

GENERAL CERTIFICATE OF SECONDARY EDUCATION

TWENTY FIRST CENTURY SCIENCE

A325/01

ADDITIONAL APPLIED SCIENCE A

Scientific Detection (Foundation Tier)

Tuesday 7 June 2011

Afternoon

Duration: 45 minutes

Candidates answer on the question paper.
A calculator may be used for this paper.

OCR supplied materials:

None

Other materials required:

- Pencil
- Ruler (cm/mm)



| | | | |
|-----------------------|--|----------------------|--|
| Candidate forename | | Candidate surname | |
|-----------------------|--|----------------------|--|

| | | | | | | | | | | |
|---------------|--|--|--|--|--|------------------|--|--|--|--|
| Centre number | | | | | | Candidate number | | | | |
|---------------|--|--|--|--|--|------------------|--|--|--|--|

INSTRUCTIONS TO CANDIDATES

- Write your name, centre number and candidate number in the boxes above. Please write clearly and in capital letters.
- Use black ink. Pencil may be used for graphs and diagrams only.
- Read each question carefully. Make sure you know what you have to do before starting your answer.
- Write your answer to each question in the space provided. Additional paper may be used if necessary but you must clearly show your candidate number, centre number and question number(s).
- Answer **all** the questions.
- Do **not** write in the bar codes.

INFORMATION FOR CANDIDATES

- The number of marks is given in brackets [] at the end of each question or part question.
- The total number of marks for this paper is **36**.
- This document consists of **12** pages. Any blank pages are indicated.

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Answer **all** the questions.

1 Forensic laboratories need to ensure good laboratory practice.
One of the key features of this is the regular checking of equipment.

(a) Name one piece of laboratory equipment.
Describe how scientists could make sure that it is giving correct results.

name of equipment

how to ensure correct results

.....

..... [3]

(b) Many jobs require use of scientific expertise.
For each of the following areas of employment, give one example of a job which uses scientific expertise.

(i) law enforcement

.....

..... [1]

(ii) consumer protection

.....

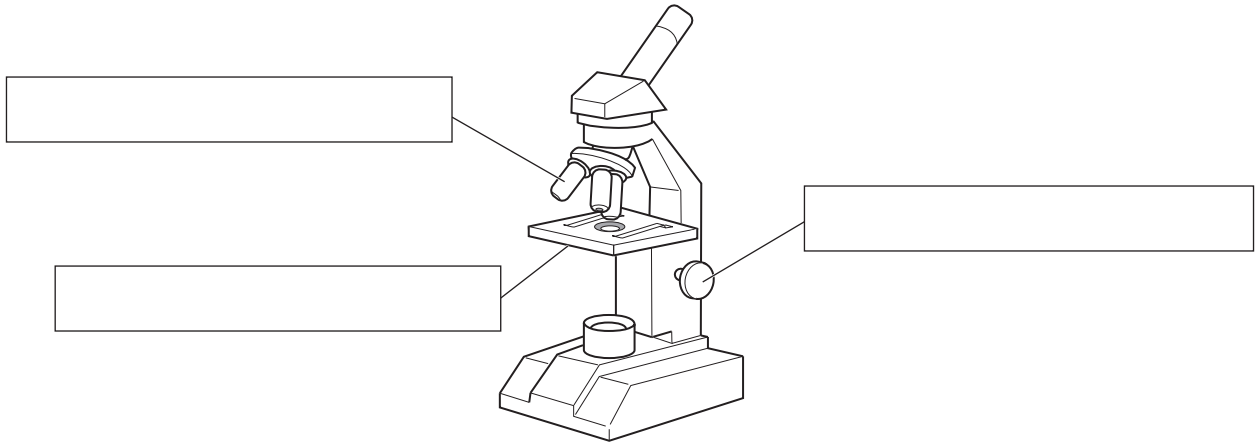
..... [1]

[Total: 5]

2 Scientists sometimes use light microscopes when examining evidence.

(a) Complete the labels on this diagram of a microscope.
Choose from this list.

- base eyepiece lens lamp clip focussing adjuster
condenser objective lens stage diaphragm



[3]

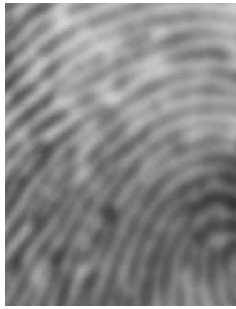
(b) The microscope affects both the magnification and the resolution of the image.
Which of the following changes helps the scientist to see most detail?

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

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

[1]

(c) A forensic scientist looks at a fingerprint through a microscope. She takes three different photographs of the print.



A



B



C

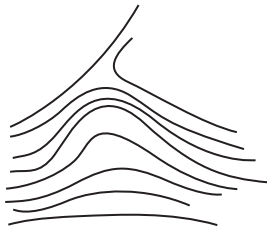
(i) Which photograph, **A**, **B** or **C**, has the greatest magnification?

answer [1]

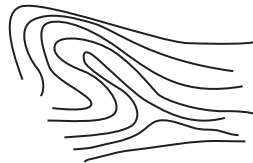
(ii) Which photograph, **A**, **B** or **C**, has the greatest resolution?

answer [1]

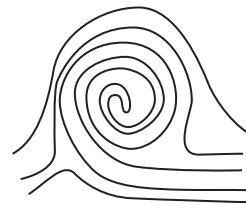
(d) Look at the drawings of three different types of fingerprint.



arch



loop



whorl

Use the drawings to identify the type of fingerprint the scientist saw in photograph **B**.

