Board/Authority Authorized Course Framework

School District/Independent School Authority Name: Nanaimo-Ladysmith Public Schools – Sd68	**School District/Independent School Authority Number (e.g. SD43, Authority #432):**
Developed by: Eric Cizeron	**Date Developed:** June 2024
School Name: Nanaimo District Secondary School	**Principal's Name:** Ricki Bartlett
Superintendent Approval Date (for School Districts only):	**Superintendent Signature (for School Districts only):**
Board/Authority Approval Date:	**Board/Authority Chair Signature:**
Course Name: Forensic Science 11 Immersion	**Grade Level of Course:** 11
Number of Course Credits: 4	**Number of Hours of Instruction:** 120

Board/Authority Prerequisite(s):

None – Science 10 Recommended

Special Training, Facilities or Equipment Required:

- Science lab.
- General Laboratory equipment (Microscopes, Glassware…)
- Recommended forensic equipment (Fingerprint powder, mock-blood, paper chromatography…)

Course Synopsis:

Forensic Science is the use of scientific method, physical evidence, deductive reasoning, and their interrelationships to gain knowledge of the events leading to the commission of a crime. This course will give students a chance to gain and apply knowledge from the areas of history, math, biology, chemistry, physics, earth science, archeology, anthropology, law, medicine, and professional/technical writing. We will examine some of the basic principles and knowledge that guides forensic laboratory processes, such as DNA testing, toxicology, and material analysis. Technics such as microscopy, chromatography, entomology, mineralogy, and spectroscopy will be examined. This course will include a series of inquiry labs, discussion of case studies, field trips and guest speakers, internet research and practical labs that will allow students to strengthen skills of observation, interpretation, reasoning, and formal presentation.

Goals and Rationale:

Providing student choice is a key understanding of the new curriculum in BC. This choice needs to go beyond choosing the type of projects or assignments within a course to include choosing entire course that interest or intrigue students.

Forensic Science 11 will allow students to fully understand what becoming a forensic scientist entails and to discover areas of interest and potential career opportunities. Forensic Science is a field of study that involves the integration of many of the courses offered at our school, including but not limited to biology, chemistry, earth science/geology, physics, and some history (law and general history of forensic science). By affording students an opportunity to take this course, it is hoped that they will become more motivated and interested in looking into the other fields of science. Through insight into the fields associated with Forensic Science, students should be assisted in determining their potential career goals including future choices of careers in Law enforcement or post-secondary education in the sciences. Students will gain valuable and practical experience for future education, training, and careers.

Aboriginal Worldviews and Perspectives:

- **Learning involves patience and time**: The structure of the course is centered on a collaborative learning environment. This will require students to make connections and organize their knowledge. Reflection on their own performance will be encouraged in order to further their own learning.
- **Learning is embedded in memory, history, and story**: The structure of this course will connect the learner to the stories of other communities and people.
- **Learning requires exploration of one's identity:** Through the learning process students are encouraged and asked to always return to their own unique experience. They will learn their strengths, challenges and their innate abilities and capacity to learn.
- **Learning ultimately supports the well-being of the self, the family, the community, the land, the spirits, and the ancestors:** This principle will be supported by providing multiple access points for students to learn. The students will also be able to represent their learning in various ways.

Course Name: Forensic 11 Immersion **Grade:11**

BIG IDEAS

Forensic science can be broken down into several specialized areas including entomology, anthropology, toxicology, etc.…	Forensic science was developed in many different cultures and stretches back many centuries.	Forensic Scientists collect and analyze data and biological evidence and pay close attention to differences or discrepancies.	Forensic scientist use technology to assist in the analysis of evidence.

