

**GENERAL CERTIFICATE OF SECONDARY EDUCATION
TWENTY FIRST CENTURY SCIENCE
ADDITIONAL APPLIED SCIENCE A**

A325/02

Unit 3: Scientific Detection (Higher Tier)

**Wednesday 16 June 2010
Morning**

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	
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Centre Number						Candidate Number				
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INSTRUCTIONS TO CANDIDATES

- Write your name clearly in capital letters, your Centre Number and Candidate Number in the boxes above.
- Use 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.
- 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).

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.

Answer **all** the questions.

1 Collecting, storing and preparing scientific evidence is an important part of scientific detection.

(a) Which **two** of the following are **not** stages in this process?

Put ticks (✓) in the boxes next to the correct answers.

- make a list of the samples
- copy samples for multiple use
- prevent change or deterioration of samples
- avoid interfering with samples
- dispose of the samples within three months

[2]

(b) Public laboratories that carry out tests have to be accredited by the United Kingdom Accreditation Service (UKAS).



The UKAS accreditation mark

(i) Explain **why** accreditation is carried out.

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

(ii) As part of accreditation, analysts carry out proficiency tests.

Which statement best explains why?

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

- to make sure that they always get the same result
- to check the quality of their work
- to ensure scientists know what to do
- to make sure the test is the same every time

[1]

(c) Good laboratory practice is important.

Describe **two** things that should be done to ensure good laboratory practice.

.....

.....

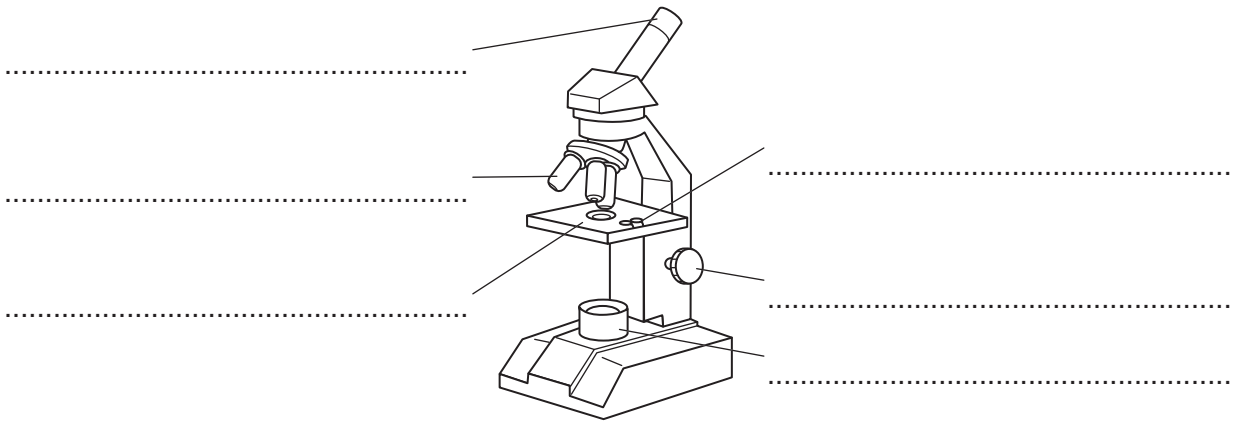
.....

.....

..... [2]

[Total: 6]

2 Scientists sometimes use light microscopes when examining evidence.



(a) Complete the labels on the diagram of the light microscope. [3]

(b) The microscope provides greater detail by increasing the magnification and the resolution.

Draw straight lines linking together each **aspect of the image** with its correct **explanation**.

aspect of the image	explanation
<div style="border: 1px solid black; padding: 5px; width: fit-content; margin-bottom: 10px;">magnification</div> <div style="border: 1px solid black; padding: 5px; width: fit-content;">resolution</div>	<div style="border: 1px solid black; padding: 5px; width: fit-content; margin-bottom: 10px;">shows errors with the image</div> <div style="border: 1px solid black; padding: 5px; width: fit-content; margin-bottom: 10px;">separates out detail</div> <div style="border: 1px solid black; padding: 5px; width: fit-content; margin-bottom: 10px;">makes the image larger</div> <div style="border: 1px solid black; padding: 5px; width: fit-content; margin-bottom: 10px;">shows more colours</div> <div style="border: 1px solid black; padding: 5px; width: fit-content;">increases contrast</div>

