

Model Assignment

Issued September 2006

OCR Level 2 Nationals in Science

Unit 3: Forensic science

Please note:

The OCR model assignment may be used to provide evidence for the unit below. Alternatively, centres may wish to adapt this assignment or devise their own assignment for the purposes of assessment. It is the centre's responsibility to ensure that any adaptations made to this assignment allow candidates to meet all the assessment objectives and provide sufficient opportunity for candidates to demonstrate achievement across the full range of grades.

The scheme codes for these qualifications are:

OCR Level 2 National Award in Science	05644
OCR Level 2 National Certificate in Science	05645

The QCA Accreditation Number for this unit is:

Unit 3: Forensic science	D/103/6661
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This OCR model assignment remains live for the life of these qualifications.

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Tutor Information

OCR Level 2 Nationals in Science

Unit 3: Forensic science

Guidance For Centres

1 General

- 1.1 OCR model assignments are issued free to centres on approval and are available to download from our website: www.ocr.org.uk.
- 1.2 Centres may choose to:
 - use OCR model assignments for formal summative assessment of candidates
 - tailor OCR model assignments for formal summative assessment of candidates
 - use OCR model assignments as a benchmark for devising their own assignment.
- 1.3 This assignment has been designed to meet the full assessment requirements of the unit. Candidates will need to take part in a planned learning programme that covers the underpinning knowledge and skills of the unit.

2 Before carrying out the assignment

- 2.1 Candidates should be provided with a copy of the *Candidate Information* section of this booklet.
- 2.2 Candidates may carry out preparations prior to undertaking the tasks; there is no time limit for this.

3 When completing the assignment

- 3.1 Candidates should be allowed sufficient time to complete all of the tasks. However, this may vary depending on the nature of the tasks and the ability of individual candidates. It is suggested that evidence is produced in several sessions.
- 3.2 Each candidate must produce individual and authentic evidence for each task within the assignment.
- 3.3 Centre staff may give support and guidance to candidates. This support and guidance should focus on checking that candidates understand what is expected of them. It is not acceptable for tutors to provide model answers or to work through answers in detail.
- 3.4 Candidates may use information from any relevant source to help them with producing evidence for the tasks.
- 3.5 It is acknowledged that candidates in their responses will refer to situations in the scenario but as the scenario is fictitious this does not break any rules of confidentiality. However, candidates must be guided on the use of information from other sources to ensure that confidentiality is maintained at all times.

4 After completing the assignment

- 4.1 Candidates' evidence is assessed by the centre's assessor against the qualification specification contained in the Centre Handbook. When grading candidates' work centres **must** use the grading descriptors in the unit. For further information about assessment please refer to the section on Assessment and Moderation in the Centre Handbook.
- 4.2 Assessors' decisions should be quality assured across the centre through internal moderation. For further information about internal moderation please refer to the section on Assessment and Moderation in the Centre Handbook.

5 Presentation of work

- 5.1 Candidates may use the *Candidate Checklist* provided to ensure that they submit evidence for ALL tasks. They can do this by using the *Candidate Checklist* as a contents page inserting references/page numbers in the boxes provided.
- 5.2 Centres may wish to discourage candidates from excessive use of plastic wallets for presentation of their evidence as this may hinder the assessment process. Instead centres may wish to encourage candidates to present their work so that it is easily accessible, eg spiral bound, stapled booklet, treasury tag.

6 Acceptable evidence

- 6.1 For guidance on generation and collection of evidence please refer to the section on Assessment and Moderation in the Centre Handbook.

7 Reworking the assignment

- 7.1 If candidates do not meet the minimum PASS requirements for the assessment objectives, further work will be required.
- 7.2 Tutors may give feedback to candidates to support and guide them in producing evidence to the required standard.

Notes For Tutors

Introduction to the Tasks

The tasks have been designed to enable candidates to develop a knowledge and understanding of how to conduct a forensic investigation. They will collect and analyse forensic information and then evaluate the information in order to draw conclusions.

