

**Wednesday 30 May 2012 – Afternoon**

**GCSE TWENTY FIRST CENTURY SCIENCE  
ADDITIONAL APPLIED SCIENCE A**

**A325/02** Scientific Detection (Higher Tier)

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)

**Duration:** 45 minutes



Candidate forename		Candidate surname	
Centre number		Candidate number	

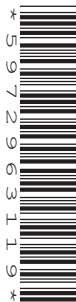
**MODIFIED LANGUAGE**

**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. HB 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.



Answer **all** the questions.

- 1** Scientific detection is used in law enforcement (Forensic Science Service), environmental protection (Environment Agency) and consumer protection (Food Standards Agency).

**(a)** Describe one example of the work carried out by each of these organisations.

Forensic Science Service .....

.....

Environment Agency .....

.....

Food Standards Agency .....

..... **[3]**

**(b)** **Collecting** and **storing** scientific evidence is an important part of scientific detection.

Which of the following are stages in this process?

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

collect representative samples	
copy samples for multiple use	
dispose of samples within a six week period	
use the samples to train colleagues	
avoid contamination of samples	
avoid interfering with samples	
prevent change or deterioration of samples	

**[2]**

- (c) Good laboratory practice is important to produce reliable results.  
Good laboratory practice depends upon
- keeping to health & safety regulations
  - maintenance and checking of equipment
  - staff training.

Describe one example of each of these in good laboratory practice.

keeping to health & safety regulations

.....

.....

maintenance and checking of equipment

.....

.....

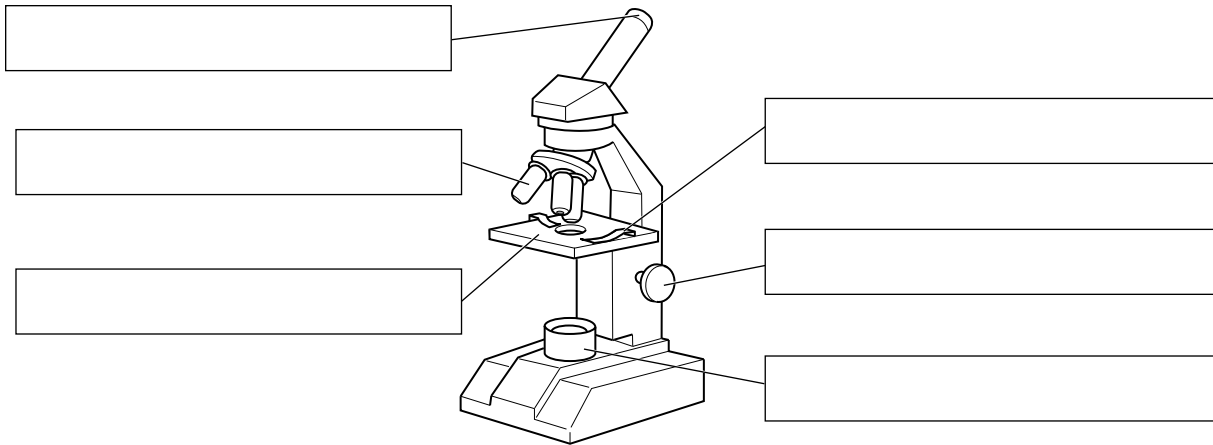
staff training

.....

..... [3]

[Total: 8]

2 Scientists sometimes use light microscopes when examining evidence.



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

[3]

(b) Using a light microscope has advantages and disadvantages over using an electron microscope.

Write down two advantages and two disadvantages of using a light microscope rather than an electron microscope.

advantages of using a light microscope

1 .....

.....

2 .....

.....

disadvantages of using a light microscope

1 .....

.....

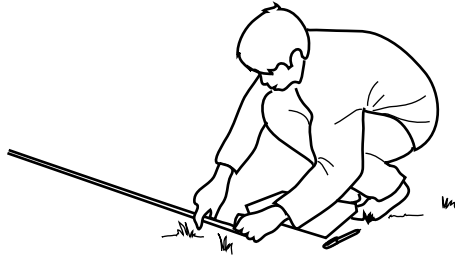
2 .....

.....

[4]

[Total: 7]

- 3 Forensic science students each measure the area of a crime scene.



They take turns using the same tape measure.  
The divisions on the tape measure are in metres and centimetres.  
These are their results.

student	width in m	length in m
Ranjit	3.52	8.31
Neil	3.61	8.42
Sunita	3.555	8.365
Michael	3.50	8.40
Jane	3.57	8.99
Peter	3.62	8.39

- (a) Write down the name of the student who produced an outlier.

