|  | **Unit 10:**  |  |  |  |
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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**  |
| **Learning Aim A****Lesson 1:** **Ignition** | * Students will know that the 4 requirements for a fire to occur exist in the fire tetrahedron: Source of ignition (heat), Oxygen, Fuel and the chemical chain reaction
* Students will know that primary sources of ignition include hot surfaces, open flames and sparks, heat from mechanical impacts, electrical discharges, electrostatic discharge, Smouldering or burning dust, smoking materials
* Students will know that secondary sources of ignition are flammable objects that are heated to their burning point and then ignited due to being heated by the primary ignitions
 |  | * ***Students need to already know about the 3 requirements for a fire to occur: the fuel, ignition and heat source***
 | Assignment write up |
| **Learning Aim A****Lesson 2:** **Combustion** | * Students will know the requirements for a combustion reaction to occur such as being above the ignition temperature
* Students will know that we can get complete combustion and incomplete combustion
* Students will know that smouldering combustion is the slow flameless combustion of a condensed fuel
* Students will know that glowing combustion is the phase that follows smouldering combustion and is the oxidation of a solid fuel accompanied by glowing, with no visible smoke
 |  | * ***Students need to already know that a fire requires 4 things to occur: Ignition source (Heat), Fuel, Oxygen and chemical chain reaction***
* ***Students need to already know that combustion is the rapid chemical combination of a substance with Oxygen***
* ***Students need to already know that combustion is an exothermic reaction***
* ***Students need to already know how to balance chemical equations***
* ***Students need to already know the reactants (a fuel and an oxidiser-usually atmospheric oxygen) and products (Carbon Dioxide and Water) involved in combustion***
* ***Students need to already know that oxidation involves the removal of electrons from an atom, molecule or ion in a chemical reaction***
 | Assignment write up |
| **Learning Aim A****Lesson 3:** **Toxic products of Combustion (with prac)** | * Students will know that combustion can also produce toxic products such as Hydrogen Chloride, Carbon Monoxide, Nitrogen Oxide, Hydrogen Cyanide
* Students will know that Hydrogen Chloride is produced when burning materials that contain Chlorine e.g. PVC and that it can cause corrosion to the skin, membranes and air passages. It can also damage buildings and machine parts and equipment
* Students will know that Carbon Monoxide is produced when burning materials without Oxygen and that it is highly toxic, and can cause unconsciousness and death.
* Students will know that Nitrogen Oxide is produced by the incineration of Nitrogen containing materials such as chipboard and that it is toxic and corrosive.
* Students will know that Hydrogen Cyanide is a colourless gas and is produced from the combustion of materials of wool, silk, nylon or polyurethane and that it is fatal.
 |  | * ***Students need to already know that combustion is the rapid chemical combination of a substance with Oxygen***
* ***Students need to already know that the products of combustion water and Carbon Dioxide can be tested by using Cobalt Chloride paper(water) which turns from blue to pink and by using limewater which turns cloudy from clear in the presence of Carbon Dioxide.***
* ***Students need to already know that exothermic reactions release energy into the surroundings***
* ***Students need to already know that combustion is an exothermic reaction***
* ***Students need to know already that the products of combustion are Carbon Dioxide and Water***
* ***Students need to know that Carbon Dioxide is a product of combustion of organic material and is hazardous to living organisms***
 | Assignment write up |
| **Learning Aim A****Lesson 4:** **Colours of Flames** | * Students will know that pyrolysis is the chemical decomposition of organic compounds at high temperatures in the absence of Oxygen
* Students will know that Pyrolysis is an Endothermic reaction
* Students will know that Pyrolysis is the conversion of a fuel into the gaseous state
 |  | * ***Students need to already know what an ion/cation is***
* ***Students need to already know that every ion/cation can be identified by the colour of the flame they produce when placed in a flame***
* ***Students need to already know how to do a flame test practical***
* ***Students need to already know that the combustion of organic material, blue flame demonstrates complete combustion and a yellow flame demonstrates incomplete combustion***
 | Assignment write up |
| **Learning Aim A****Lesson 5:** **Heat Transfers** | * Students will know that conduction of a fire involves heat transferred from one body to another by direct contact or by an intervening heat-conducting medium.
* Students will know that conduction happens in different materials better than others and this will determine how fast a fire will spread and how it can be reduced
* Students will know that convection involves the transfer of heat by the movement of air or liquid particles and in a fire, it mostly occurs in an upward direction
* Students will know how to reduce the spread of a fire by convection
* Students will know that radiation will travel through space until it reaches an Opaque object where it is absorbed, transmitted or reflected based on the type of Opaque material.
