

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

**A325/02**

Scientific Detection  
(Higher Tier)

**Monday 19 January 2009  
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, however additional paper may be used if necessary.

**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.

FOR EXAMINER'S USE		
Qu.	Max.	Mark
1	6	
2	6	
3	5	
4	5	
5	10	
6	4	
<b>TOTAL</b>	<b>36</b>	

Answer **all** the questions.

1 Many organisations collect scientific evidence.

(a) For each example below, name the organisation involved and give an example of a role they carry out.

One has been done for you.

**Environmental protection**

Organisation ..... Environment Agency .....

Role ..... Protection against floods .....

(i) **Law enforcement**

Organisation .....

Role ..... [2]

(ii) **Consumer protection**

Organisation .....

Role ..... [2]

(b) It is important that scientific evidence is reliable.

Describe **one** way that reliability can be increased.

Give an example.

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

[Total: 6]

2 Evidence must be collected before it can be analysed.

(a) Which **two** of the following are **not** stages in the collection, storage and preparation of samples for analysis?

Put crosses (X) next to the **two incorrect** statements.

- collect representative samples
- estimate cost of collecting samples
- prevent deterioration of samples
- avoid contamination of samples
- avoid tampering of samples
- dispose of samples

[2]

(b) Standard procedures are used for analysing and testing the samples of evidence.

Which **two** of the following statements would **not** form part of a standard procedure?

Put crosses (X) next to the **two incorrect** statements.

- use standard reference materials to calibrate equipment
- buy new equipment at the end of each test
- make sure the equipment is from the same manufacturer
- use graphs to calibrate data
- record the standard procedure used
- record the outcomes achieved

[2]

(c) State **two** ways in which data from analysis can be presented.

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

[Total: 6]

3 Some tests use colour to show results.

Look at the pH colour charts for litmus and universal indicator.

**litmus**

4	5	6	7	8	9	10
red			purple	blue		

**universal indicator**

4	5	6	7	8	9	10
red	orange	yellow	green	green-blue	blue	blue-black

(a) Universal indicator gives the more precise measure of acidity.

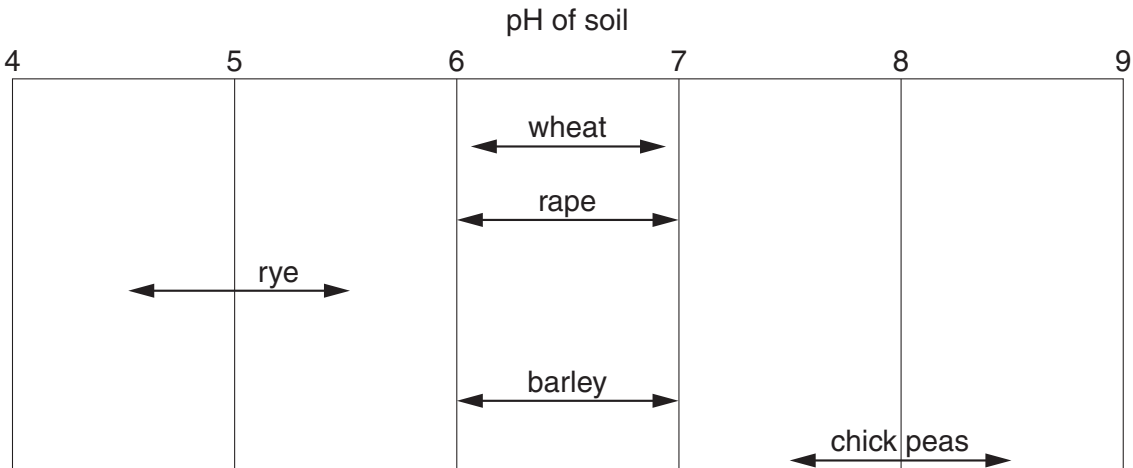
Explain why.

.....

.....

..... [1]

(b) Look at the data about the soil pH in which crops grow best.



Give the colour which universal indicator would turn if the following soils were tested.

(i) Soil in which rye grows best ..... [1]

(ii) Soil in which chick peas grow best ..... [1]

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

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

**qualitative**

**semi quantitative**

**quantitative**

[1]

(d) Which of the following best describes the universal indicator test?

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

**qualitative**

**semi quantitative**

**quantitative**

[1]

[Total: 5]

- 4 Neil uses a colorimeter and this standard procedure to measure the intensity of colour in solutions.

stage 1	place a sample of pure colourless solvent in the colorimeter
stage 2	set the meter to zero
stage 3	place solutions of known concentration in the colorimeter
stage 4	plot data from known concentrations to produce a calibration graph
stage 5	place a test sample in the colorimeter
stage 6	use the calibration graph

- (a) Why did Neil place a sample of pure colourless solvent in the colorimeter?

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

- (b) Why did Neil set the meter to zero?

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

- (c) Why did Neil place samples of known concentration in the colorimeter?

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

- (d) Why did Neil produce a calibration graph?

