

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

H A325/02

Scientific Detection
HIGHER TIER

THURSDAY 21 JUNE 2007

Afternoon
Time: 45 minutes

Calculators may be used.
Additional materials: Pencil
Ruler (cm/mm)



* G U E / T 2 6 2 6 1 *

Candidate
Name

Centre
Number

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Candidate
Number

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INSTRUCTIONS TO CANDIDATES

- Write your name, Centre number and Candidate number in the boxes above.
- Answer **all** the questions.
- Use blue or black ink. Pencil may be used for graphs and diagrams only.
- Read each question carefully and make sure you know what you have to do before starting your answer.
- Do **not** write in the bar code.
- Do **not** write outside the box bordering each page.
- WRITE YOUR ANSWER TO EACH QUESTION IN THE SPACE PROVIDED. ANSWERS WRITTEN ELSEWHERE WILL NOT BE MARKED.

INFORMATION FOR CANDIDATES

- The number of marks for each question is given in brackets [] at the end of each question or part question.
- The marks allocated and the spaces provided for your answers are a good indication of the length of answers required.

FOR EXAMINER'S USE

Qu.	Max.	Mark
1	4	
2	9	
3	7	
4	5	
5	5	
6	6	
TOTAL	36	

This document consists of **11** printed pages and **1** blank page.

2
BLANK PAGE

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Answer **all** the questions.

1 **Proficiency tests** are used to assess the standards of analytical laboratories.

(a) Which **two** of the following statements best describe proficiency testing?

Put ticks (✓) next to the **two** best answers.

Proficiency tests list the number of chemicals present in an unknown sample.

Proficiency tests are used to accredit a laboratory to carry out a specific test.

Proficiency tests are used to train staff to use new equipment.

Proficiency tests are used to check for Health & Safety procedures.

Proficiency test results are analysed by the agency that set the test.

[2]

(b) Supervisors of laboratories have to ensure that good laboratory practice is carried out.

Describe **two** things that good laboratory practice depends upon.

1

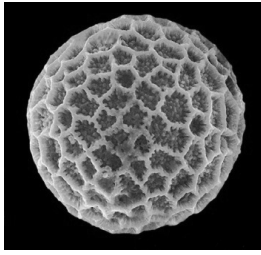
.....

2

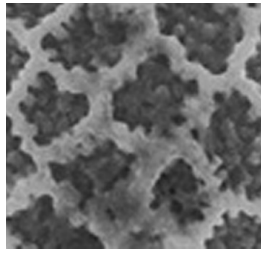
..... [2]

[Total: 4]

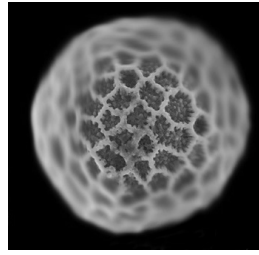
2 The following images of a pollen grain were obtained using different electron microscopes.



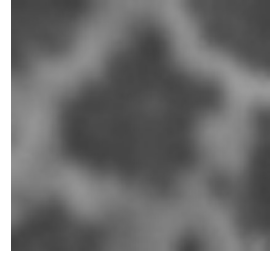
A



B



C



D

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(a) (i) Which image, **A**, **B**, **C** or **D**, was taken by the electron microscope with the greatest resolving power?

Explain your answer.

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

(ii) Which image, **A**, **B**, **C** or **D**, has the greatest depth of field?

Explain your answer.

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

(iii) Which image, **A**, **B**, **C** or **D**, has the greatest magnification?

Explain your answer.

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

(b) Image **A** was obtained by magnifying the pollen grain 45 000 times.

Explain why the picture labelled **A** may or may not be 45 000 times larger than the pollen grain.

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

(c) The laboratory also uses a light microscope with an objective lens of $\times 40$ and an eyepiece lens of $\times 25$.

What magnification does this light microscope give?

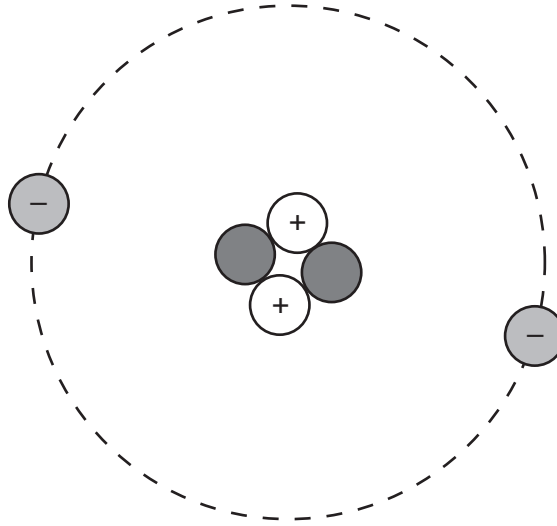
magnification = \times [1]

[Total: 9]

3 Jane is a forensic scientist.

She uses both an electron microscope and a light microscope in her work.

(a) Look at this diagram of a simple atom.



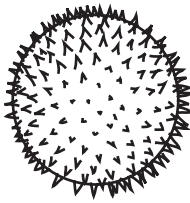
[1]

(i) Put a ring around a particle in the atom that is used in an electron microscope to produce images.

(ii) Name this particle.

..... [1]

(b) Look at the image of a pollen grain seen through a light microscope.



