| **Science**  **Year 12 Forensic Science** | **Unit 4** |  |  |  |
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| **Lesson/Learning Sequence** | **Intended Knowledge:**  *Students will know that…* | **Tiered Vocabulary** | **Prior Knowledge:**  *In order to know this students, need to already know that…* | **Assessment** |
| **Lesson:**  **Learning Aim A**  **Processing a crime scene chain of custody** | * Students will know that a crime scene must be restricted, both to the scene and access. This can be done by using police tape, vehicles, police officers, forensic tents and a cordon log. The scene must be observed and recorded by making a crime scene notes, videography, photography and sketches. Students will be able to know how to limit contamination of the crime scene. |  | * ***Students need to already know that police are present at crime scenes to prevent any hazards and search for evidence*** |  |
| **Lesson:**  **Learning Aim A**  **Processing a Crime Scene Search Patterns** | * Students will be able to identify which search patterns is necessary for each scene. In the quadrat method the crime scene is virtually divided into different zones. The number of zones depends upon the size and complexity of the crime scene. This method can be applicable to both indoor and outdoor crime scene. The lane method the virtual strips or line are being imagined to walk through on the crime scene and look for the evidences. The method is well suited for the crime scene like class rooms, where rows are present already, each row can be considered as a strip. The grid will be done with two people can do the searching walking through on separate strips and then will switch their strips for the more accuracy. It is a good method for large indoors and outdoors crime scenes. The spiral is well suited for larger indoor and outdoor crime scene with less obstacles (like furniture etc.). The searcher will start either from the centre of the room (outward) or from the periphery (inward) search as show in the images below. The wheel method is only applicable to the lager outdoor scenes like fields, desert, or other such open areas. It is like the zonal method; however, the wheel is divided into various zones depending upon the size of the crime scene. Different individuals will be employed in separate zones and then switching their zone for more accuracy. |  | * ***Students need to already know that evidence needs to be collected from the crime scene by the police*** |  |
| **Lesson:**  **Learning Aim A**  **Risk assessments, Health & Safety** | * Students will know the 'Health and Safety at work etc. Act 1974' to be Employers must protect the 'health, safety and welfare' at work of all their employees, as well as others on their premises, including temps, casual workers, the self-employed, clients, visitors and the general public. Students will know that COSHH is control of substances hazardous to health. Students will know that management of health and safety at Work Regulations 1999: require employers to carry out risk assessments, plan to implement necessary measures, appoint competent people and arrange for appropriate information and training. Students will be able to state some personal protective equipment (PPE) and when they would be required in various scenarios such as; crime scenes, fire scenes, hospital visits etc. |  | * ***Students need to already know that PPE can be used for health and safety purposes as they will have had experience of using face masks throughout the pandemic.*** |  |
| **Lesson:**  **Learning Aim A**  **Labelling & packing of evidence** | * Students will know that there are different forms of labelling & packaging techniques used for evidence collection at a crime scene. Paper bags are used for clothing samples. The samples will be dried prior to being stored in the bag if possible, otherwise the sample will be put in wet (as plastic will cause mould growth). Plastic bags are used for evidence that needs to be readable, for example; letters, credit card numbers etc. Nylon bags are used for accelerants as it can seep through the plastic. Evidence tubes are used to store sharp objects and secured so that the object cannot move. |  | * ***Students need to already know that evidence from the crime scene needs to be collected and can be analysed for use in court.*** |  |
| **Lesson:**  **Learning Aim A**  **Recovery fingerprints** | * Students will know that fingerprints are unique to every human. Fingerprints are formed due to the move of amniotic fluid and environmental factors. Students will also know that fingerprints change throughout your life due to cuts/scarring, therefore new fingerprints are taken upon arrest every time. |  | * ***Students need to already know that fingerprints have different patterns.*** |  |
| **Lesson:**  **Learning Aim A**  **Recovery of trace materials - fibres** | * Students will know how to recover to recover trace materials by using the following methods. Casting is used when it is not possible to collect the entire item (3D impression is taken). Swabbing is used to collect unidentifiable residue, it is important that the swab is free of contamination before use. Large items may be collected by hand, as long as there are steps taken to ensure there is no cross-contamination, for example latex gloves. Tapping is used when the individual parts of item cannot be removed, tape is placed above the area to ensure that it is protected against contamination. All evidence should be avoid shaking. Students should know to avoid shaking and dislodging evidence, brushing can be a used to remove unwanted residue. Vacuum lifting is a particularly useful method of trace collection. The scene is divided into smaller grids for the purpose of ease and documentation. The vacuum is used in each grid with a different filter every time. Each individual filter can then be packaged and analysed separately, allowing for the exact grid location of items of evidence to be noted. |  | * ***Students need to already know that evidence is collected from a crime scene and analysed by a forensics team.*** |  |