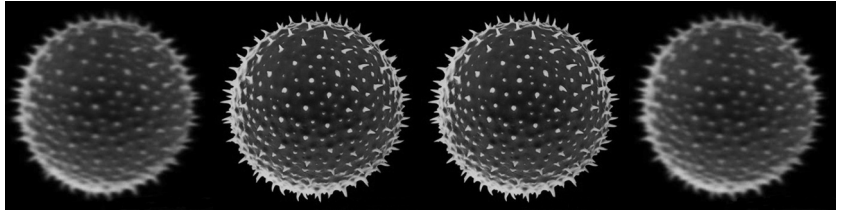
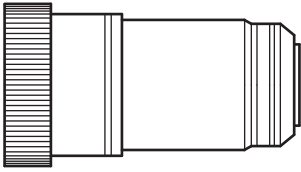
[2]

(c) The depth of field using a light microscope is limited.

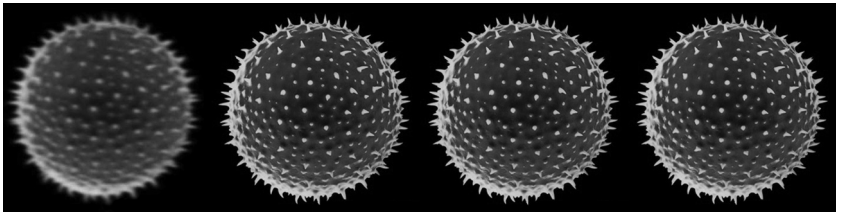
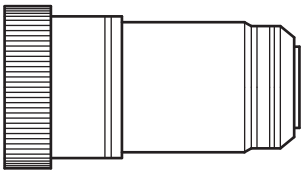
objective lens

image of pollen grain at increasing distance from the lens

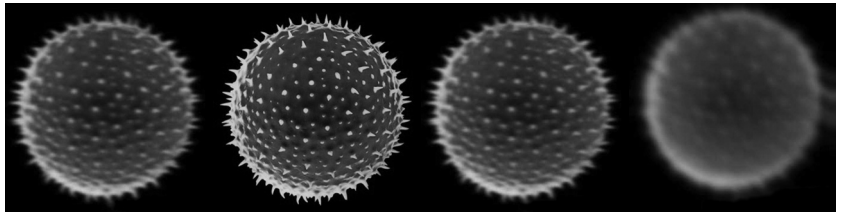
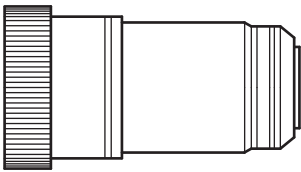
A



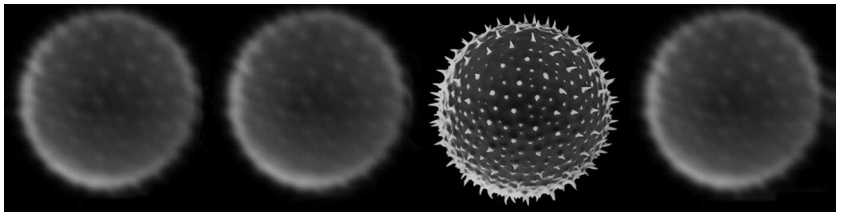
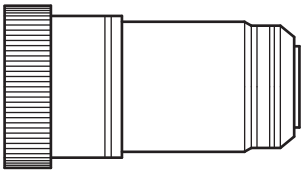
B



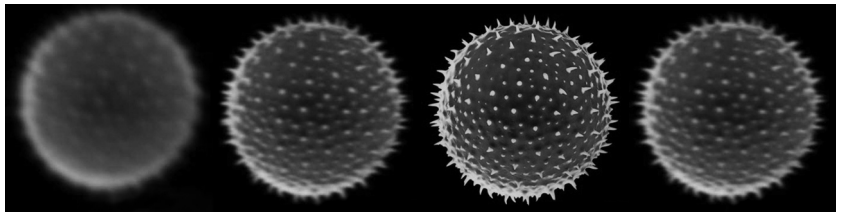
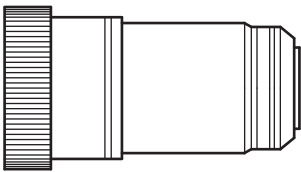
C



