

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

A325/01

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	4	
3	10	
4	12	
5	5	
TOTAL	36	

This document consists of **12** printed pages.

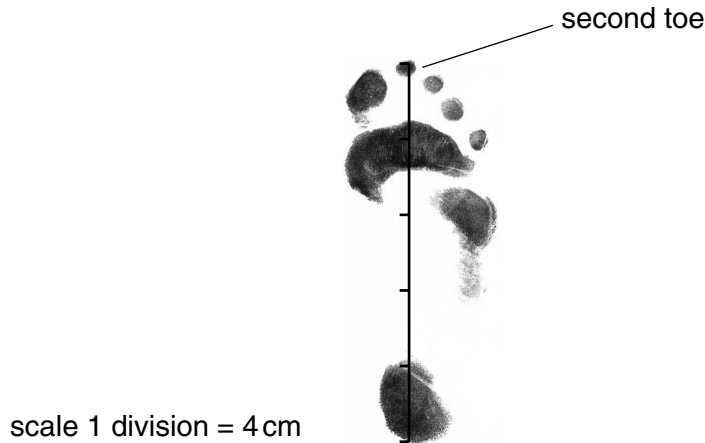
Answer **all** the questions.

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) The police take measurements of the footprint.



(i) What is the length of the burglar's foot?

.....

[1]

(ii) Estimate the width of the burglar's second toe print.

.....

[1]

(b) Police examined the footprints of four suspects.



Which of the suspects, **A**, **B**, **C** or **D**, do you think committed the crime?

..... [1]

(c) Give **two** examples of how the police may record images from the scene of the crime.

1

2 [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.

Choose from the following statements to help you answer the questions.

- to focus the image
- to hold the slide in place
- to illuminate the specimen
- to avoid damaging the lens and the slide
- to record the image
- to choose the magnification

(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]

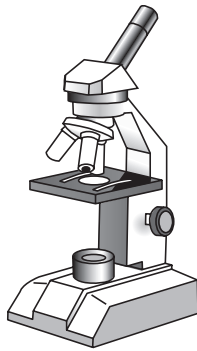
(d) Why did Petra lower the objective lens **before** looking through the microscope and then raise it?

.....

..... [1]

[Total: 4]

3 Scientists sometimes use light microscopes when collecting evidence.



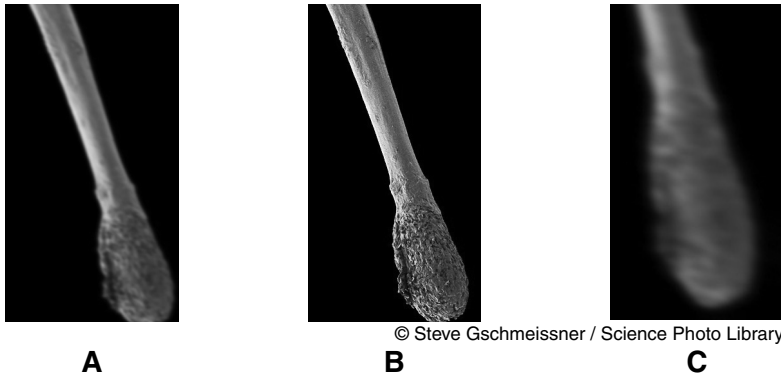
(a) How does the microscope help you to see more detail?

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?

.....

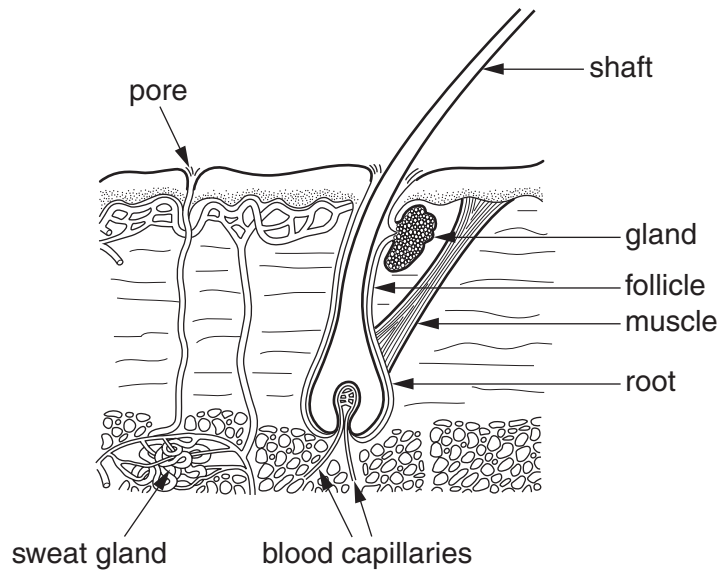
[1]

(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 $\times 15$.

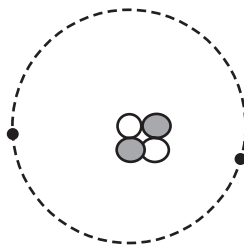
Calculate the magnification of the image.

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 Jake tests a drink with litmus paper.



(a) (i) What colour will the litmus paper turn if the drink is acidic?

.....

[1]

(ii) Which of the following best describes the litmus test?

Put a **ring** around the best answer.

qualitative

quantitative

semi quantitative

[1]

(b) Jake uses another indicator to test the drink.

pH scale	indicator colour
pH 2	
pH 4	
pH 7	
pH 10	
pH 13	

Jake's drink

What is the pH of Jake's drink?

pH [1]

(c) Give an example of a colour test kit that is used in **medical** diagnosis.