Learning Standards

Curricular Competencies	Content
Students are expected to do the following: **Questioning and predicting** • Demonstrate a sustained intellectual curiosity about a scientific topic or problem of personal, local, or global interest. • Make observations aimed at identifying their own questions, including increasingly abstract ones, about the natural world. • Formulate multiple hypotheses and predict multiple outcomes. **Planning and conducting** • Collaboratively and individually plan, select, and use appropriate investigation methods, including field work and lab experiments, to collect reliable qualitative and quantitative data. • Assess risks and address ethical, cultural, and/or environmental issues associated with their proposed methods. • Use appropriate SI units and appropriate equipment, including digital technologies, to systematically and accurately collect and record data. • Apply the concepts of accuracy and precision to experimental procedures and data:	*Students are expected to know the following:* **History of forensic science, criminal law and crime scene investigation techniques:** • Examine the history of forensic science. • Know the role of Forensic scientist in the aftermath of a crime. • Understand the essential elements of Canadian criminal law governing evidence found at the crime scene. • Distinguish between individual evidence and class evidence. • Demonstrate basic techniques used by forensic scientists to collect evidence and documenting a crime scene. • Understand how evidence is preserved. • Explain the **Locard Exchange Principle**. • Discuss careers available in the field of forensic science and training required for each.

Processing and analyzing data and information

- Experience and interpret the local environment.
- Apply First Peoples perspectives and knowledge, other ways of knowing, and local knowledge as sources of information.
- Seek and analyze patterns, trends, and connections in data, including describing relationships between variables, performing calculations, and identifying inconsistencies.
- Construct, analyze, and interpret graphs, and/or diagrams.
- Use knowledge of scientific concepts to draw conclusions that are consistent with evidence.
- Analyze cause-and-effect relationships.

Evaluating

- Evaluate their methods and experimental conditions, including identifying sources of error or uncertainty, confounding variables, and possible alternative explanations and conclusions.
- Describe specific ways to improve their investigation methods and the quality of their data.
- Demonstrate an awareness of assumptions, question information given, and identify bias in their own work and in primary and secondary sources.
- Consider the changes in knowledge over time as tools and technologies have developed.
- Connect scientific explorations to careers in science.
- Exercise a healthy, informed skepticism and use scientific knowledge and findings to form their own investigations to evaluate claims in primary and secondary sources.
- Consider social, ethical, and environmental implications of the findings from their own and others' investigations.
- Critically analyze the validity of information in primary and secondary sources and evaluate the approaches used to solve problems.
- Assess risks in the context of personal safety and social responsibility.

Forensic biology

- Fingerprinting:
    - Apply physical and chemical methods to develop **latent prints**.
    - Know the basic properties of fingerprint identification.
    - Use points of identification to compare fingerprints.
    - Recognize and classify ridge patterns (loops, whorls, and arches)

- Blood analysis:
    - Explain the **ABO / Rh classification system**.
    - Determine the blood type of a simulated bloodstain.
    - Analyse blood stain patterns.

- DNA fingerprinting:
    - Explain what DNA is and how it uniquely identifies an individual.
    - Isolate and extract DNA from a sample.
    - Describe the process of **electrophoresis**.
    - Analyse and compare **autoradiograms**.

- Hair analysis:
    - Describe the structure of a hair using a compound microscope.
    - Compare and contrast human and animal hair specimen.

Toxicology and drugs

- Provide examples of drugs, toxins and poisons and their effects.
- Describe the role of a toxicologist in analysing substance evidence.

