

GENERAL CERTIFICATE OF SECONDARY EDUCATION
TWENTY FIRST CENTURY SCIENCE
ADDITIONAL APPLIED SCIENCE A
Scientific Detection (Foundation Tier)

A325/01

Wednesday 20 January 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, 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.

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Answer **all** the questions.

1 This question is about collecting scientific evidence.

- (a) Three friends have jobs in different government agencies.
They each collect scientific evidence.

Neil works for the *Environment Agency*.

Steve works for the *Forensic Science Service*.

Jane works for the *Food Standards Agency*.

- (i) Draw a straight line to join each **job** to an example of **work done**. [2]

- (ii) Write the **name** of each person carrying out each job in the correct box. [2]

job	work done	name of person
provides evidence for law enforcement	checking the quality of drinking water	
environmental protection	crime scene investigation	
consumer protection	monitoring effect of acid rain on a woodland	

- (b) Each of the friends knows the importance of getting reliable data.
Which statement best explains how reliability can be increased?
Put a tick (✓) in the box next to the **best** answer.

Ask other people what results they have got.	
Use data from previous experiments.	
Ensure scientists are employed to carry out the experiments.	
Use a system of standard practice and procedures.	

[1]

[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) Choose from the following statements to help you answer the questions.

- to focus the image
- to hold the slide in place
- to illuminate the specimen
- 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 switch on the lamp?

.....
 [1]

(ii) Why does Steve place clips over the slide?

.....
 [1]

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

.....
 [1]

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

.....
 [1]

- (v) Why does Steve photograph the image?

.....
 [1]

- (b) Which statement explains how a light microscope works?

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

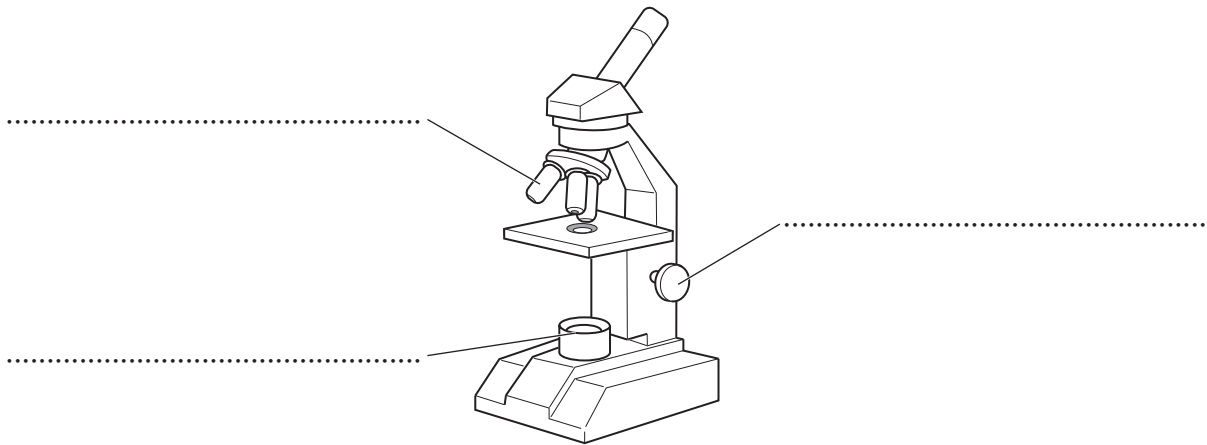
A light microscope works by ...

... 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 Here is a diagram of Steve's light microscope.



(a) Complete the labels on the diagram of the light microscope. Choose from the following words.

lamp focussing knob objective lens stage eyepiece lens

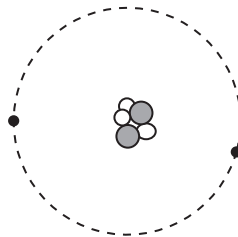
[2]

(b) Scientists also use other methods to collect data. Draw a straight line to join the **method** with its correct **advantage**, and the **method** to its correct **disadvantage**.

advantage	method	disadvantage
can see smaller objects than any other method	light microscope	cannot increase the size of an image
can be very cheap and use simple equipment	electron microscope	very expensive
can see small details of living things	chromatography	can only magnify up to about 1200 \times

[4]

(c) Electron microscopes use electrons. Electrons are found in atoms. Look at the diagram of an atom.



Put a **ring** around an electron in the diagram.

[1]

[Total: 7]

- 4 Police officers investigate a murder scene.
 They find the body of an unidentified victim.
 The victim scratched the murderer during the fight.
 They find blood under the nails of the victim.
 They do a DNA analysis of this blood and compare the result with the victim's own blood.
 The police question three suspects who volunteer to have DNA analysis of their blood.

The results of all these DNA tests are shown below.

band no.	DNA of victim	DNA of suspect A	DNA of suspect B	DNA of suspect C	DNA of blood under nails
1		██████████	██████████		
2	██████████			██████████	██████████
3			██████████		
4	██████████	██████████		██████████	██████████
5					
6		██████████	██████████	██████████	██████████
7	██████████	██████████			██████████
8	██████████		██████████	██████████	

- (a) Which of the suspects, if any, did the victim scratch?
 Explain your answer stating the evidence that you used from the results.

.....

 [2]

- (b) Scientists analysed the blood of the victim.
 Explain two reasons **why**.

reason 1

.....

reason 2

..... [2]

- (c) Name one **other** example of the use of DNA profiling.
 Explain **why** it is used.