..... [1]

(d) Colorimeters can be used to give **quantitative** results.

(i) Explain what is meant by a quantitative result.

.....
 [1]

(ii) Which of the following best describes what a colorimeter measures?

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

the shade of a colour

the name of a colour

the greyscale of a colour

the intensity of a colour

[1]

(iii) The following statements describe how to measure the concentration of a coloured solution using a colorimeter.

They are in the wrong order.

A Put in the unknown sample and match its absorption with the calibration graph.

B In turn, put in a range of standard reference solutions of known concentration.

C Use the standard solution results to draw a calibration graph.

D Put pure colourless solvent into the sample cell and set the meter to zero.

E Record the absorbance of each standard solution.

Put the statements, **A**, **B**, **C**, **D** and **E**, in the correct order.

The first one has been done for you.

D				
---	--	--	--	--

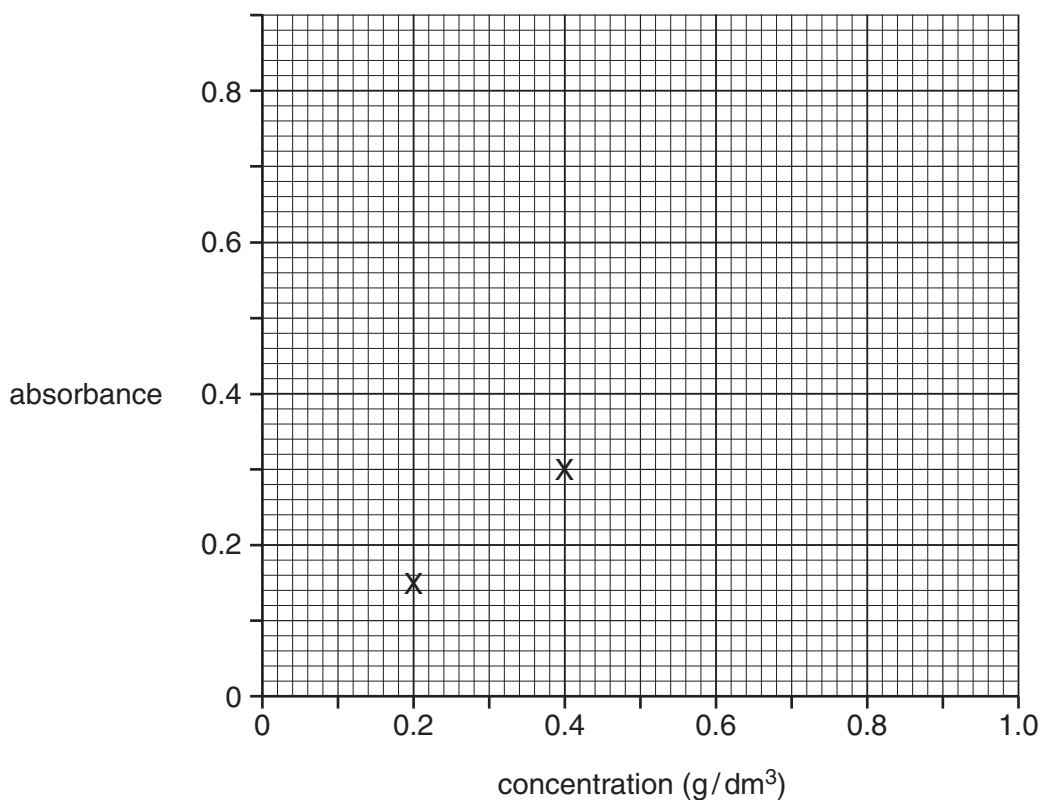
[3]

- (iv) The following data were obtained when Jake tested standard reference solutions using a colorimeter.

concentration (g/dm ³)	absorbance
0.2	0.15
0.4	0.30
0.6	0.45
0.8	0.80
1.0	0.75

Plot the results on the grid below.

The first two have been done for you.



- (v) Draw the line of best fit on the graph. [1]

Which of the results is an outlier?

.....

[1]

- (vi) Jake tested a solution of the same substance with an unknown concentration. Its absorbance was 0.6.

Use your graph to determine its concentration.

..... g/dm³ [1]

[Total: 12]

5 Public laboratories have a system of **accreditation**.

(a) Which of the following best explains why?

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

to ensure reliability

to check equal opportunities

to pay the minimum wage

to check safety

[1]

(b) Which of the following best describes what accreditation does?

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

It provides a mark out of 100.

It gives them a grade from A to E.

It puts them on a list of laboratories who may be given contracts.

It lists tests the laboratory is allowed to carry out.

[1]

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

Which **three** of the following are about good laboratory practice?

Put ticks (✓) in the boxes next to the **three** best answers.

- | | |
|--|--------------------------|
| keeping to Health & Safety regulations | <input type="checkbox"/> |
| providing a staff canteen | <input type="checkbox"/> |
| making a profit | <input type="checkbox"/> |
| running a staff football team | <input type="checkbox"/> |
| looking after equipment | <input type="checkbox"/> |
| training staff in new techniques | <input type="checkbox"/> |
| having regular staff meetings | <input type="checkbox"/> |
| being in a good pension scheme | <input type="checkbox"/> |

[3]

[Total: 5]

END OF QUESTION PAPER

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