Assignment Brief 6.1

Unit Name: Forensic Science		**Unit Number:** Unit 6
Assignment Title: Examination Coursework destroyed by Arsonists		**Assignment Number:** 6.1
Date Set:	**Due Date:**	
Assessment Objective(s): AO1 and AO2		

Brief:

There has been a fire at a school. Some class rooms and the staff work room have been badly damaged. In the staff room there was some examination coursework ready to be moderated at a meeting the following day. The coursework was burnt.

Bricks were found on the floor of the staffroom.

During investigation of the bushes outside the damaged rooms, cigarette ends, footprints, empty drink cans and a plastic bottle containing a liquid were found.

The school was monitored by CCTV.

Forensic investigation could only begin after the fire had been put out using water.

Task:

Write a report on this case. In the report include:

- the way in which the crime scene was preserved and recorded;
- the techniques (biological,chemical and physical) used to analyse the evidence;
- the deductions that can be made from the analysis results (include limitations);
- the value of the evidence in obtaining a conviction;
- the resources used.

Resources:

Teacher Notes

Assignment Brief 6.1 has been used to generate sample coursework on the following pages. A commentary on the mark allocation has also been provided alongside the work.

AO1 and AO2 can be marked from the report on the case study.

Assessment objectives AO1 and AO2 are subdivided as shown on the assessment evidence grid in the unit specification (and reproduced at the end of this document). These subdivisions are indicated by a, b and c in the commentary.

The exact mark given within the mark band will depend on the detail in the written course work.

A list of resources will be needed if Mark Bands 2 and 3 are to be obtained.

Additional resources to those given in the specifications:

- T*he Forensic Science World,* a booklet with ideas for experiments sponsored by Pfizer.
- Television programmes such as CSI (there is also a CSI interactive CD ROM in which crimes are solved using evidence. Also there are CSI DVDs for sale commercially). CSI is on Channel 5.
- The number of reference books is increasing rapidly owing to the popularity of Forensic Science courses at Universities. A look at those available form Amazon might be helpful.
- Bio-Rad produce a DNA Fingerprinting Kit amongst other kits (www.explorer.bio-rad.com).

Exemplar Material with Commentary
Unit 6: Forensic Science (AO1 and AO2)

Candidate Portfolio Work (Work is in note form)	Commentary on Mark Allocation.
<u>Initial action after the fire had been put out.</u> The scene is cordoned off with tape. No unauthorised person is allowed on the scene. Investigators wear personal protective clothing including gloves, breathing masks and gloves etc. to prevent contamination of the crime scene and for their own safety. Photos are taken of the fire damage, recording time and site of damage and date.(video recording would have been another possibility). A detailed plan of the fire damage is made. Plan of the building before the fire obtained. Samples of the burnt material taken and placed in plastic bags which are then sealed to prevent contamination before analysis,as well as deterioration and the effect of air. Bags labelled with the position of the sample (both where in the building and at what depth), date and the name of the investigator. This is to provide the link between evidence and location Search of the area surrounding the classrooms and staff room carried out. (This was when the plastic bottle, cigarette ends ,footprints and empty drink cans were found.) Teachers and site staff asked to describe the rooms before the fire. Tapes from the CCTV removed. Tapes will have to be signed for as school property. Guidelines on use of CCTV in schools obtained from school of LE.A. Evidence is collected ensuring that there is no contamination and that any deductions from analysis of the evidence can be directly linked to that piece of evidence, The jury needs to be sure that each piece of evidence shown in court came from the crime scene.	AO1a – Mark Band 2 possible if there is a discussion on necessity of not contaminating the crime scene. AO1a Mark Band 2 possible if reason for sealing and labelling bags mentioned. AO2a Mark Band 2/3 may be possible. AO1a Mark Band 2 given if this range of techniques mentioned. AO1a Mark Band 3 given if reasons mentioned for the collection of each bit of evidence. AO1c Mark band 2; Mark Band 3 will be given if there is more relevant detail.

Analysis of evidence. <u>Fire damage</u>.	
The pattern in which the fire spread is deduced using photographic evidence of the fire damage and comparing the plan of the damage with the plan of the rooms and their contents before the fire. The state of the rooms before the fire obtained from verbal accounts from the teachers and site staff.	Physical technique
Fires burn so that the flames go upwards. The blackening due to burning on the walls will be like an inverted cone. The tip of the cone is the source of the fire. Diagram should be inserted	
When the ceiling is encountered the flames spread out. Any burnable material encountered by the flames will start to burn. The burning material could then fall down to the ground and then the burning cycle is repeated. These points are known as secondary sources	
Different materials have different flash points e.g. (Flash point data).	AO1b Mark Band 3 – actual data
Examination of burnt samples will give an indication of the temperature of the fire.	
Evidence will have been damaged by water used to put out the fire so other evidence will be needed	AO2a Mark Band 3
<u>Analysis of the liquid in the plastic bottle</u> using Gas Liquid Chromatography as the liquid may be the accelerant.	Chemical technique (Detailed description of gas liquid chromatography needed for AO1b Mark Band 2 or 3)
Calibration with known substances is essential as the retention time depends on the flow of the carrier gas, as well as the type of carrier gas, the length of the column, the adsorbing material in the column and the temperature of the column. This method is very sensitive. For example it is possible to identify the grade and the production company of a fuel.	Discussion of limitations. AO2a Mark Band 2 or 3 depending on detail.
A s the exact type of fuel is known then a survey of the local area for sources of this fuel is made. The sources can then be questioned and a description of a person who brought the fuel obtained. Identification would not be sufficient evidence for a conviction.	AO2a Mark Band 2. More detail and discussion needed for Mark Band 3.