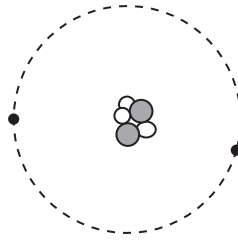
answer [1]

(e) For photograph **A**, the scientist uses an eyepiece lens of **x5** and an objective lens of **x10**. Calculate the magnification of the image. Show your working.

magnification = \times [2]

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

Look at the diagram of an atom.



(i) Put a **ring** around **one** electron. [1]

(ii) Put a **box** around **one** negatively charged particle. [1]

(iii) Explain why it is called an electron microscope.

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

[Total: 12]

3 Materials can be tested in different ways.
Different tests give different levels of details in the results.

(a) A scientist tests a drink with litmus paper.

(i) Which of these words **best** describes the litmus test?
Put a ring around the correct answer.

qualitative quantitative semi quantitative

[1]



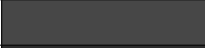

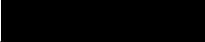
(ii) Explain how a **quantitative** test differs from a **qualitative** test.


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

(iii) What colour will the litmus paper turn if the drink is alkaline?

..... [1]

(b) The scientist tests the drink with a different indicator.

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

results of the test on the drink 

What is the pH of the drink?

pH =

How can you tell?

..... [1]

(c) Indicators to identify acids or alkalis, and pregnancy testing kits, are examples of colour tests used in medical diagnosis.

Name one other example of a colour testing kit used in medical diagnosis.

..... [1]

[Total: 5]

- 4 A scientist prepares material to be viewed using an electron microscope. He uses a standard procedure.

The table shows the steps the scientist follows. They are in the correct order.

| step | what is done to the material | reason (A to F) |
|--------|---|----------------------|
| step 1 | A very thin slice is cut from the material. | <input type="text"/> |
| step 2 | The slice is dried and fixed. | <input type="text"/> |
| step 3 | The slice is placed in the electron microscope. | <input type="text"/> |
| step 4 | Air is sucked out of the electron microscope. | <input type="text"/> |
| step 5 | The image of the slice is viewed on a screen. | <input type="text"/> |

The sentences **A**, **B**, **C**, **D**, **E**, and **F** give possible reasons for steps in the standard procedure.

- A** to prevent the material changing during the sample preparation
- B** the eye cannot see electrons
- C** to kill any living specimens
- D** air would stop electrons passing through
- E** to allow electrons to pass through the specimen
- F** air oxidises the inside of the microscope

Write a letter, **A**, **B**, **C**, **D**, **E** or **F**, inside each empty box to show the correct reason for the step. **[4]**

[Total: 4]

5 A forensic scientist collects a sample of blood from a crime scene.

(a) There are several stages in the collection, storage and preparation of blood samples for analysis.

For each **stage**, the scientist takes a different **action**.

Draw a straight line to join **each stage** with the correct **action** taken.

Then for **each action**, draw a straight line to join it to the **reason** why it is done.

| stage | action | reason |
|--|------------------------------------|---|
| collect representative samples | ensures the freezer is locked | to see if all the blood is from the same person |
| avoid contamination of samples | collects blood from various places | unwanted material in the sample could ruin the evidence |
| prevent change or deterioration to samples | places blood samples in freezer | so that the blood can be analysed at a later time |
| avoid tampering of samples | places blood in a sealed tube | so the evidence remains secure |

[4]

(b) When the blood has been analysed the data tells the scientist

- the blood group
- the proportion of red cells, white cells and platelets
- the DNA profile.

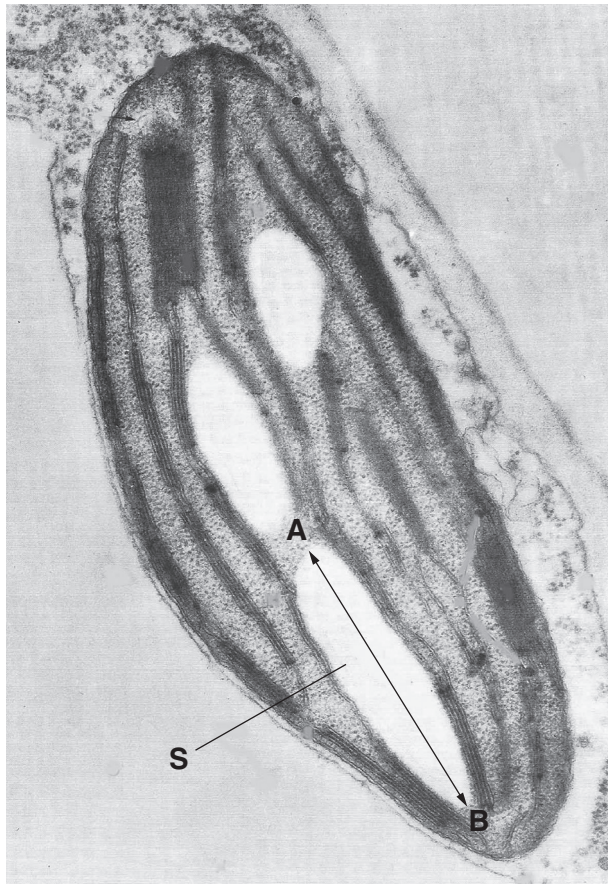
Suggest two ways that the scientist could present this data.

1

2 [2]

[Total: 6]

6 A scientist made an electron micrograph of part of a plant cell.



(a) Structure **S** is a starch grain.
How many starch grains are visible in the electron micrograph?

answer [1]

(b) Measure the length of the image of the starch grain between points **A** and **B**.

length = mm [1]

(c) The magnification of the image is $\times 10\,000$.
Calculate the **actual** length of the starch grain.
Show your working.

actual length of starch grain = mm [2]

[Total: 4]

END OF QUESTION PAPER

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