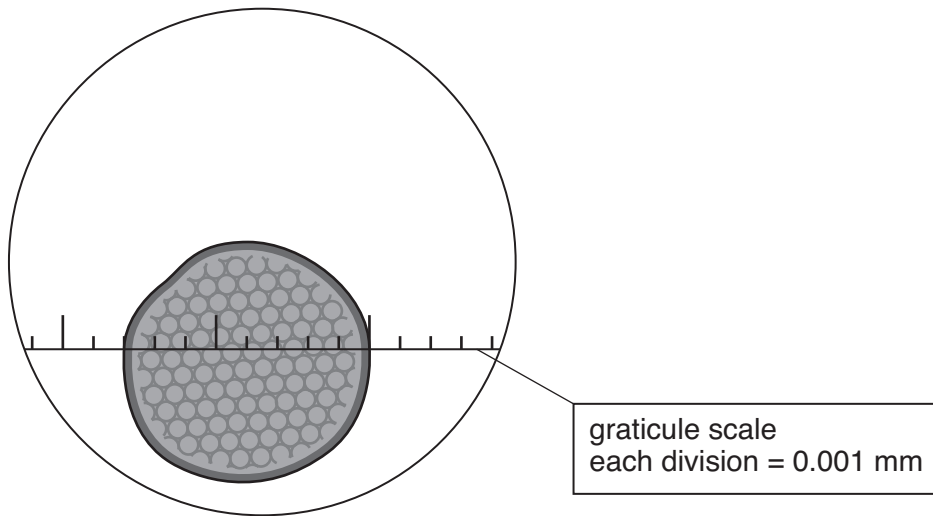
.....

 [2]

[Total: 6]

- 5 Scientists examine pollen grains from soil samples.

To help them identify the pollen the scientists use a microscope with an eyepiece graticule to measure the diameter of the pollen grain.



- (a) What is the diameter of the pollen grain?

diameter = mm [1]

- (b) The eyepiece lens has a magnification of $\times 12$.
The objective lens has a magnification of $\times 100$.

Calculate the magnifying power of the microscope.
Show your working.

magnification = [2]

[Total: 3]

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Question 6 starts on page 10

- 6 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.

.....

.....

.....

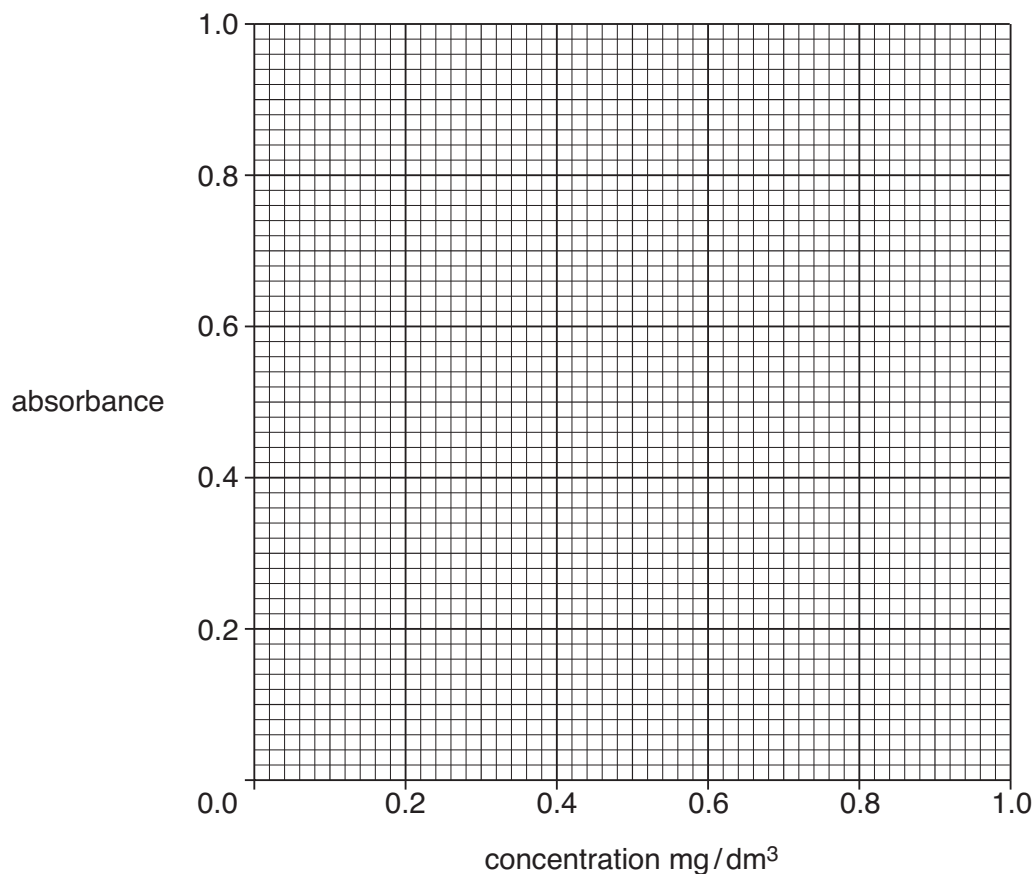
..... [2]

- (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]



(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.
Draw lines on the grid to show how you find the concentration of the dye.

What is the concentration of the dye?

concentration of dye = mg/dm³ [2]

(f) Which of the following is 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]

[Total: 9]

END OF QUESTION PAPER

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