H

General Certificate of Secondary Education

TWENTY FIRST CENTURY SCIENCE

ADDITIONAL APPLIED SCIENCE A

Scientific Detection (Higher Tier)

A325/02

Candidate Forename		Candidate Surname	

Centre Number						Candidate Number					

MODIFIED LANGUAGE

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.

Turn over

2

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Answer **all** the questions.

1 Proficiency testing is important to maintain standards in public laboratories in order to accredit them.

(a) The following statements describe how proficiency testing is carried out.
They are in the wrong order.

    A   The results of the analysis are sent back to the organiser.

    B   The results are coded for confidentiality.

    C   Different laboratories get different samples to analyse.

    D   The organiser evaluates results of the analysis.

    E   The coded results are sent back to the laboratories with advice where necessary.

    F   The test is designed by an organiser.

Write down the correct order of the statements.
The last one has been done for you.

					E

                                                                       [3]

(b) Explain why public laboratories are accredited.

....

....

.... **[2]**

[Total: 5]

2 Steve works for the *Forensic Science Service.*

He uses this standard procedure whenever he uses a light microscope.

step 1	Prepare the microscope slide.
step 2	Switch on the microscope lamp.
step 3	Put the slide on the microscope stage.
step 4	Place clips over the slide.
step 5	Select a low power objective lens.
step 6	Lower the objective lens close to the slide.
step 7	Look through the eyepiece lens and raise the objective lens until the image is in focus.
step 8	Change to a higher power lens and adjust the fine focus.
step 9	Take photographs of the image.

(a) (i) Why does Steve use a standard procedure?

....

.... **[1]**

(ii) Why does Steve switch on the lamp and place clips over the slide?

....

.... **[1]**

(b) Choose from the following statements to help you answer the questions **(i)**−**(iii)**.

- to focus the image
- to make the image dimmer
- to make the image sharper
- to avoid damaging the lens and the slide
- to record the image
- to make it easier to focus and select what he wants to look at
- to get greater magnification

   (i) Why does Steve first select a low power objective lens?

   ....

   .... **[1]**

   (ii) Why does Steve lower the objective lens **before** looking through the microscope and then raise it?

   ....

   .... **[1]**

   (iii) Why does Steve photograph the image?

   ....

   .... **[1]**

(c) Which statement explains how a light microscope works?

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

   A light microscope works by …

… increasing the magnification and the resolution.	
… increasing the magnification but decreasing the resolution.	
… decreasing the magnification but increasing the resolution.	
… decreasing the magnification and the resolution.	
… having no effect on the magnification or the resolution.	

   [1]

   [Total: 6]

3 Electrophoresis is a technique used to separate and identify chemicals.

The diagram shows how electrophoresis works.

negative electrode

buffer
solution to
keep the
pH constant

gel

positive electrode
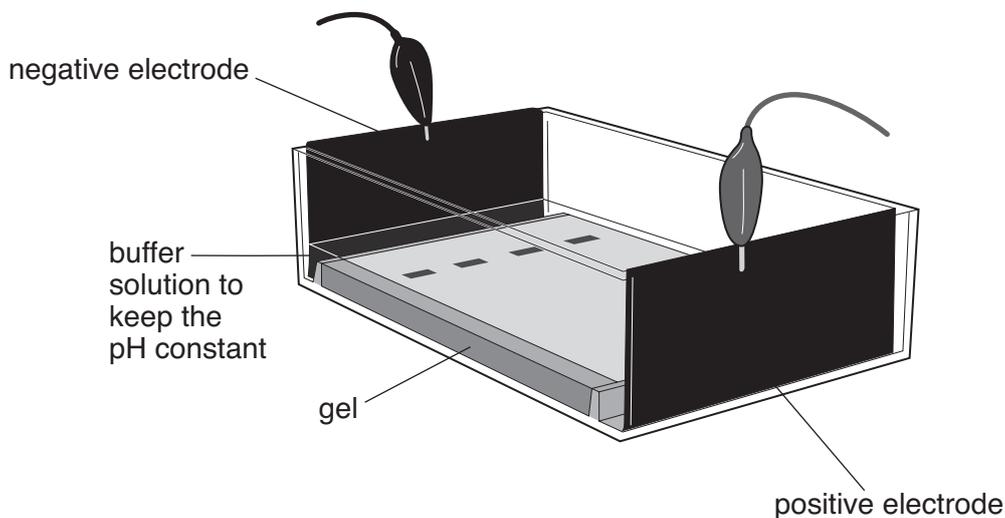
(a) Draw an X on the diagram to show where a mixture to be separated is placed. **[1]**

(b) Put ticks (✓) in the boxes next to any of these samples which can be separated by electrophoresis.

non soluble metal compounds	
a mixture of different gases	
DNA fragments	
small biological molecules	
elements in the same group of the periodic table	

[2]

(c) Draw an arrow on the diagram to show the direction in which the negative ions in the mixture will move. **[1]**

(d) Suggest two factors about the negative ions that will affect how quickly they move.