The pollen grain is **0.05 mm** in diameter.

(i) Measure the diameter of the image of the pollen grain with your ruler.

diameter = mm [1]

(ii) Calculate the magnification of the image of the grain.

Show your working.

magnification = \times [2]

(c) Jane uses both a light microscope and an electron microscope in her work.

Describe **two** differences between a light microscope and an electron microscope.

.....

.....

.....

..... [2]

[Total: 7]

4 Sheena is a food scientist.

She wants to know the concentration of a food colouring in a soft drink.

She uses a colorimeter.

(a) Explain why she first sets the colorimeter with distilled water.

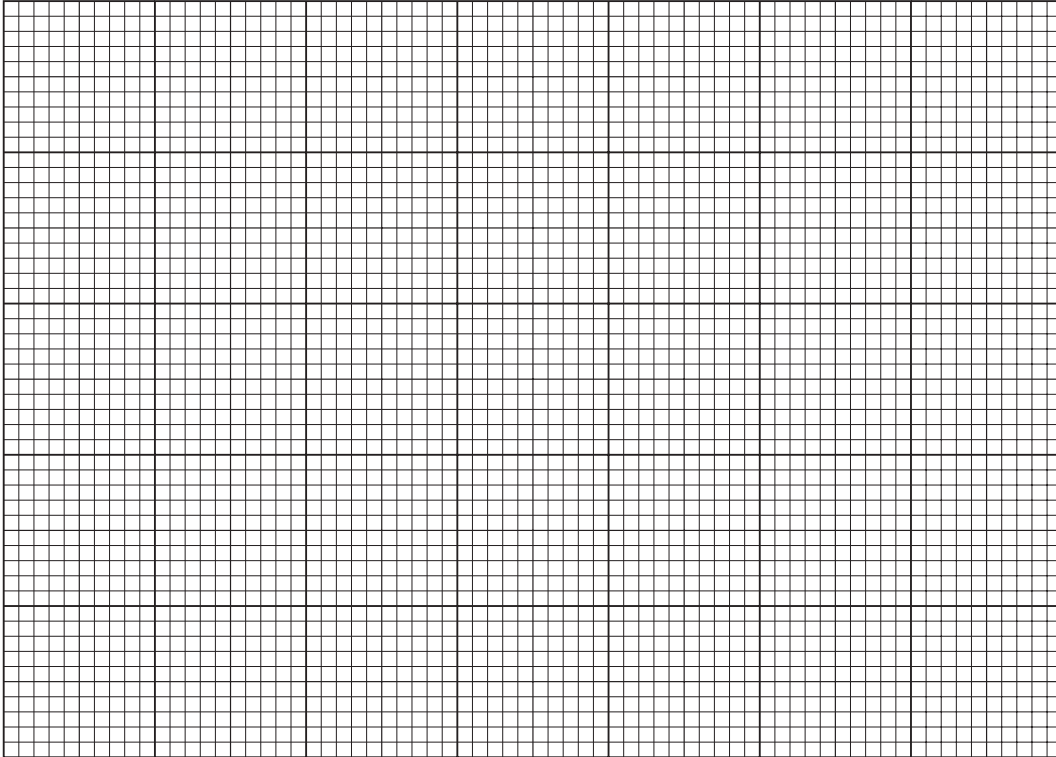
.....
..... [1]

(b) Sheena then tests different concentrations of the food colouring in the drink and obtains the following results.

sample number	concentration g/l	absorbance
1	0.1	0.06
2	0.2	0.12
3	0.3	0.19
4	0.4	0.23
5	0.6	0.36
6	0.7	0.42

(i) Plot the results, from the table, on the grid.

Draw the line of best fit.



[3]

(ii) When Sheena tested the soft drink, it had an absorbance of 0.21.

Use the graph to determine the concentration of the food colouring in the drink.

Draw a horizontal line and a vertical line on your graph to show how you obtained your answer.

concentration = g/l [1]

[Total: 5]

5 Jason works in a laboratory.

He uses this standard procedure to separate food colourings in a hard sweet.

stage 1	Dissolve the sweet in distilled water.
stage 2	Place drops of reference food colourings on chromatography paper.
stage 3	Place a drop of the dissolved sweet on the chromatography paper.
stage 4	Place the paper in a tank of solvent so that the drops of colourings are above the surface of the solvent.
stage 5	Cover the tank.
stage 6	Leave until the solvent has soaked nearly up to the top of the paper.
stage 7	Remove the paper and dry the chromatogram.

(a) Why did Jason dissolve the sweet in water?

.....
 [1]

(b) Why did Jason place drops of reference colourings on the paper?

.....
 [1]

(c) Why did Jason make sure the drops of food colouring were above the surface of the solvent?

.....
 [1]

(d) Why did Jason cover the tank?

.....
 [1]

(e) Why did Jason leave the paper until the solvent had soaked nearly up to the top of the paper?

.....
 [1]

[Total: 5]

6 Data can be collected using a variety of instruments and measuring equipment.

Describe **one advantage** and **one limitation** of using the following instruments or methods.
Do **not** include cost.

You **must not** give the same advantage or limitation more than once.

(a) light microscope

advantage

.....

limitation

..... [2]

(b) electron microscope

advantage

.....

limitation

..... [2]

(c) chromatography

advantage

.....

limitation

..... [2]

[Total: 6]

END OF QUESTION PAPER

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