In a chromatogram,the area under each peak depends on the amount of that compound present in the mixture so relative amounts of components can be obtained. If the peak is broad, then the formula for the area under the peak can be used. Area of triangle = 0.5 x base x height And the ratio of the areas calculated. If the peak is sharp then the heights can be used to obtain relative amounts.	AO2b Mark Bands 1 or 2 possible.
<u>Plastic bottles were tested for finger prints</u> The fingerprints are matched using computer technology with the data base. At present in England a match of 16 points is needed. (even identical twins do not have the same fingerprints). There is a national data base of fingerprints of those who have been convicted/suspected of a crime. However not everyones fingerprint is in the data base. At present there is a discussion about whether there should be a national data base as other organisations e.g commercial organisations might use it. If everyone had their fingerprint taken it would feel like a dictator state.	AO2a Mark Band 2
<u>Cigarette ends</u> Analysis by DNA	Biological technique
The cigarette ends were analysed for DNA. DNA samples were taken from suspects. Suspects have to be willing to give DNA samples. The samples were analysed and compared with DNA fingerprints in the police data base. However not everyones DNA fingerprint is in the data base. At present there is a discussion about whether there should be a national data base as other organisations e.g commercial organisations might use it. DNA is a very sensitive method as 10 sites are compared. Chance of an error is now 1 in 10^{13} .	(Detailed description of the technique of obtaining a DNA fingerprint needed for AO1b Mark Band 2 or 3)
A match does not necessarily prove that the fire was started by that person . Although an explanation of why the cigarette ends were present at the scene of the fire would be needed.	AO2a Mark Band 1

Guilt One piece of evidence alone is not considered sufficient to convict a suspect. There will need to be several pieces of evidence. Also there must be chain that links the evidence to the suspect. In the case the fingerprints on the bottle which contained a flammable fuel which had a flash point that could cause the fire damage would provide the chain of evidence. It must be proved in court that the evidence was collected in such a manner that it was not contaminated. Additional evidence could come for the tapes from the CCTV and casts made from the footprints, which are then matched with known footprints. The depth of the footprint indicates whether the person was heavy or light. Soil analysis of the soil outside the classroom and the soil in the footwear of the suspect could provide yet more evidence. Resources	AO2a Mark Band 1 More detail would be required for AO2a Mark Bands 2 and 3. More focus needs to be made on bullet points and the assessment evidence grid (see below). Resources must be listed for the higher mark bands.

Assessment Evidence Grid

This is the section of the Unit 6 Assessment Evidence Grid relating to AO1 and AO2.

Unit 6: Forensic science

What you need to do:

You need to produce evidence of your investigation into forensic science [**50** marks].

This evidence needs to include**:**

AO1: a knowledge and understanding of the need to preserve and record the crime scene, and the chemical, biological and physical techniques used to collect and visualise forensic evidence safely, including ethical considerations [**21**];

AO2: a report on a forensic case study on evidence and proof, including evidence of work which demonstrates the use of calculations to support forensic measurements or observations [**10**].

How you will be assessed:

Assessment Objective	Mark Band 1	Mark Band 2	Mark Band 3	Mark Awarded
AO1	You will demonstrate a basic knowledge of the need to record and preserve the crime scene, giving some of the techniques used; **[0 1 2]**	you will demonstrate knowledge and understanding of the need to record and preserve the crime scene, describing a range of techniques used; **[3 4]**	you will demonstrate a thorough knowledge and understanding of the need to record and preserve the crime scene with a detailed description and explanation of a wide range of techniques used. **[5]**	**/21**
	Your work will show some information on how forensic scientists collect and visualise evidence safely using: chemical techniques; **[0 1]** biological techniques; **[0 1]** physical techniques; **[0 1]**	your work will show research and information on ways in which forensic scientists collect and visualise evidence, safely and appropriately, using: chemical techniques; **[2]** biological techniques; **[2]** physical techniques; **[2]** generally, you will use appropriate scientific terms and conventions correctly;	you will produce an in-depth research report showing understanding of a range of ways in which forensic scientists collect and visualise evidence, safely and appropriately, using: chemical techniques; **[3 4]** biological techniques; **[3 4]** physical techniques; **[3 4]** you will understand the science behind these techniques and use appropriate scientific terms and conventions correctly.	
	Your work will show a basic knowledge of ethical issues involved in retaining samples or data; **[0 1]**	your work will show a range of information on ethical issues related to forensic science; **[2 3]**	your work will show a range of relevant information on ethical issues in forensic science and an understanding of the need for an ethical code. **[4]**	

Unit 6: Forensic science (continued)				
Assessment Objective	**Mark Band 1**	**Mark Band 2**	**Mark Band 3**	**Mark Awarded**
AO2	Your report, based on a case study, will contain some information on evidence and proof including information on the strengths and limitations of some types of forensic evidence; **[0 1 2]**	your report, based on a case study, will contain detailed information on evidence and proof which includes: – the ways in which forensic scientists ensure that the quality of evidence collected and analysed is objective; – strengths and limitations of the analytical techniques used and some interpretation of the probability of guilt; **[3 4]**	your report, based on a case study, will contain researched and relevant detailed information on evidence and proof which includes: – the ways in which forensic scientists ensure that the quality of evidence collected and analysed is objective; – detail on limitations; – strengths and weaknesses of the analytical techniques used; – an understanding of the probability of guilt and of a need to review evidence. **[5 6]**	
	You will complete *straightforward* calculations on forensic data and you will sometimes obtain the correct solutions; **[0 1]**	you will complete *straightforward* calculations on forensic data and you will obtain the correct solutions; **[2 3]**	you will complete more *complex* calculations and you will obtain the correct solutions to an appropriate degree of accuracy. **[4]**	**/10**