D



E



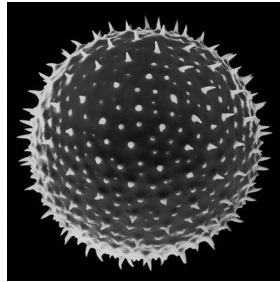
(i) Which lens, A, B, C, D or E, has the greatest depth of field?

answer [1]

(ii) Which lens, A, B, C, D or E, produces the least depth of field?

answer [1]

3 A forensic scientist examines pollen grains collected from a crime scene.



×100

(a) Describe **two** of the main features of the pollen grain.

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

(b) The scientist needs to know the actual size of the pollen grain.

(i) Use your ruler to measure the width of the pollen grain image.

Do **not** include the spiky bits on the surface of the grain.

answer mm [1]

(ii) Use the scale to calculate the actual size of the pollen grain.

Show your working.

answer mm [2]

[Total: 5]

4 Sometimes electron microscopes are used to examine evidence.

(a) Which of the statements about electron microscopes is true?

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

An electron microscope uses a beam of ...

... electrons only.

... light only.

... both electrons and light.

... neither electrons nor light.

[1]

(b) Which of the statements about atoms and electrons is true?

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

An atom consists of a tiny ...

... negative nucleus surrounded by positive electrons.

... positive nucleus surrounded by positive electrons.

... negative nucleus surrounded by negative electrons.

... positive nucleus surrounded by negative electrons.

[1]

(c) Electron microscopes can only be used with certain types of samples.

Which **two** statements are good examples of this limitation?

Put ticks (✓) in the boxes next to the correct answers.

Electron microscopes **cannot** be used to examine ...

... very thick specimens.

... living organisms.

... specimens that are opaque.

... moving objects.

... specimens that are very hard.

[2]

(d) Describe one **other** disadvantage and one advantage of using an electron microscope.

disadvantage

.....

advantage

..... [2]

[Total: 6]

5 Two-way paper chromatography can be used to separate the different food dyes in drinks.

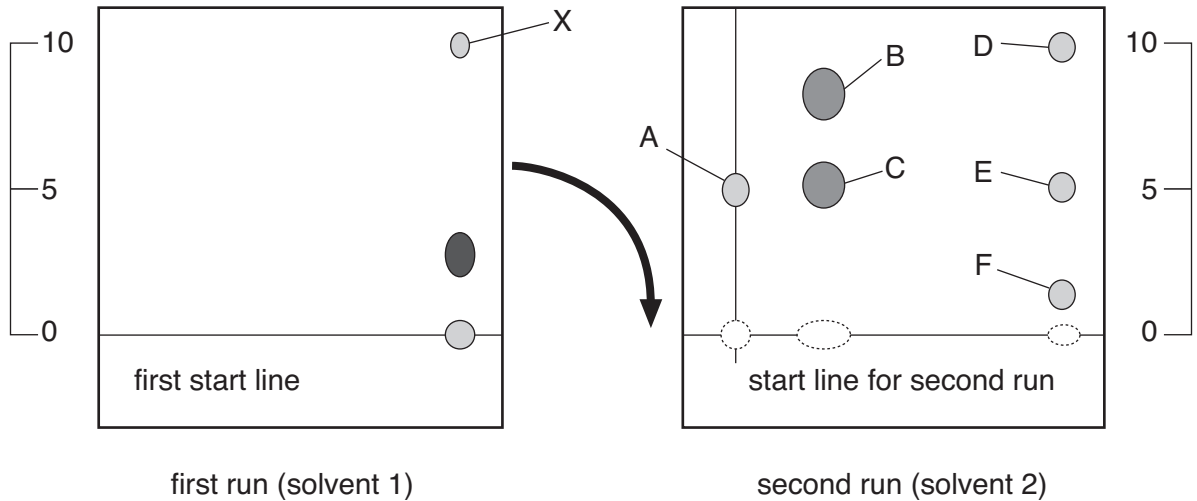
First a normal paper chromatogram is made and left to dry.

