rifling? How is a rifling pattern used to identify a gun? How is it detected? Is it class or individual evidence? Define grooves and lands.
104. What are the different types of long guns and handguns? How do you tell them apart?
105. What is caliber? Trajectory?
106. Describe fire pin impressions, breechblock marks, ejector marks. Are they individual or class characteristics?
107. What databases are available to ballistics investigators?
108. Describe the difference between entrance and exit wounds.
109. What tests are used to look for gunshot residue?
110. Describe packaging of ballistic evidence.

Spring Semester:

Unit 7: Document Examination, Hairs and Fibers

111. What is the difference between a questioned document and an exemplar?
112. What is an obliteration, alteration, erasure, and indented writing? What techniques are used to analyze each?
113. What is forgery and fraudulence?
114. Why is every person's hand writing different?
115. What are the types of forgery?
116. How did *Gilbert v. California and* United *States v Mara* impact forensic science? What amendments to the Bill of Rights were affected by each verdict?

117. What type of light does the VSC produce for infrared luminescence? What type of light is coming OFF the ink dyes during this test that the VSC will collect?
118. How is infrared reflectance different from infrared luminescence? What is infrared reflectance used for?
119. Described ESDA
120. What is TLC? How is it used in document examination? Can you calculate Rf?
121. How can the date of a document be authenticated? (still not definite, but what analysis would they use?
122. What is presumptive vs conclusive evidence?
123. What part of hair is class? Individual?
124. What are the 3 stages of hair growth?
125. What are the cuticle, cortex, medulla, and follicular tag?
126. How do you tell the difference between human and animal hairs?
127. How do you tell the difference between hairs and fibers?
128. How can forensic scientists determine when someone last dyed or bleached their hair?
129. What information can you determine from someone's hair? Ex. Sex? Age? Etc.
130. What are fibers, yarn, fabric (definitions)?
131. What is cross-transfer? Direct transfer? Secondary Transfer? Tertiary Transfer?
132. How do you tell the difference between natural and manufactured fibers (microscopically and burn tests)
133. What is a Becke Line
134. How is infrared light used to identify fibers?

Unit 6: Serology and Rape

135. Define gene, chromosome, allele (heterozygous vs homozygous), dominant vs recessive vs codominant, genotype vs phenotype.
136. How is blood type inherited? (ABO and Rh Punnett Squares)
137. Who determined that there are multiple blood types and Rh?
138. What tests are used to uncover latent or old blood? What are the benefits or problems with these tests?
139. What test is used to determine if something is blood? What are the limitations of these tests?
140. What tests are used to determine origin? How do they work? What are the limitations of these tests?
141. What is the antibody/antigen response?
142. Know how blood typing works. What antigens does each blood type have? What antibodies? What would an agglutination test look like for each blood type? What blood types can safely accept/donate to each blood type?
143. What are the cells that make-up our blood? What is the problem with most of the cells? Which one can be used to individualize a person?
144. How is blood evidence packaged?
145. When do you see satellites vs spines? How does blood spatter help with reconstruction?
146. How do you use blood spatter to determine point of origin? A weapon?
147. Understand how the shape of the spatter changes based on how it falls/angle of impact.
148. What are the presumptive tests for rape evidence? What are they testing for?
149. How is sperm identified? What are potential problems as to why you wouldn't find sperm?
150. What are the confirmation tests for semen?
151. How is evidence collected and packaged for a rape victim vs rape suspect?

152. Understand the time line for rape evidence collection.
153. Be prepared to interpret tests from any of the tests for this unit!

Unit 8: DNA Fingerprinting

154. What 3 parts make-up DNA?
155. Why do scientists use introns instead of exons for DNA fingerprinting? What is an STR vs VNTR? Why are they important to DNA fingerprinting?
156. Who determined that DNA could be individualized to 1 person? What is the exception to individualizing to 1 person?
157. What information can you get about parentage from nuclear DNA? What information can you get from parentage from mitochondrial DNA? What DNA is used for DNA fingerprinting?
158. Be prepared to read a DNA fingerprint for matching parents as well as tissue matching of a crime scene.
159. How is DNA evidence collected and packaged?
160. What is PCR? What are the steps? What occurs at each step? What is a primer? How do they match up to the template? What is the rate of DNA amplification?
161. What is multiplexing? How is it different than traditional PCR?
162. What gene is used to determine the sex of a person?
163. What is RFLP? (Remember…can be done instead of PCR or after PCR)
164. How does electrophoresis work to separate DNA? Where do large pieces go relative to the loading wells? What should you always run with a sample?
165. What is the DNA database? What DNA is put into this database?

Unit 9: Forensic Chemistry and Forensic Toxicology

166. Define psychological and physical dependence. What is withdrawal?
167. What is the difference between a controlled substance and an illegal substance? What is a drug?
168. What are the categories of illegal drugs? Know the basic impact on the body for each category.
169. What is the Controlled Substance Act? Compare/contrast Schedule I and Schedule II drug? How are Schedule III-V different from I and II?
170. Forensic drug analysis – understand if each SCREENS OR CONFIRMS the identify of a drug.
    A. Screening test vs confirmation test
    B. Color tests
        i. Microcrystalline tests
        ii. Chromatography
            a. Thin-layer chromatography – Importance of Rf.
            b. Gas chromatography – retention time
        iii. Spectrophotometry
            c. UV/Vis Spectrophotometry
            d. Mass Spectrophotometry (GC/Mass spec)
            e. Infrared spectrophotometry

171. What is the difference between a forensic chemist and a forensic toxicologist?
172. What is the difference between an intoxicant, poison, and toxin?
173. What is the difference between intentional, deliberate, and accidental poisoning?

174. Who is the Father of Toxicology?
175. What is the difference between metabolic and functional tolerance?
176. What is biotransformation/metabolism? How are metabolites related?
177. How are toxic substances classified? What can affect toxicity of a compound? What is LD50?
178. What are the steps of metabolism?
179. What samples are collected for toxicological analysis?
180. What is the Reinsch test? Is it presumptive or confirmatory?
181. What is atomic absorption spectrophotometry? Is it presumptive or confirmatory?
182. What is TLC? Can you calculate Rf? Is it presumptive or confirmatory?
183. What is gas chromatography? Is it presumptive or confirmatory?
184. What are immunoassays?
185. What is mass spectrometry? Is it presumptive or confirmatory?
186. Be prepared to interpret data from any of the tests that we've covered this unit!
187. How does the amount of alcohol in the breath relate to what's in the blood?
188. Know how to use the equation to calculate BAC
189. What factors affect BAC?
190. Understand how the breath tests work: Breathalyzer, Fuel Cell, and Infrared.
191. What is the Implied-Consent Law?
192. What is the legal limit of BAC?
193. How did *Schmerber v. California* impact cases involved BAC? Know the amendments involved.