They will:

- plan a forensic investigation
- use techniques to examine a crime scene and collect evidence
- use techniques for examining the collected evidence
- interpret their findings
- present their findings in the appropriate manner.

The tasks involve a practical approach that will require a crime scene to be set up, to allow the opportunity for candidates to:

- undertake crime scene examination
- collect evidence
- analyse the evidence
- interpret the results
- prepare a report.

The scenario chosen for this crime incident:

A house has been broken into via a garden window leading into a study and a threatening message has been left on a table. There are two suspects – one who carried out the crime and one who did not.

Evidence at the scene:

1. a footprint in the soil outside the window
2. a broken flower
3. textile fibres on the broken window
4. fingerprints
5. a written message, in ink, on paper
6. witness statement of a neighbour.

There are two suspects, taken from each:

1. a trainer with soil on
2. a pair of trousers with pollen on
3. a torn pullover
4. their fingerprints
5. a pen and paper found in each of their houses
6. a statement.

The evidence and equipment will need to be prepared by the tutor and presented to the candidates as realistically as possible in the form of a crime scene.

We are aware that in a real investigation, it is unlikely that one individual would carry out all the tasks in this scenario. This should be conveyed to the candidates. Candidates should be aware that there are many roles and responsibilities involved and that a successful investigation requires teamwork.

These guidance notes should be used in conjunction with the unit specification and Centre Handbook.

The Tasks

Task 1: Collect initial information from the scene of the crime

Assessment Objective 1 is assessed by task 1.

This initial task will create the starting point of the assignment. The tutor will need to set the crime scene up with the relevant evidence (see scenario). The scene may have to be contained within a classroom for teaching purposes, so the tutor will also establish what the climatic and physical conditions were when the crime took place.

The more realistic the scene of crime the more believable the tasks will become. **In addition, it is recommended that not all the evidence points in the same direction.** For example, both suspects could have the same type of pen or both sets of fingerprints could be left at the scene of the crime.

Prior to carrying out the assignment, candidates will have covered the Knowledge, understanding and skills required by the assessment objectives. So they should already have the expertise to solve a simple crime.

The candidates will need to produce a logical plan that they will follow when undertaking detailed analysis at the scene of the crime. This will include how the evidence will be collected. They also need to understand why forensic investigations depend on following standard procedures, so that the integrity of the evidence can be maintained.

Higher level candidates will produce a plan that is very well structured and will have no guidance on the choice of appropriate forensic tools.

Task 2: Undertake specialist crime scene examinations

Assessment Objective 2 is assessed by task 2.

Candidates working in small teams of crime scene investigators will visit the crime scene and collect the evidence.

This will require the tutor preparing a number of sets of evidence, so the evidence can be replenished as the teams collect it.

The types of evidence included at the scene:

- **Footprints**

When someone walks over soil, impressions are left in the ground. To collect the evidence a frame is built around the print and suitable casting material is poured in and allowed to dry. The cast is then removed and photographed. As shoes are used, individual characteristics such as nicks, cuts, and wear patterns develop. These characteristics may show up in prints and impressions and can be compared with a suspect's shoes.

Footprint impressions from casts will give investigators information about:

- the number of criminals
- points of entry and exit
- positions of suspect
- direction of movement through the crime scene
- time period, from short-lived impressions in frost, snow, dew
- sequence and manner (walking, running, limping, staggering) in which the impressions were created
- the type, size and areas of specific wear on the shoes.

Certain seasons or weather conditions lend themselves more to the creation of footprint impressions than others do.

- **Fingerprints**

Fingerprint impressions may be left behind at the scene of crime. These fall into three basic types:

- Latent – this is the most common type of print, invisible to the naked eye.
- Visible print – resulting from fingers stained with blood, ink or dirt.
- Plastic print – this is an impression made by the fingers on a soft surface.