1 ....

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

(e) Name one other method that can be used to separate and identify chemicals.

.... **[1]**

[Total: 7]

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4 Measuring is an important skill used by scene of crime officers.
Scene of crime officers go to a crime scene.

crime scene

cordoned area
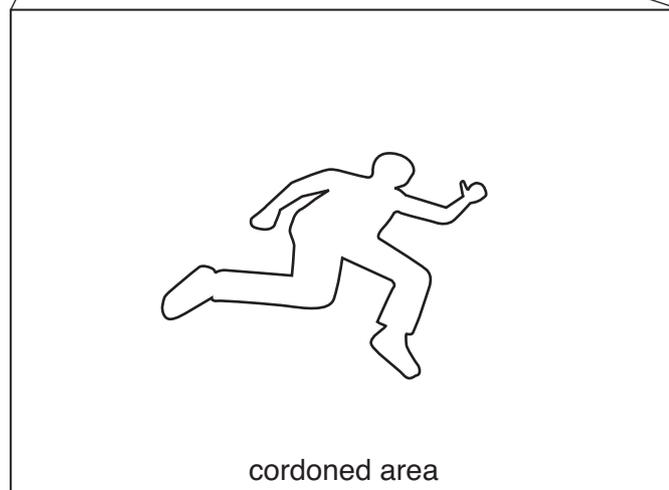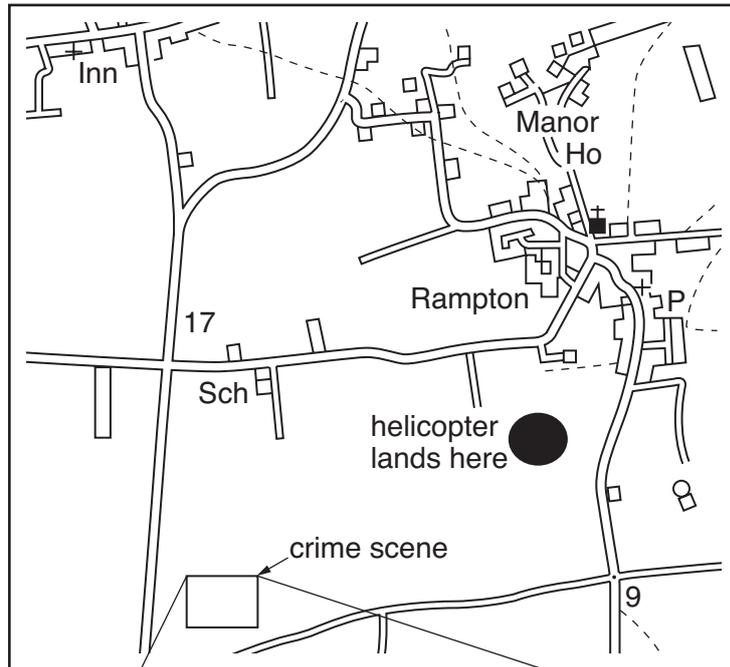
(a) Officers cordon off the crime scene.
They measure the area as 9.3 metres by 6.8 metres.

   **(i)** Calculate the size of the area.
   Show your working.

area = ... m² **[2]**

(ii) Their result for the area of the crime scene has a greater uncertainty than either of the measured lengths.
Why is this?

....

....

.... **[2]**

(b) A button found at the crime scene did not belong to the victim.
The investigators used a Vernier measuring device to measure the diameter of the button so that they could compare it with known samples.
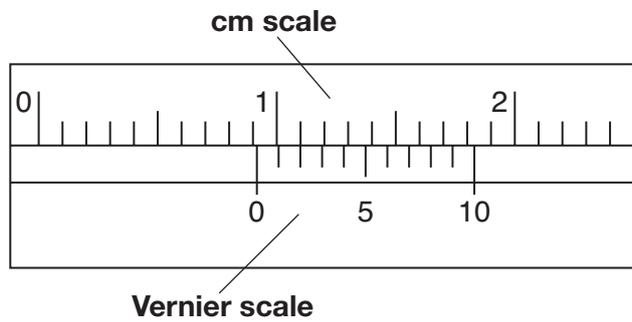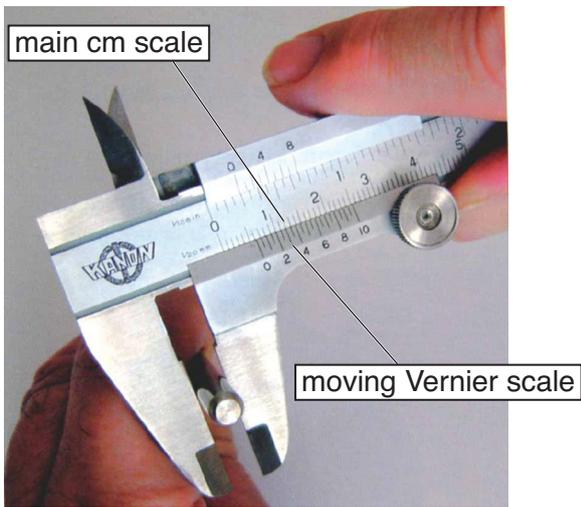
Use the Vernier scale to determine the diameter of the button.

diameter = ... cm **[2]**

[Total: 6]

5 Scientists need to check that the food dye in children's sweets is not too concentrated.

They do this by using a colorimeter.