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

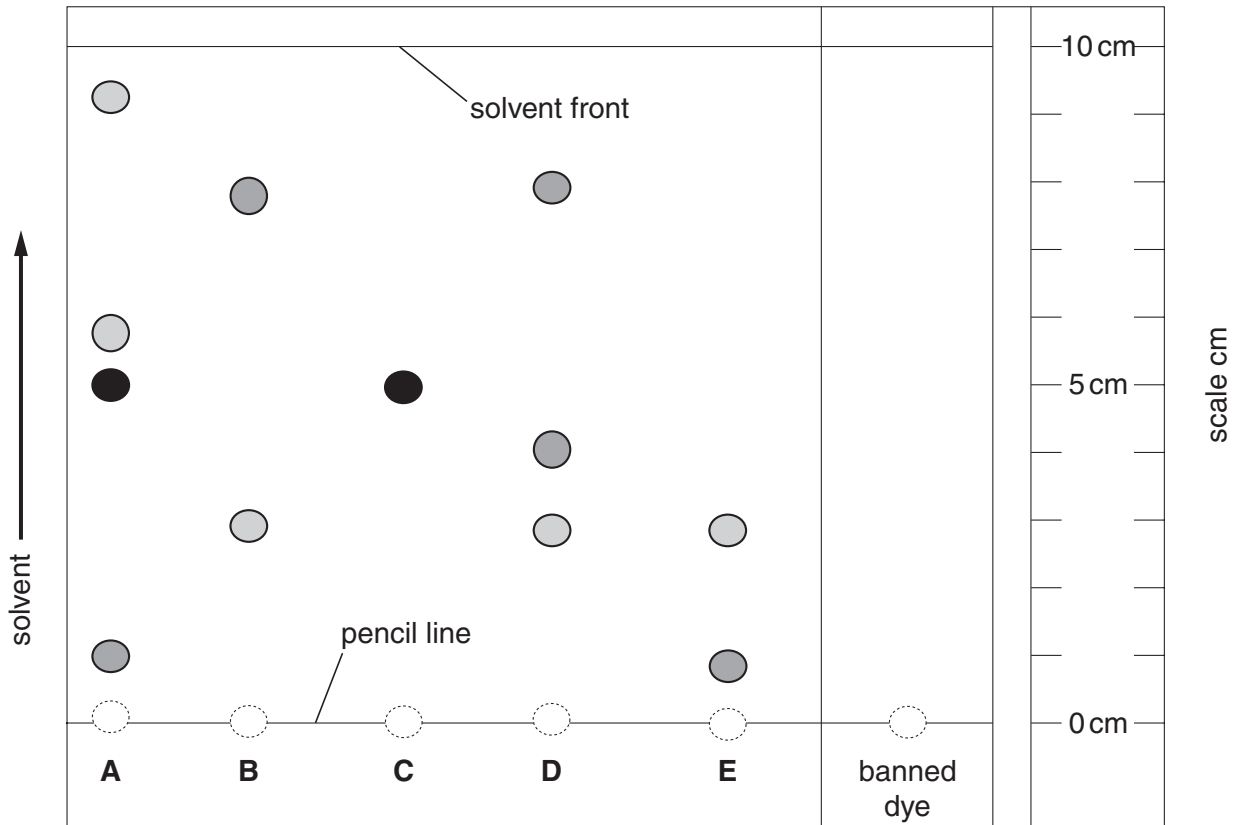
- (e) How could Neil use the graph to work out the concentration of the test sample?

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

[Total: 5]

5 A Trading Standards scientist tests children's toys to make sure that they are not coloured with banned dyes.

She tests colours from five different coloured toys, **A**, **B**, **C**, **D** and **E**, using **paper chromatography**.



(a) She also tests the banned dye.

banned dye	Rf value
●	0.5

Draw the spot from the **banned dye** in the correct position on the chromatogram. [1]

(b) Chromatography separates **samples** using a **mobile phase** and a **stationary phase**.

(i) What are the **samples** used in this procedure?  
 .....

(ii) Name the **mobile phase** used in this procedure.  
 .....

(iii) Name the **stationary phase** used in this procedure.  
 .....

- (c) Explain how chromatography depends on relative attractions between the sample, the solvent and the medium.

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

- (d) Another banned dye was tested.

The spot moves 4 cm up the paper.

Calculate its  $R_f$  value.

Show your working.

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

$R_f$  value ..... [1]

- (e) Scientists often use ‘thin layer’ rather than ‘paper’ chromatography.

Explain why.

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

- (f) Thin layer chromatograms of amino acids are developed by spraying with a chemical called ninhydrin and heated in an oven.

Suggest why.

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

[Total: 10]

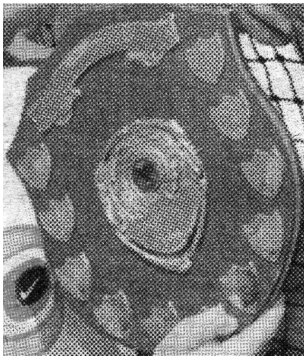


6 A trophy is stolen from a school display case.

The forensic scientists use a photo from an old school magazine to obtain a description.



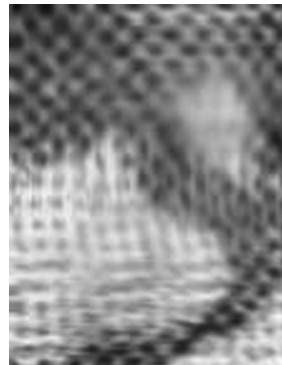
The scientists magnify the image to try to get more detail.



A



B



C



D

(a) Which image **A**, **B**, **C** or **D** shows the greatest magnification?

Explain your answer.

Image .....

..... [2]

(b) These photographs do not all show the same resolution.

Explain what is meant by resolution.

.....

.....

..... [2]

[Total: 4]

**END OF QUESTION PAPER**

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Q.6 image

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