Fingerprints can be collected by:

- Dusting – powder is dusted lightly over the surface on which a print has been left, the powder colour depends on the colour of the background. When a print is seen, the powder is very gently brushed off, the print is then lifted using sticky tape.
- Iodine fuming – use on porous surfaces. A few iodine crystals are placed in a fuming pipe, heating the pipe with a lighter or match, and blowing the iodine fumes through the mouthpiece of the pipe onto the surface to produce yellow-brown prints that can be photographed.

- Ninhydrin spray – this will produce blue-purple prints on paper.
- Superglue fuming – Superglue vapour reacts with water in the print. A few drops of superglue are placed on a hotplate in a glass tank. The object is then placed into the tank, and in about fifteen or twenty minutes, any prints that were invisible are now visible in greyish tone on the object.

When prints are found, they can be compared with samples known to have been made by a suspect. The patterns are compared, looking for identical ridge characteristics. Suspects' prints can be taken by inking the fingertips and pressing them onto paper.

- **Fibres and pollen**

Fibres and pollen can be collected by lifting them with sticky tape or tweezers. A visual comparison is then made of the fibres and pollen from the suspect.

- **Soil**

Most soil analysis consists of comparing two or more samples by their pH, mineral content, colour and density. Soil from the trainers can be tested and soil samples should be collected from the scene of the crime. Useful forensic information can be obtained from soil sedimentation analysis, pH measurement and chemical analysis.

Soil sedimentation:

- Place approximately 25 cm³ of the soil from the scene of crime in a 50 cm³ measuring cylinder
- top up the measuring cylinder with water to the 50 cm³ mark
- shake the soil/water mixture thoroughly and set aside to settle for at least two days
- repeat with the soil from the suspect's shoe, this time using 2.5 cm³ of the soil topped up to 5 cm³ in a graduated test tube
- the different types of particle settle out according to their density
- record accurately the depths of the layers of the different particles
- compare the composition of the two soils.

pH measurement:

- place samples of the soils, to the depth of 5 mm, in two test tubes
- add some barium sulphate (about a spatula-full) to the test tubes. Add distilled water (10 cm³) and shake thoroughly
- allow to settle and add sufficient Universal Indicator solution to obtain a density of colour similar to that on the colour chart
- record the pH of the soils from a colour chart.

- **Ink**

Using thin-layer chromatography (TLC), a sample of the inks is applied to a sheet of glass coated with a thin layer of a chemical such as silica gel or cellulose. It is placed in a solvent (or more usually, a mixture of solvents called a solvent system), and if the ink contains a mixture of substances, they will move up the TLC 'plate' at different speeds.

When the chemicals have separated out sufficiently, the plate is removed and allowed to dry. The components of the ink will appear at different the positions on the plate as different spots or lines which are then compared with known components of ink.

If water soluble inks are used, the chromatography can be carried out using filter paper, providing the relevant calculations are carried out.

Candidate evidence

The candidate evidence will be that the forensic evidence has been collected using the appropriate procedure and then recorded and stored appropriately. In addition, for their portfolio they will need to include notes from the crime scene and the statement they have taken from a witness to the crime.

Higher level candidates must undertake an extensive crime scene examination and identify all of the possible forensic evidence. They must also ensure that they always collect and store evidence in the most appropriate manner so that the possibility of degradation or cross contamination is minimised.

Task 3: Carry out laboratory examination

Assessment Objective 3 is assessed by task 3.

Candidates will carry out tests to analyse the evidence collected in the previous task. They will have practised the techniques prior to the assignment and will have carried out a risk assessment.

The tests will include:

- comparing the footprint to the suspects' trainers, using visual examination
- comparing pollen to the pollen found on suspects' trousers, using microscopic examination
- comparing the fibre to suspects' torn pullovers, using microscopic examination
- comparing fingerprints from the scene to suspects fingerprints, using visual examination
- analysing soil at the scene, using chemical analysis
- analysing soil on the suspects' trainers, using chemical analysis
- analysing the ink, using chromatography, on the message at the scene of crime
- analysing the ink, using chromatography, in the suspects' pens.