The paper is then turned through 90° and the process is repeated using a different solvent.

Food dyes have different solubilities in different solvents.

The diagrams show the results of each stage for a coloured drink.

(a) Use the information from these diagrams to answer these questions.



(i) In the left hand diagram, put a ring around the spot which is **insoluble** in solvent 1. [1]

(ii) For the second run, how many different colours have been separated from spot X?

answer [1]

(iii) In **total**, how many coloured spots have been separated by using this two-way method?

answer [1]

(iv) If only one-way chromatography had been used, using solvent 2 only, which dyes would **not** have been separated?

answer [1]

(b) Paper chromatograms have both stationary and mobile phases.

Draw a straight line linking the **phase** with its correct **description**.

phase	description
mobile phase	solvent
stationary phase	dyes
	paper

[2]

(c) Explain why forensic scientists use standard reference dyes in their chromatograms.

.....

..... [1]

[Total: 7]

6 Different types of chromatography can be used for separating mixtures.

Gas chromatography is often used to separate complex mixtures.

(a) Which statements explain the advantages of using gas chromatography?

Put a tick (✓) in the boxes next to the **two** best statements.

It separates a greater range of colours than paper chromatography.

It is much faster than thin layer chromatography.

It can use two solvents at the same time.

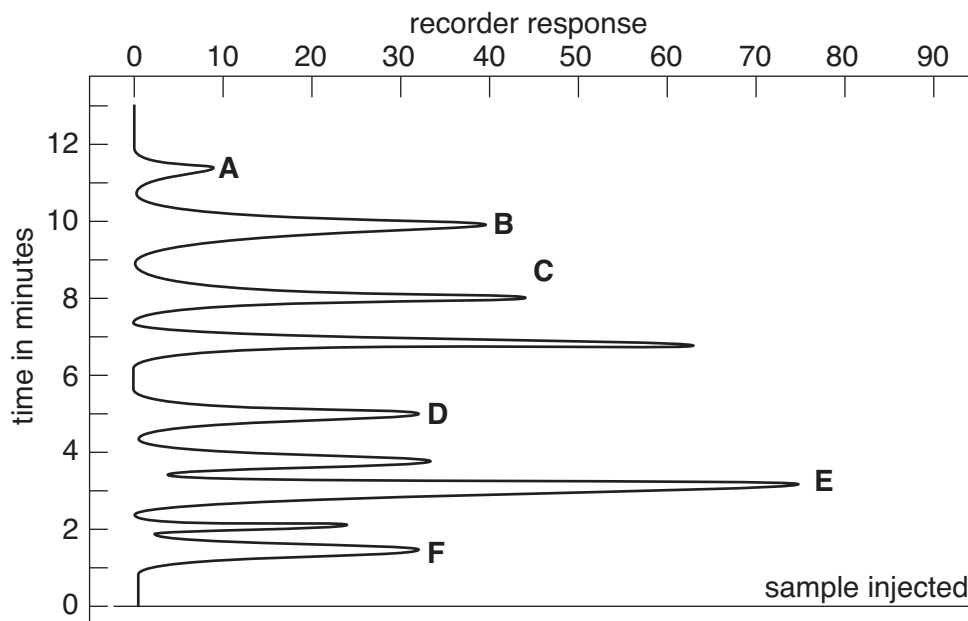
It has greater separating power than paper or thin layer chromatography.

It costs less to use than thin layer chromatography.

It can separate liquids, gases and volatile solids.

[2]

(b) The chart shows different components separated by their retention times.



(i) Which component, **A**, **B**, **C**, **D**, **E**, or **F**, has a retention time of five minutes?

answer [1]

(ii) Which two components, from **A**, **B**, **C**, **D**, **E** and **F**, are present in the same concentration?

answer and [1]

(iii) Which component, **A**, **B**, **C**, **D**, **E**, or **F**, is present in the greatest concentration?

answer [1]

[Total: 5]

END OF QUESTION PAPER



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