| **Lesson:**  **Learning Aim A**  **Recovery of foot prints** | * Students will know that footwear can give some forensic evidence about the perpetrator. For example; their shoe size, their posture and the type of shoes they were wearing. Students will be able to take castings of the footprints accurately and make scientific observations. |  | * ***Students need to already know that casting is a form of evidence collection*** |  |
| **Lesson:**  **Learning Aim A**  **Recovery of tool markings** | * Students will know that tool markings can be taken as physical evidence in court. Tools can undergo casting, to take an impression of the tool. Students will know how to take accurate tool marks and identify tools by their markings. |  | * ***Students need to already know that evidence is collected from crime scenes using different techniques.*** |  |
| **Lesson:**  **Learning Aim A**  **Coursework write up** | * Students will be writing the learning aim A 'Explore procedures used to preserve, collect and record forensic evidence from a simulated crime scene |  | * ***Students need to already know the key content from Unit 4 learning aim A*** |  |
| **Lesson:**  **Learning Aim B**  **Microscopes** | * Students will be able to label a microscope, base, stand, clips, eye piece, focusing wheel, slide, objective lenses, light. * Students will be able to compare light and electron microscopes. * Students will be able to prepare a microscope slide. |  | * ***Students need to already know microscopes are used to magnify the object.*** * ***Students need to be able to recall the magnification equation.*** |  |
| **Lesson:**  **Learning Aim B**  **Biological evidence: Hair analysis** | * Students will be able to identify an unknown sample of hair through comparison with the use of a microscope. * Students will be able to explain how hair samples can be used to identify the species of organism. * Students can describe how hair samples have been used to identify offender in real life crime scenes. |  | * ***Students need to already know how to use a microscope.*** * ***Students need to already understand that different species have different types of hair/fur.*** |  |
| **Lesson:**  **Learning Aim B**  **Physical evidence - Footwear, tool marks and Casting** | * Students will be able to carry out a method of how to take a casting of a footwear sample * Students will be able to identify the different patterns of tread on different footwear samples * Students will know how footwear are visually identified using oblique lighting * Students will be able to identify the methods of lifting footwear samples such as electrostatic lifting, gel lifting and casting * Students will be able to write a method of how to produce a casting of a footwear and tool mark sample |  | * ***Students need to already know the key content from Unit 4 learning aim A*** |  |
| **Lesson:**  **Learning Aim B**  **Physical evidence: Ballistics** | * Students will explain how the weapon will leave its own unique pattern on a bullet. * Students will explain that crimes can be linked through ballistics if the same weapon is used. * Students will describe how firing a weapon will leave a trace of gunshot residue on the perpetrator, including hands, clothing etc. * Students will describe how the calibre of the bullet will affect the injuries caused to the victim. * Students will explain the trajectory of the bullet. |  |  |  |
| **Lesson:**  **Learning Aim B**  **Physical evidence - IT and Documents** | * Students will be learning what is meant by physical evidence to be actual tangle evidence that can be touched and picked up that is relevant to the case. Students will know that mobile phones, computers and CCTV are all types of digital evidence. They will learn that mobiles can provide evidence of call logs, contact numbers, messages, video recordings, photographs, sound recordings and sim identification. They will learn that computers can provide evidence for; emails, documents, images, internet search histories and CCTV can give evidence of; track and highlight particular events, enhance slow down and annotate, identify/compare times and features, make measurements of objects or people, face mapping and time codes. |  | * ***Students need to already know about common features of a mobile phone and computers.*** |  |
| **Lesson:**  **Learning Aim B**  **Identification of Chemical analysis: Chromatography** | * Students will be learning the technique of performing paper chromatography, they will be able to identify the mobile phase to be the phase that moves, and the stationary phase to be the phase that stays still. They will learn that chromatography is used to separate components based on their solubility. * Students will learn how it applies to forensic science such as, ATM's and other protected cash containers have anti-theft devices which release an ink and therefore marks the bank notes. * Students will learn the differences between paper and TLC chromatography. In TLC silica gel/alumina coated on a piece of glass as they adsorb onto the surface better, cover the beaker to ensure no solvent evaporates and capillary tubes are used to deposit a small amount of sample. Students will learn the definition of adsorb to be the process adhere to a surface of the adsorbent. |  | * ***Students need to already know how to conduct and write a method for paper chromatography.*** |  |