Although this task focuses on candidates outlining the test procedures they have used, they also need to make sure that they carry out enough tests and measurements in order to ensure adequate preparation for task 5.

Higher level candidates will carry out more than **THREE** tests independently and comment in great detail on the reliability and validity of the procedures.

Task 4: Describe different types of instrumental analysis

Assessment Objective 4 is assessed by task 4.

Forensic scientists have access to a number of methods of instrumental analysis that have a far greater sensitivity than the tests that candidates have access to. Candidates need to research and summarise the instrumentation that is used by forensic investigators in the laboratory. This will enable them to comment on the reliability and accuracy of the tests that they have used in task 3, as they can compare the tests that they conducted in the school/college laboratory with those used in a professional laboratory.

The range of more complicated instrumental techniques that candidates will research and summarise will include:

- gas chromatography
- high performance liquid chromatography
- mass spectroscopy
- infra-red spectroscopy
- electrophoresis/DNA fingerprint
- microscopical examination.

Their summaries need to include...

- at least **FOUR** of the techniques listed above
- the main function of each technique
- how the technique is used in forensic science
- any appropriate image or drawing to illustrate the technique.

Candidates may require computer time to research and obtain the relevant images from the internet.

Evidence could be in the form of a summary of a range of techniques and their use, laid out as pages in the magazine of a supplier of forensic testing equipment.

Higher level candidates would be expected to discuss the instrumental techniques when evaluating the limitations of their own testing. They would also be expected to compare and evaluate the types of tests that can be conducted in a school/college with those used in professional laboratories.

In terms of delivery, tutors may wish to complete this task after task 5 to keep continuity of the practical sequence.

Task 5: Present results and findings from your tests

Assessment Objective 5 is assessed by task 5.

Candidates will summarise their findings from task 3 before the preparation of a final report for the Crown Prosecution Service for task 6.

Candidates' laboratory notes will collate their results accurately and in a clear format.

They will include:

- any calculations that they have carried out
- relevant information
- the accuracy, reliability and limitation of the results
- a brief summary of the conclusions that they have drawn from each test.

This will need to be presented as clearly as possible, as these notes will be the basis of their written report in task 6.

The evidence for this task will be the recorded and collated the results of the investigation.

Higher level candidates will have recorded the relevant information clearly and comprehensively and commented on the accuracy, reliability and limitations of their results in detail.

Task 6: Report findings

Assessment Objective 6 is assessed by task 6.

Candidates must write up their findings into a report for the Crown Prosecution Service. In real life, a forensic report would be seen by a wide range of individuals, most of whom would have little scientific knowledge. The contents of the report must therefore be clear and as unambiguous as possible.

Candidates should realise that evidence that does not fit their particular theory must still receive due consideration, and it is important that such evidence is built into the original scenario by the tutor.

Candidates should outline and explain their conclusions clearly, and include:

- an outline of the background of the incident
- an explanation of the requirement of individual for whom the report is intended
- a description of the examinations conducted and their outcomes
- an assessment of the examination results.

Candidates must use ICT tools to present **AT LEAST** part of their report.

Higher level candidates will provide an extensive analysis of their results, which considers most alternative interpretations.

Candidate Information

OCR Level 2 Nationals in Science

Unit 3: Forensic science

CANDIDATE NAME: _____

General Information for Candidates

Q *Do I have to pass this assignment?*

A Yes. You must pass this assignment to achieve the full qualification.

Q *What help will I get?*

A Your tutor will help you when completing the OCR model assignment and will make sure that you know what resources/facilities you need and are allowed to use.

Q *What if I don't understand something?*

A It is your responsibility to read the assignment carefully and make sure you understand what you need to do and what you should hand in. If you are not sure, check with your tutor.

