

**GENERAL CERTIFICATE OF SECONDARY EDUCATION
 TWENTY FIRST CENTURY SCIENCE
 ADDITIONAL APPLIED SCIENCE A
 Scientific Detection (Higher Tier)
 MONDAY 21 JANUARY 2008**

A325/02

Afternoon
 Time: 45 minutes

Candidates answer on the question paper.

Additional materials: Calculator
 Pencil
 Ruler (cm/mm)



Candidate Forename

Candidate Surname

Centre Number

Candidate Number

INSTRUCTIONS TO CANDIDATES

- Write your name in capital letters, your Centre Number and Candidate Number in the boxes above.
- Use blue or black ink. Pencil may be used for graphs and diagrams only.
- Read each question carefully and make sure that you know what you have to do before starting your answer.
- Answer **all** the questions.
- Do **not** write in the bar codes.
- Do **not** write outside the box bordering each page.
- Write your answer to each question in the space provided.

INFORMATION FOR CANDIDATES

- The number of marks for each question is given in brackets [] at the end of each question or part question.
- The total number of marks for this paper is **36**.

FOR EXAMINER'S USE		
Qu.	Max.	Mark
1	5	
2	5	
3	10	
4	11	
5	5	
TOTAL	36	

This document consists of **11** printed pages and **1** blank page.

Answer **all** the questions.

1 A burglar breaks into a house.

He takes off his shoes and wears gloves so as not to leave any clues.

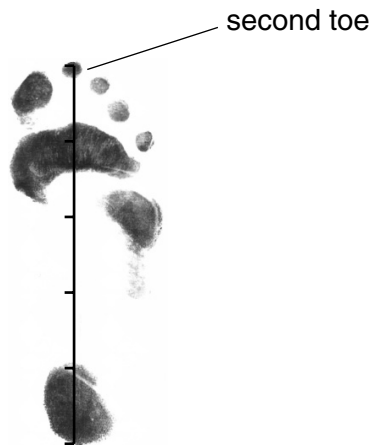
However, he leaves a footprint behind.



(a) Identify **two** important features of the image that the police may want to record. You may label the diagram above if you wish.

.....
.....
..... [2]

(b) The police take measurements of the footprint.



Estimate the width of the burglar's second toe print.

.....

[1]

(c) Give **four** examples of ways in which the police may record information from the scene of the crime.

.....

.....

.....

..... [2]

[Total: 5]

2 Petra works in a laboratory.

She uses this standard procedure to set up a light microscope.

step 1	Prepare the microscope slide.
step 2	Switch on the lamp.
step 3	Place the slide on the stage under the clips.
step 4	Select and position an objective lens.
step 5	Lower the objective lens close to the slide, then raise slowly until the image is in focus.
step 6	Take photographs of the image.

(a) Why did Petra switch on the lamp?

..... [1]

(b) Why did Petra place the slide under the clips?

..... [1]

(c) Why did Petra need to select an objective lens?

..... [1]

(d) Petra lowers the objective lens **before** looking through the microscope and then raises it.

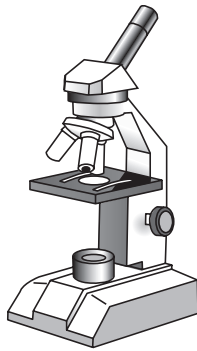
Explain why.

.....

 [2]

[Total: 5]

3 Scientists sometimes use light microscopes when collecting evidence.



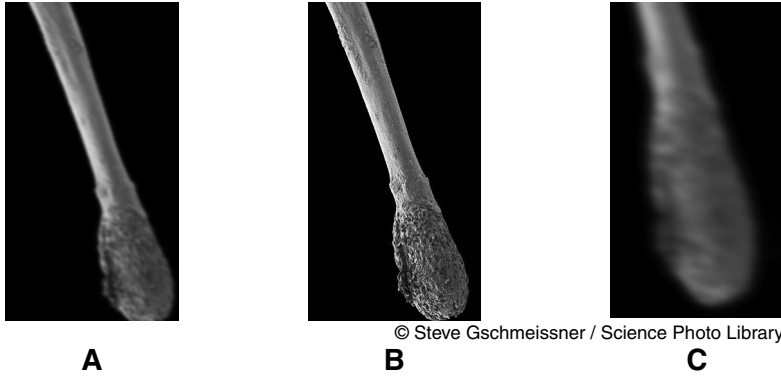
(a) How does the microscope help you to see more detail?