(a) The scientists first set up the colorimeter.
Explain **two** things the scientists would do to prepare the colorimeter for use.
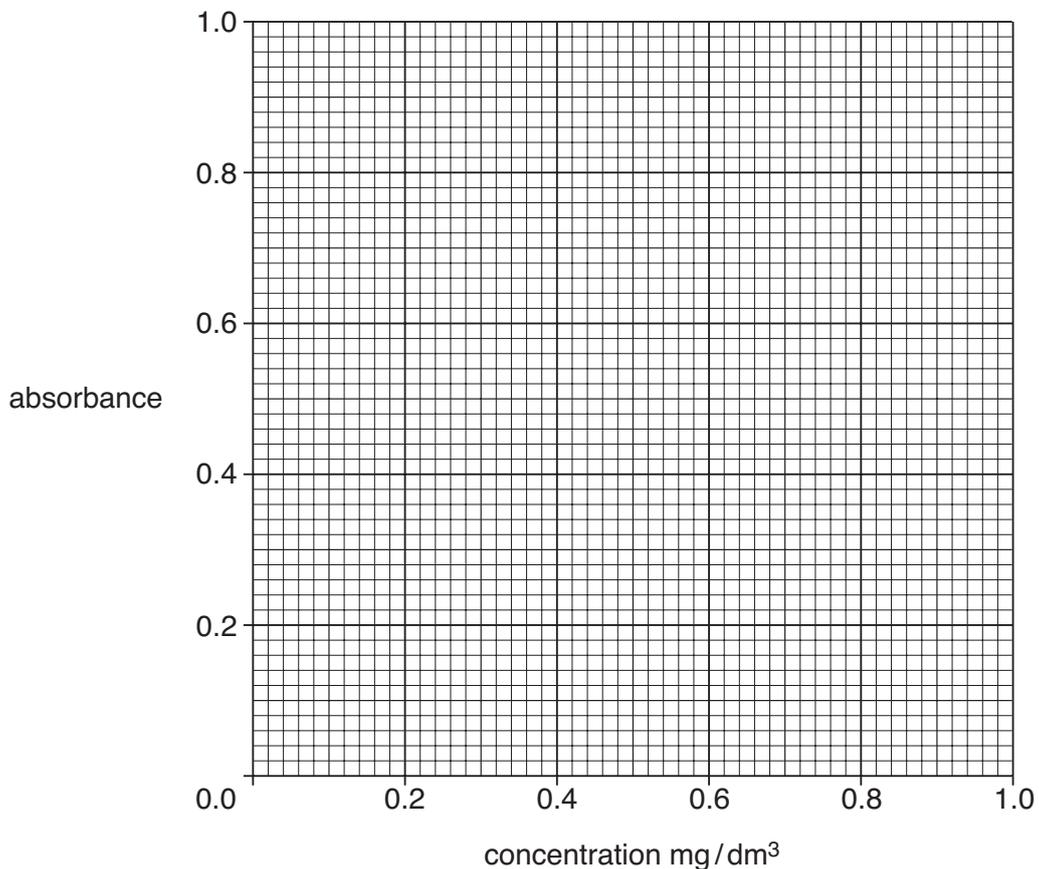
....

....

....

.... **[2]**

(b) They then use the colorimeter to find the absorbance of standard solutions of the dye.

standard reference solutions	
concentration mg/dm^3	absorbance
0.2	0.16
0.3	0.90
0.5	0.40
1.0	0.78

Plot these results onto the grid. **[2]**

absorbance

concentration mg/dm^3

(c) Draw a (ring) around any outlier (anomalous) result. **[1]**

(d) Draw a line of best fit. **[1]**

(e) A sweet containing the dye is tested.
The solution of dye from the sweet has an absorbance of 0.30.
Find the concentration of the dye by drawing lines on the grid.

What is the concentration of the dye?

concentration of dye = ... mg/dm³ **[2]**

(f) Which of the following is actually measured by the colorimeter?
Put a tick (✓) in the box next to the **correct** answer.

shade of colour	
range of colours	
intensity of colour	
difference between different colours	

[1]

(g) Using indicator paper or clinistix is an example of colour matching.
Compare the quality of results between colour matching and colorimetry.
Use ideas about **uncertainty**, **range** and **sensitivity** in your answer.

....

....

....

....

....

.... **[3]**

[Total: 12]

END OF QUESTION PAPER

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