..... [1]

- (b) Suggest why Sunita's measurements have three digits after the decimal point although the tape measure is only divided into metres and centimetres.

.....

..... [1]

- (c) Use Michael's figures to calculate the surface area of the crime scene.  
Show your working.

area = ..... units ..... [2]

- (d) Explain why the calculated area has a greater uncertainty than the measured lengths.

.....

.....

.....

..... [2]

[Total: 6]

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 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) Colour matching and colorimetry are also used to collect information.

Which of these statements describe what colorimetry can be used for?  
Put ticks (✓) in the boxes next to the **two** correct answers.

Colorimetry can be used to ...

... find the pH of different substances.	
... produce quantitative results.	
... discriminate between different colours.	
... identify different substances.	
... measure the intensity of a colour.	

[2]

- (d) Using cards of different colours is not a very accurate way of matching the colour of a sample during analysis.  
Explain why.

.....

.....

.....

.....

.....

..... [2]

[Total: 6]



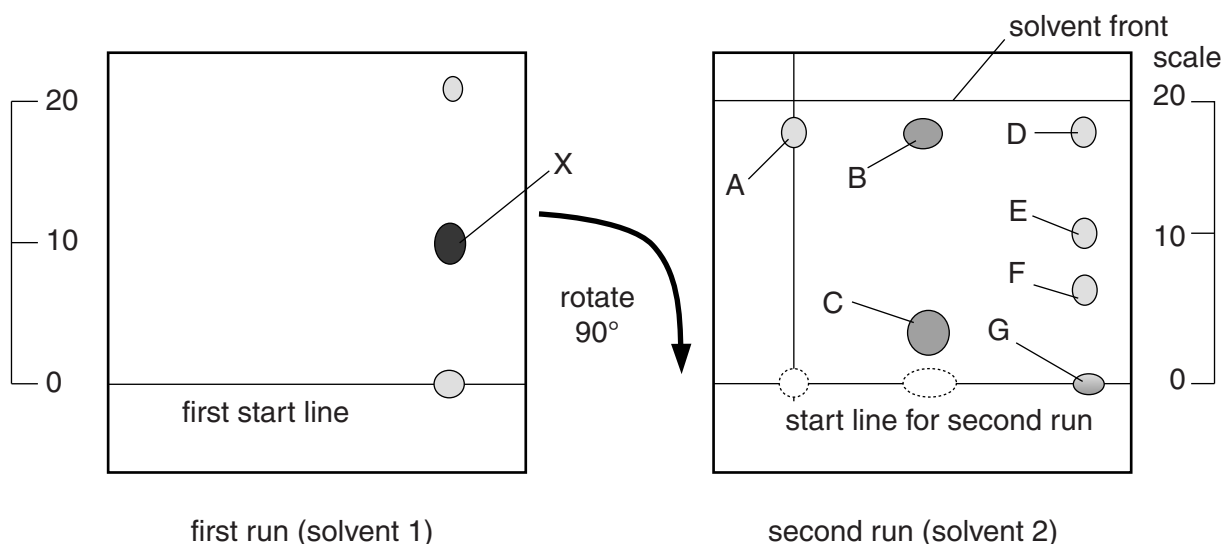
- 5 Two-way paper chromatography can be used to separate the different food dyes in drinks.

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 solubility 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) Write down the letter of the dye which is **insoluble** in solvent 2.  
 ..... [1]
- (ii) For the second run, how many different colours have been separated from spot **X**?  
 ..... [1]
- (iii) In **total**, how many colours have been separated by using this two-way method?  
 ..... [1]
- (iv) If only solvent 2 had been used to make a one-way chromatogram from the drink, which dyes would **not** have been separated?  
 ..... [1]
- (v) Use the equation to calculate the R<sub>f</sub> value of substance **E** in solvent 2.

$$R_f = \frac{\text{distance travelled by substance}}{\text{distance travelled by solvent}}$$

Use the given scale and show your working.

answer = ..... [2]

- (b) Paper chromatograms have both stationary and mobile phases. Draw a straight line linking the **phase** with its correct **description**.

phase	description
stationary phase	dyes
mobile phase	solvent
	paper

[1]

- (c) Explain the advantages of using gas chromatography (GC) over paper chromatography when separating complex mixtures.

.....

.....

.....

..... [2]

[Total: 9]

**END OF QUESTION PAPER**

11  
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