| **Lesson:**  **Learning Aim B**  **Chemical analysis using food tests** | * Students will be writing the learning aim A 'Explore procedures used to preserve, collect and record forensic evidence from a simulated crime scene |  | * ***Students need to already know the key content from Unit 4 learning aim A*** |  |
| **Lesson:**  **Learning Aim B**  **Chemical analysis: Fuming fingerprints** | * Students will be learning that a latent fingerprint is caused by a transfer of oils, and other body secretions onto a surface, patent fingerprints to be visible prints that are left on smooth surfaces, plastic fingerprints indentations left in soft materials such as clay, putty or wax. The ridge patterns are formed before birth and the shapes of the fingerprints are unique for each person. The shapes are arch, loop, whorls, double loop, pocked loop, mixed. |  | * ***Students need to already know that they have unique fingerprints and that fingerprints can be transferred onto different objects upon holding.*** |  |
| **Lesson:**  **Learning Aim B**  **Chemical analysis: Infrared Spectroscopy & UV** | * Students will be learning that different substances absorb light at different frequencies in infrared spectroscopy. IR spectroscopy is determined by a spectrophotometer. IR is used to identify the structures substance and identify it. UV spectroscopy is similar to IR but uses UV. Atoms, molecules and ions can absorb electromagnetic radiation of specific frequencies and can be used to identify them. IR spectra is calculated using wavenumber = 1/Wavelength (cm) |  | * ***Students need to already know that different chemical analysis techniques are used to identify structures of substances.*** |  |
| **Lesson:**  **Learning Aim B**  **Chemical analysis: Mass Spectrometry** | * Students will be learning that mass spectroscopy is used to analyse the structure and chemical properties of unknown molecules by their molecular mass. They will learn that the substance is vaporised, it undergoes ionisation (particles become charged), acceleration (electrons are accelerated until they are all the same energy), deflection (ions are passed through a strong magnetic field which separates them according to their mass on charge. Detection is when the ions produce an electric current that can be converted into a mass spectrum. The limitations for MS are that it is time consuming, high running costs, trained supervisor, and destructive to sample. |  | * ***Students need to already know that different analytical techniques are used to identify different substances.*** * ***Students will already know that metals and non-metals can form ions.*** |  |
| **Lesson:**  **Learning Aim B**  **Rationalising Analytical Techniques** | * Students will be learning what is meant by 'bias' an inclination to present or hold a partial perspective at the expense of alternatives. * Students will learn the advantages of mass spectrometry can detect a large range of molecules, disadvantages large equipment, expensive and specific training required. Chromatography advantages are that is cheap and simple, whereas gas chromatography is expensive and complicated. Ninhydrin is used to detect fingerprints on porous surfaces. Presumptive tests are cheap, quick but sensitive colour change tests to check for presence of bodily fluids and it is not a 100% accurate. |  | * ***Students need to already know the use of each analytical technique, mass spec, gas chromatography and IR and UV spectroscopy*** |  |
| **Lesson:**  **Learning Aim B**  **Coursework Write up** | * Students will be writing the learning aim A 'Explore procedures used to preserve, collect and record forensic evidence from a simulated crime scene |  | * ***Students need to already know the key content from Unit 4 learning aim A*** |  |
| **Lesson:**  **Learning Aim C**  **Expert witness statements** | * Students will learn that an expert witness statements used to present the findings from your analytical examination that includes;   Details of yourself and experience including name, DOB, occupation, work place address, professional qualifications and work experience. List of exhibits received with exhibit number. Purpose of each examination/analytical test carried out. The results of each examination/analytical test carried out. Interpretation of the results in relation to the crime committed. Valid scientific conclusions with evidence and scientific reasoning. Justification for the conclusions drawn from your case results, commenting on its significance in terms of possible, probable and likely. Justification could be aided using statistical analysis and/or literature to assist the court in reaching their decision. Suggestion for further analysis to be carried out. The expert’s opinion is designed to give the members of the court a probable or more likely explanation of the evidence to assist the court in reaching their decision. |  | * ***Students need to already know the key content from Unit 4 learning aim A*** |  |
| **Lesson:**  **Learning Aim C**  **Interpretation of analytical techniques** | * Students will use the knowledge of analytical techniques from learning aim B, discuss the why each analytical technique was used to analyse physical, biological and chemical evidence. To interpret the results that are relating to a crime. |  | * ***Students need to already know the analytical techniques from learning aim B.*** |  |
| **Lesson:**  **Learning Aim C**  **Drawing valid conclusions** | * Students will be writing scientific conclusions for their analytical techniques, with evidence with scientific reasoning. |  | * ***Students need to already know the analytical techniques from learning aim B.*** |  |
| **Lesson:**  **Learning Aim C**  **Write up** | * Students will learn to write an expert witness statement. |  | * ***Students will know all of the intended knowledge for learning aim A, B and C*** |  |