Put a tick (✓) in the box next to the best answer.

magnification		resolution		
increases	decreases			<input type="checkbox"/>
no change	increases			<input type="checkbox"/>
increases	increases			<input type="checkbox"/>
decreases	decreases			<input type="checkbox"/>
increases	no change			<input type="checkbox"/>
decreases	increases			<input type="checkbox"/>

[1]

(b) A forensic scientist looks at a human hair through a microscope.
She takes three different photographs.



(i) Which photograph, **A**, **B** or **C**, has the greatest magnification?

.....

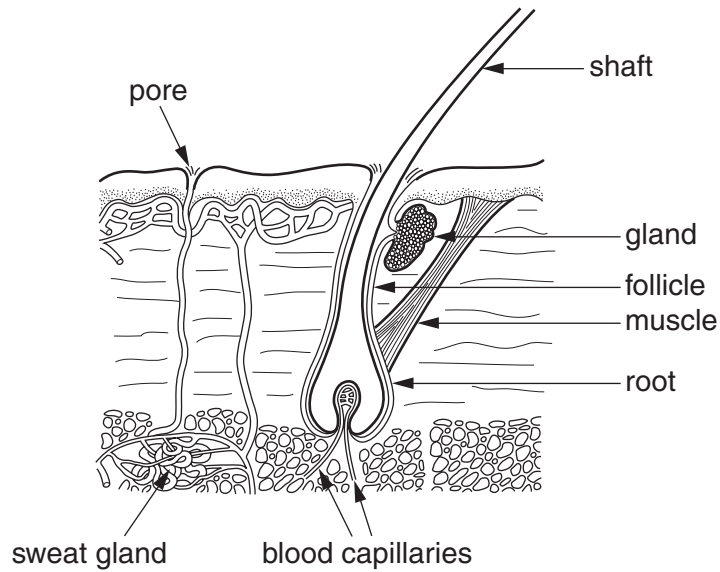
[1]

(ii) Which photograph, **A**, **B** or **C**, has the greatest resolution?

.....

[1]

(c) Look at the diagram showing a human hair growing in skin.



Use information from the diagram to label **two** features on the following photograph.



© Steve Gschmeissner / Science Photo Library

[2]

- (d) For a photograph of a human hair, the scientist uses an eyepiece lens of $\times 5$ and an objective lens of $\times 15$.

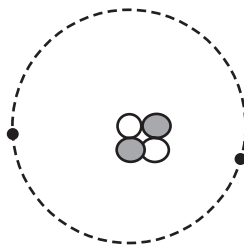
Calculate the magnification of the image.

Show your working.

magnification = \times [2]

- (e) Even greater detail can be obtained using an electron microscope.

Look at the diagram of an atom.