* Students will know how to reduce the spread of radiated heat by choosing different materials to reduce the absorption
 |  | * ***Students need to already know that conduction happens in a solid***
* ***Students need to already know that convection happens in liquids and gases***
* ***Students need to already know that radiation is a wave that can travel any medium including a vacuum***
 | Assignment write up |
| **Learning Aim A****Lesson 6:** **Methods of Extinction** | * Students will know that different methods of extinguishing a fire affect a part of the fire tetrahedron
* Students will know that one of the main methods of extinguishing a fire is smothering with a use of a fire blanket being an example on a chip pan fire boil over
* Students will know that another of the main methods of extinguishing a fire is starving when you cut of the fuel supply e.g. turning the gas tap off on a Bunsen burner
* Students will know that another one of the main methods of extinguishing a fire is Cooling when you apply water to reduce the temperature e.g. water from a hose will reduce the heat from a house on fire
* Students will know that the final main method of extinguishing a fire is using a fire extinguisher with there being different ones for different uses e.g. Carbon Dioxide extinguisher for electrical fires, foam extinguishers used for liquid fires, dry chemical extinguishers used on combustible solids, liquids and electricity or water extinguishers which are used for most materials except electrical or where there are flammable liquids and gases.
 |  | * ***Students need to already know that the fire tetrahedron requires four elements for fire propagation: Heat source (ignition), Fuel, Oxygen, chain of reaction***
 | Assignment write up |
| **Lesson:** **Learning Aim A****Coursework write up** | * Students will be writing up their coursework for learning aim A 'Explore the Chemistry of combustion and methods of extinction and heat transfer
 |  | * ***Students need to already know the outcomes for the unit and be able to apply it to a scenario***
 | Assignment write up |
| **Lesson 1****Learning Aim B****Causes of a Fire** | * Students will know there are four elements in the fire tetrahedron which includes; fuel, heat, oxygen and chemical chain reaction.
* Students will know that is any of the quadrants in the fire tetrahedron is removed, the fire will go out.
* Students will know that oxygen is on the fire tetrahedron to sustain combustion
* Students will know that heat is on the fire tetrahedron to raise the material to its ignition temperature.
* Students will know that fuel is used to sustain the fire
* Students will know that the point of origin is the exact physical location within the Ignition Area where a heat source and the local fuel interact, resulting in a fire.
* Students will know that the source of ignition may be at or very near the point of origin. The source should be identified in order for the cause to be proven.
* Students will know the causes of a fire to be; natural- heat sources such as the sun and lightening can supply enough heat to spark a fire. Accidental- faulty appliances/leads/fuel supply, misuse of equipment/appliances. Deliberate are caused by intentional human activity such as, arson.
* Students will know that fires can be classified as undetermined if the fire investigator cannot determine the cause of the fire.
 |  | * ***Students will know about the different fuel resourcs***
 | Assignment write up |
| **Lesson 2****Learning Aim B****Phases of a fire** | * Students will know that there are 4 stages of a fire; incipient, growth, fully developed and decay.
* Students will know that the incipient stage of a fire occurs immediately after ignition. It can be identified by the following factors; no affect on the immediate vicinity, not reduced visibility, people can escape without too much trouble, the heat of the fire is relatively low.
* Students will know that whether the fire is extinguished is dependent upon; the vicinity of other flammable fuels, fires access to oxygen, whether there are people nearby who can distinguish the fire. Incipient fires can usually be extinguished by using a fire extinguisher or fire blanket.
 |  | * ***Students will know about the fire triangle***
* ***Students will know about the methods of extinguishing a fire***
 | Assignment write up |
| **Lesson 3****Learning Aim B****Behaviour of a Fire** | * Students will know about flame propagation (flame spreading) into the surroundings, depends upon the rate at which flammable pyrolysis products are released from different materials.
* Students will know about rapid spread can occur through chemically unstable solid materials
* Students will know about the behaviour of fire through materials like thermal insulators, low thermal materials conductivity, low-density materials, foamed plastics and thin sheets of material
 | Conductivity – heat or electricity is directly transmitted through a material*Insulator* – The reduction in heat transfer between objects | * ***Students will know about the point of origin***
* ***Students will know how thermal energy is transferred via conduction, convection and radiation***
* ***Students will know about good conductors/insulators***
 | Assignment write up |
| **Lesson 4****Learning Aim B****Fire Patterns** | * Students will know about ‘U’ and ‘V’ fire behaviour patterns
* Students will know about inverted and truncated cone and hour glass fire patterns
* Students will know about the spalling of concrete and plaster
 | *Plume* - A plume of smoke, dust, fire, or water is a large quantity of it that rises into the air in a column.*Ventilation*: The provision of fresh air to a room, building, etc. The availability of oxygen. The more ventilation, the more oxygen the fire.  | * ***Students will know the behaviours of fires from previous lessons***
 | Assignment write up |
| **Lesson 5****Learning Aim B****Flame Propagation & Surroundings** | * Students will know about the role of ventilation in the role of flame propagation – limited and unlimited
* Students will know about the hot gas layer, flame over and flashover in a flame’s propagation.