Applying and innovating • Contribute to care for self, others, community, and world through individual or collaborative approaches. • Co-operatively design projects with local and/or global connections and applications • Contribute to finding solutions to problems at a local and/or global level through inquiry. • Implement multiple strategies to solve problems in real-life, applied, and conceptual situations. • Consider the role of scientists in innovation. **Communicating**. • Communicate scientific ideas and information, and perhaps a suggested course of action, for a specific purpose and audience, constructing evidence-based arguments and using appropriate scientific language, conventions, and representations. • Express and reflect on a variety of experiences, perspectives, and worldviews through place.	• Present the technology behind testing drugs (**IR, UV-VIS spectroscopy GC-MS analysis)** and explain its use in forensic science. • Describe how people get exposed to environmental toxin and describe their effects on the body. • Discuss the use of screening tests and confirmatory tests in criminal investigations. **Forensic of non-biological evidence** • Interpret pieces of evidence such as trace evidence, soil and glass found on the crime scene. • Use a **topographic map** to determine the location of a soil sample. • Classify **lip prints.** • Design and carry out an experiment in **thin-layer chromatography.** • Compare chips from hit-and-run car accidents. • Use impressions to classify tools, shoes, and tire tracks. • Understand the correlation between shoe size to heigh using statistical analysis. • Create a criminal profile using garbage (Lab) **Forensic ballistic** • Understand what ballistic evidence is, why it can be very useful and how it is produced. • Demonstrate a knowledge of the basic types of firearms. • Perform ballistic fingerprinting to distinguish features unique to each firearm. • Analyze bullet trajectory to determine the position of the shooter.

	• Understand the importance of testing gunpowder residue on suspect and their clothing and on the victims as it can provide information on the position of the suspect during the shooting. **Entomology** • Describe several ways forensic entomology is used to help in the solving of crimes. • Know which insects and arthropods are common pieces of evidence in criminal investigations. • Differentiate between complete and incomplete metamorphosis, larva, pupa, and maggots. • Compare and contrast the four stages of blow fly metamorphosis and describe their significance to forensic entomology. • Describe the effect of different environmental factors on insect development. • Describe the 5 stages of decomposition. • Relate the process of insect succession to changes in the environment as decomposition occurs. **Anthropology** • Study a human skeleton to determine gender, age range, height, and race. • Discuss the significance of isotopes in determining where someone lived. • Provide examples of different types of skeletal trauma due to disease, injuries, occupation, or environmental factors that can provides clues to the identification of skeletal remains.

	Death: manner, mechanism, and cause • Distinguish between **cellular death and death of an organism.** • Distinguish between the manner, cause, and mechanism of death. • Outline the sequence of events that occurs in the first minutes after death. • Predict time of death using **rigor mortis, algor mortis, livor mortis**, stomach content and stages of decomposition. • Describe the procedure of an autopsy and provide examples that can be used to help establish manners, mechanisms, and cause of death. • Compare and contrast the role of medical examiners and coroners

Big Ideas – Elaborations

Forensic science was developed in many different cultures and stretches back many centuries.
Sample questions to support inquiry with students:

- What is the history of forensic science and how has this area of study evolved over time?
- How is the scientific method used in Forensic science?
- How can culture affect the perspective on forensic science?

Forensic science can be broken down into several specialized areas including entomology, anthropology, toxicology, psychology etc.…
Sample questions to support inquiry with students:

- What are the basic of forensic entomology, anthropology, toxicology?
- How forensic psychology can be used in criminal profiling?
- How the workings of the human mind is essential to all aspects of crime and criminality?
- How are chemistry and biochemistry closely intertwined with forensic science?
- How do the substances you ingest or use on your body can affect your metabolism and behaviour?

Forensic Scientists collect and analyze data and biological evidence and pay close attention to differences or discrepancies.
Sample questions to support inquiry with students:

- How to perform scientific observations and what is the proper procedure to collect evidence?
- *How are Impression Evidence, Trace Evidence, Ballistics, and Arson Evidence used in Crime Scene Reconstruction?*
- How can different types of evidence help characterize death as to manner, mechanism, and cause?

Forensic scientist use technology to assist in the analysis of evidence.
Sample questions to support inquiry with students:

- How different technologies can contribute to solve crime?
- How does DNA fingerprinting work and what types of crime it can help solve?

Content – Elaborations

Locard Exchange Principle: Is the rule that the perpetrator of a crime will bring something into the crime scene and leave with something from it, and that both can be used as forensic evidence.

latent prints: Is an impression of the friction skin of the fingers or palms of the hands that has been transferred to another surface.