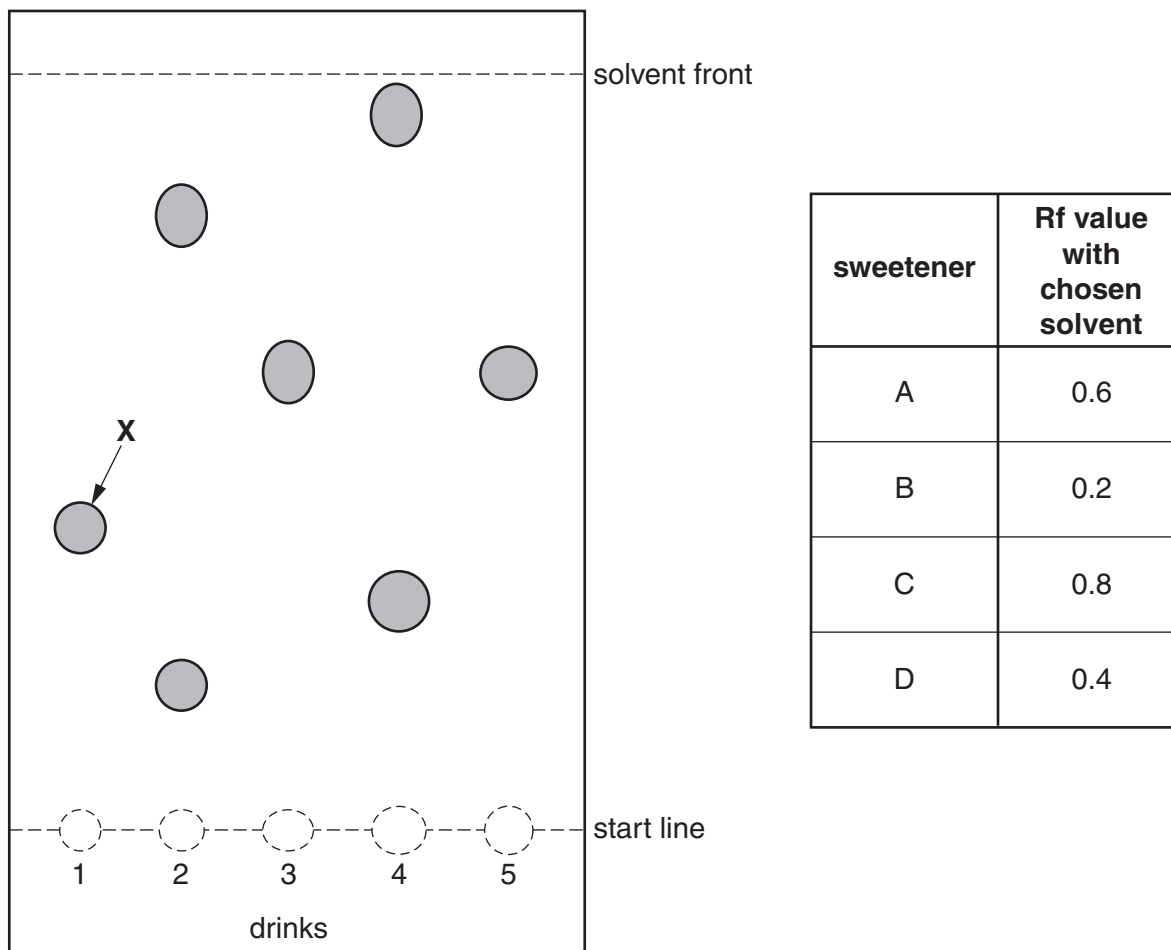
- (i) Put a ring around an electron. [1]

- (ii) Explain fully why it is called an electron microscope.

.....
.....
..... [2]

[Total: 10]

- 4 A student uses paper chromatography to identify unknown sweeteners found in five different drinks.



- (a) The chromatogram above is drawn actual size.

- (i) Use your ruler to measure the distance moved by the solvent.

..... cm [1]

- (ii) Use your ruler to measure the distance moved by **sweetener X**.

..... cm [1]

- (b) The Rf value of the sweetener **X** can be calculated using the following formula.

$$R_f = \frac{\text{distance moved by sweetener}}{\text{distance moved by solvent}}$$

- (i) Use the equation to find the Rf value of sweetener **X**.

Rf of sweetener **X** = [1]

(ii) Which of the sweeteners, **A, B, C** or **D**, is sweetener **X**?

..... [1]

(c) State which two drinks contain a **mixture** of sweeteners.

..... and [1]

(d) State which drink contains sweeteners **not** listed in the table at the beginning of the question.

..... [1]

(e) Explain why some sweeteners travel further up the paper than others.

.....
..... [1]

(f) The same drinks were tested by a food scientist.

(i) The food scientist included the known sweeteners on her chromatogram.

Explain why.

.....
.....
..... [2]

(ii) The food scientist used thin layer rather than paper chromatography.

Explain the advantages of using thin layer chromatography.

.....
.....
..... [2]

[Total: 11]

5 Public laboratories have a system of accreditation to ensure reliability.

(a) To gain accreditation, laboratories have to carry out proficiency tests.

Explain the purpose of a proficiency test.

.....
.....
..... [1]

(b) What can be done to ensure that different laboratories produce comparable results?

.....
.....
..... [1]

(c) Public laboratories also try to use good laboratory practice.

State how each of the following improves laboratory practice.

(i) maintaining and checking equipment

.....
..... [1]

(ii) training staff

.....
..... [1]

(iii) keeping to Health & Safety regulations

.....
..... [1]

[Total: 5]

END OF QUESTION PAPER

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