* Students will know about the full room involvement/post flashover
* Students will know about fire suppression in a fire’s behaviour
 | *Flame over - occurs when the hot gas layer of a***fire***ignites*Flashover - an instance of a fire spreading very rapidly through the air because of intense heat. Pyrolysis: Decomposition brought about by high temperatures | * ***Students will know what a vacuum is***
* ***Students will know about good conductors and insulators***
 | Assignment write up |
| **Learning Aim B****Learning Aim B write up** | * Students will use the intended knowledge from lessons 1-5 to write up learning aim B
 |  | * ***Students use intended and prior knowledge from lessons 1-5***
 | Assignment write up |
| **Lesson 1:** **Learning Aim C****Fire Scenes: Roles of Agencies** | * Students will know the role of the fire scene investigator is to determine the cause of the fire, physical inspection, locating the seat of the fire and liaising with other professionals and witnesses.
* Students will know the scientific method approach - a systematic approach to data collection, analysis and hypothesis testing for any investigation.
* Students will know safety issues at a fire scene, including hazards and hazardous material, structural, electrical, gas, and chemicals.
* Students will know how to conduct a risk assessment and determine an PPE that is required.
* Students will understand the importance of preservation of a scene, including the use of scene logs.
* Students will know the role of other agencies such as, Police - to make the scene safe, identify causalities and gather information, Crime scene investigators (CSI), collect potential evidence from the scene. Specialist dog unit, forensic scientists, pathologists, gas advisors, electricity advisors, insurance loss adjuster, Health and Safety Executive (HSE), Solicitor.
 |  | * ***Students need to already know causes, phases and behaviour of fires.***
* ***Students need to already know how combustion occurs and method of extinction.***
* ***Students need to already know how to identify hazards.***
 | Assignment write up |
| **Lesson 2:** **Learning Aim C****External and Internal Examinations** | * Students will know that a thorough external examination needs to be conducted, including, entry point, signs of forced entry, origin or cause of the fire, artefacts, any other evidence that could assist in the investigation.
* Students will know that a thorough internal examination needs to be conducted, including, origin and cause of the fire, layout and position of items and any persons, use search methods.
* Students will know how to make accurate and detailed notes of their findings. Record weather conditions, photos, drawings.
* Students will know how to excavate items from the scene, package and preserve evidence.
 |  | * ***Students need to already know search methods, such as spiral, grid, quadrant and line.***
 | Assignment write up |
| **Lesson 3:** **Learning Aim C Preservation of the Scene** | * Students will know that every contact leaves a trace.
* Students will know how to effectively use a scene log and the reasons for using.
* Students will know different methods to preserve evidence, such as airtight containers, paper bags, nylon bags, weapon tubes etc.
 |  | * ***Students need to already know that evidence is essential in any investigation.***
 | Assignment write up |
| **Lesson 4:****Learning Aim C** **Witness Statements** | * Students will know that witnesses can include any person with information about a specific investigation, such as eye witness, fire crew, police etc.
* Students will know that witness evidence can be gained through statements, interviews, phone calls etc.
* Students will know how much detail is required in a witness statement. Details of the premises prior to the fire, details of the fire, suspicious activity, fire spread, smoke colour, photographs or video recordings taken on mobile phone or cameras, details of the building contents, layout. Firefighters provide useful information on the possible origin of the fire, any unusual conditions and any disturbances made to the scene during firefighting efforts.
 |  | * ***Students need to already know that witness evidence of important in an investigation.***
* ***Students need to already know that evidence can be in many different forms, such as physical, verbal etc.***
 | Assignment write up |
| **Lesson 5:** **Learning Aim C****Documentation** | * Students will know that documentation can include, fire reports, safety documents, risk assessments, diagrams, floor plans, room and contents, damage patterns.
* Students will know that all relevant documentation has to be provide to the court.
* Students will know that other agencies involved in the investigation will produce documentation and should share this information.
 |  | * ***Students need to already know that anything generated in an investigation is required.***
 | Assignment write up |
| **Lesson 6:** **Learning Aim C****Presentation in Court** | * Students will know that some investigations will end in a court case. Court cases can lead to criminal convictions.
* Students will know how to produce accurate files for court and how to present these.
* Students will know the role of each member of the court.
 |  | * ***Students need to already know what documentation is required at court.***
 | Assignment write up |
| **Lesson:** **Learning Aim C Coursework Write up** | * Students will complete the coursework piece 'Understand the methods involved in processing a fire scene and the role played by other agencies in fire prevention and investigation'
 |  | * ***Students need to already know the learning outcomes for learning aim c***
 | Assignment write up |