ABo / Rh classification system: The classification of human blood based on the inherited properties of red blood cells as determined by the presence or the absence of the antigens A and B, which are carried on the surface of the red cells/

Process of Electrophoresis: Is the technique used in the lab to separate charged molecules, like DNA, according to size.

Autoradiograms/Autoradiographs: A technique using X- ray film to visualize molecules or fragments of molecules that have been radioactively labeled.

IR, UV-VIS spectroscopy GC-MS analysis:

Topographic map: Is a type of map that is characterized by large-scale detail and quantitative representation of relief, usually using contour lines.

Lip prints: The pattern of wrinkles on the lips has individual characteristics like fingerprints. Cheiloscopy is a forensic investigation technique that deals with identification of humans based on lips traces.

Paper Chromatography: Is an analytical method used to separate colored chemicals or substances based on the differential solubility in the stationary phase and mobile phase (solvent).

Cellular Death and Death of an organism: Cellular death happens when the cell stops from performing its biological functions. As a result, it swells up and it leaks its content to the external environment. Death of the Organism: This occurs when all of the cells in an organism die and they do not function anymore.

Pallor Mortis, Rigor Mortis, Algor Mortis, Livor Mortis: After death, there are four stages, called postmortem stages. The first stage is pallor mortis, where the skin pales due to blood pooling. The second stage is algor mortis, where the body cools over time. The third stage is rigor mortis, where muscles stiffen and contract. The fourth stage is livor mortis, where areas of pooled blood begin to take on a bruised-like discoloration.

Recommended Instructional Components:

- Direct instruction
- Guest speakers
- Co-operative learning opportunities
- Traditional Laboratories
- Inquiry laboratories
- Case studies
- Peer teaching

Recommended Assessment Components: Ensure alignment with the Principles of Quality Assessment

Students' progress will be assessed by using the triangulation of assessment, which allows the teacher to collect evidence of student learning from 3 sources: Conversations, Observations, and products.

The following Principles of Quality Assessment will be applied:

- Assessment is ongoing, timely, specific, and embedded in day-to-day instruction.
- Students are involved in assessment and feedback.
- Assessment focuses on all the 3 components of the curriculum model: Knowing, Doing, and Understanding
- Assessment provides ongoing descriptive feedback to students.

Students will play an active role throughout all the stages of assessment to ensure that they feel ownership of their work and to hear and provide feedback about how they are doing and what to do next in order to improve.

Students Assessment for this course will include:

- Self-evaluation on assignments
- Peer evaluation of group projects
- Self-reflections

Teacher Assessment for this course will include:

- Laboratories and inquiry laboratories
- Projects and research assignments
- Lesson quizzes and unit tests
- Presentations

Learning Resources:

May include but not limited to:

- *Introductory Forensic Science Teacher Resource Manual*, Kowalyk, Audri; Kowalyk, Apollo; and Christensen Susanne, 2002.
- *Advanced Forensic Science Teacher Resource Manual*, Kowalyk, Audri; Kowalyk, Apollo; and Christensen Susanne, 2003.
- *Introductory to Crime Case Studies*, Kowalyk, Audri; Kowalyk, Apollo; and Christensen Susanne, 2006.

- *Forensic Science, an introduction*, by Richard Saferstein, Second Edition, 2011. Pearson Education Inc. ISBN 13#978-013-507433-6.

Recommended readings:

- *Molecules of Murder-Criminal Molecules and Classic Cases*, John Emsley, 2008. RSC Publishing. ISBN #978-0-85404-965-3
- *Forensic Science*, Andrew Jackson and Julie Jackson, 2004. Pearson Education Ltd. ISBN #0-13-043251-2
- *Practical Skills in Forensic Science,* Alan Langfor, John Dean, Rob Reed, David Holmes, Jonathan Weyers and Allan Jones. Pearson Inc. ISBN #013-114400-6.