Q *Can I copy other people's work?*

A No. The work that you produce must be your own work and you may be asked to sign a declaration to say that the work is your own. You should never copy the work of other candidates or allow others to copy your work. Any information that you use from other sources, eg books, newspapers, professional journals, the Internet, must be clearly identified and not presented as your own work.

Q *Can I work in a group?*

A Yes. However, if you work in a group at any stage you must still produce work that shows your individual contribution.

Q *How should I present my work?*

A You can present your work in a variety of ways, eg hand-written, word-processed, on video. However, what you choose should be appropriate to the task(s). For some work, eg presentations, coaching sessions, role-play, work experience, you will need to provide proof that you completed the task(s). A witness statement or observation sheet could be used for this. If you are unsure, check with your tutor.

Q *When I have finished, what do I need to hand in?*

A You need to hand in the work that you have completed for each task. Do not include any draft work or handouts unless these are asked for. When you hand in your work make sure that it is labelled, titled and in the correct order for assessing.

Scenario

You are a senior scene of crime investigator and have been sent to investigate a break-in at a house.

The house has been broken into via a garden window, which leads into a study, and a threatening message has been left on a table. There are two suspects – one who carried out the crime and one who did not. Your job is to identify the guilty party.

The police have taken the following evidence from each suspect:

1. a trainer with soil on
2. a pair of trousers with pollen on
3. a torn pullover
4. their fingerprints
5. a pen and paper found in each of their houses
6. a statement.

You will need to examine the crime scene thoroughly to obtain all available forensic evidence, to see whether any of it matches the items taken from the two suspects.

Tasks

Task 1: Collect initial information from the scene of the crime

Assessment Objective 1

As the senior crime scene investigator, your task is to:

- **produce a detailed brief for your scene of crime officers**

You need to include...

- the area of the crime scene
- the area to be searched
- the weather conditions at the time of the crime
- sketches of the scene of the crime
- photographs, with a scale, of the possible evidence
- precautions, including health and safety considerations, required when collecting evidence.

- **produce practical instruction for collecting the relevant evidence**

You need to include methods of collection for...

- footprints
- fingerprints
- fibres
- pollen
- soil.

- **include the following additional information**

- risk assessment for each process
- a commentary on why it is important to follow standard procedures when processing a crime scene.

For your portfolio, you should produce a plan of action to carry out the investigation. To achieve the higher grades your plan must be very well structured and you will have chosen the appropriate forensic tools for your investigation independently.

Task 2: Undertake specialist crime scene examinations

Assessment Objective 2

Your task is to:

- **choose the appropriate method and collect examples of evidence from the scene of the crime**

You need to...

- identify the area of the scene, marking it out and protecting it to preserve the scene
- locate, identify and collect evidence
- handle, package and record evidence
- preserve evidence ensuring its integrity, whilst preventing contamination or degradation
- record relevant information accurately and comprehensively.

Make sure that you...

- package and label examples of evidence
- take a statement from someone who has witnessed the crime and make a record of the information.
- **make clear notes at the scene of the crime**

You will need to include in the notes...

- when the crime took place
- where the crime took place
- list of evidence
- a sketch of where the evidence was located at the scene
- a list of people who may have been at the scene of the crime
- where the evidence will be stored.

To achieve the higher grades you must undertake an extensive crime scene examination and identify all of the possible forensic evidence. You must also ensure that you always collect and store evidence in the most appropriate manner so that the possibility of degradation or cross contamination is minimised.

Task 3: Carry out laboratory examination

Assessment Objective 3

Your task is to:

- **carry out forensic tests on the materials you have collected as evidence**

This is evidence collected from:

- the scene of the crime
- each of the suspects.

- **carry out at least THREE tests to compare the evidence you have collected from the crime scene and your suspects**

Your tests could include...

- visual examination and measurement
- the use of a microscope
- chemical analysis (eg of soil)
- physical analysis (eg using chromatography)
- biological analysis (eg of plant material)

- **keep a detailed account of the standard procedures you have followed, as you may have to justify these to the Crown Prosecution Service**

You must...

- produce a record of the practical test methods you followed and risk assessments for each method.

To achieve the higher grades you must independently carry out more than **THREE** tests and comment in great detail on the reliability and validity of the procedures you used.

Task 4: Describe different types of instrumental analysis

Assessment Objective 4

Forensic scientists have access to a number of methods of instrumental analysis that have far greater sensitivity than the tests that you have access to. Although you will not use these methods yourself, you need to be aware of them for task 5, when you have to comment on the reliability and accuracy of the tests that you have used.

Your task is to:

- **research and make a summary of the instrumentation that forensic investigators might use when analysing evidence in the laboratory**
- **explain how the instrumentation is used**

The range of more complicated instrumental analysis that may be used by the professional Forensic Scientist could include:

- gas chromatography
- high performance liquid chromatography
- mass spectroscopy
- infra-red spectroscopy
- electrophoresis/DNA fingerprint
- blood typing
- microscopical examination.

Your summary should include...

- at least **FOUR** of the techniques listed above
- the main function of each technique
- how the technique is used in forensic science
- any appropriate image or drawing to illustrate the technique.

To achieve the higher grades you would be expected to discuss the instrumental techniques when evaluating the limitations of your own testing. You would also be expected to compare and evaluate the types of tests that can be conducted in a school/college with those used in professional laboratories.

Task 5: Present results and findings from your tests

Assessment Objective 5

You need to summarise your results and findings from task 3.

Your task is to:

- **produce lab notes that show how you have recorded and collated results accurately in a clear format**

You need to include...

- any calculations that you have carried out
- relevant information
- the accuracy, reliability and limitation of the results
- a brief summary of your findings from each test.

The evidence will be recorded and the results of the investigation collated.

To achieve the higher grades you must record the relevant information clearly and comprehensively. You must also comment on the accuracy, reliability and limitations of your results, in great detail.

Task 6: Report findings

Assessment Objective 6

Your task is to:

- **write a report of your conclusions from the investigation that will be forwarded to the Crown Prosecution Service (CPS)**

You should include an outline of...

- the background of the burglary, using the witness statement and the initial brief
- why the prosecutor needs the report
- a list of the tests carried out and, for each test, a brief statement of the main outcomes
- your opinion as to who is responsible for the crime and the evidence that supports your conclusion
- any findings that conflict with your conclusions.

You **MUST** use ICT tools to present at least part of your report.

To achieve the higher grades you must provide an extensive analysis of your results which considers most alternative interpretations of the evidence.

Candidate Checklist

OCR Level 2 Nationals in Science

Unit 3: Forensic science

CANDIDATE NAME: _____

For task 1 have you produced:	Ref/Page number(s)
<input type="checkbox"/> a detailed brief for your scene of crime officers	
<input type="checkbox"/> a risk assessment for each process	
<input type="checkbox"/> a commentary on why it is important to follow standard procedures?	

For task 2 have you:	Ref/Page number(s)
<input type="checkbox"/> collected evidence using the appropriate procedure and then recorded and stored appropriately	
<input type="checkbox"/> produced detailed notes of your crime scene investigation	
<input type="checkbox"/> obtained and recorded a statement from a witness?	

For task 3 have you:	Ref/Page number(s)
<input type="checkbox"/> carried out at least THREE tests to compare the evidence you have collected from the crime scene and your suspects	
<input type="checkbox"/> produced a record of the practical test procedures you followed, including risk assessments for each procedure?	

For task 4 have you produced:	Ref/Page number(s)
<input type="checkbox"/> a summary of at least FOUR forensic techniques and their uses?	

For task 5 have you produced:	Ref/Page number(s)
<input type="checkbox"/> a record of your results and findings from each test	
<input type="checkbox"/> a comment on the reliability and accuracy of your results?	

For task 6 have you:	Ref/Page number(s)
<input type="checkbox"/> produced a report of your overall conclusions from the investigation	
<input type="checkbox"/> used ICT tools to present at least part of your report?	