Candidate Forename		Candidate Surname	

Centre Number						Candidate Number				

OXFORD CAMBRIDGE AND RSA EXAMINATIONS
GENERAL CERTIFICATE OF SECONDARY EDUCATION

A325/02

TWENTY FIRST CENTURY SCIENCE

ADDITIONAL APPLIED SCIENCE A
Scientific Detection
(Higher Tier)

FRIDAY 19 JUNE 2009: Morning
DURATION: 45 minutes

SUITABLE FOR VISUALLY IMPAIRED CANDIDATES

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)

READ INSTRUCTIONS OVERLEAF

DC (AC/JG) OV90905 13095/1

INSTRUCTIONS TO CANDIDATES

- **Write your name clearly in capital letters, your Centre Number and Candidate Number in the boxes on the first page.**
- **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.**
- **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.**

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Answer ALL the questions.

1 Scientific detection is carried out in many different ways.

(a) On the page opposite draw a straight line to link PEOPLE AND ORGANISATIONS with their correct ROLE. Draw a second straight line from the ROLE to the JOB they carry out. [2]

PEOPLE AND ORGANISATIONS	ROLE	JOB
Defra	law enforcement	monitor food quality and safety
scene of crime officer	environmental protection	check air pollution
public analyst	consumer protection	gather forensic evidence

(b) Good laboratory practice is very important.

Which of the following help with good laboratory practice?

Put ticks (✓) in the boxes next to the <u>THREE</u> best answers.

working with other laboratories	
good health and safety procedures	
using regular proficiency tests	
making sure staff are well trained	
waiting for accreditation	

[2]

[Total: 4]

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2 A scene of crime officer attends a murder.

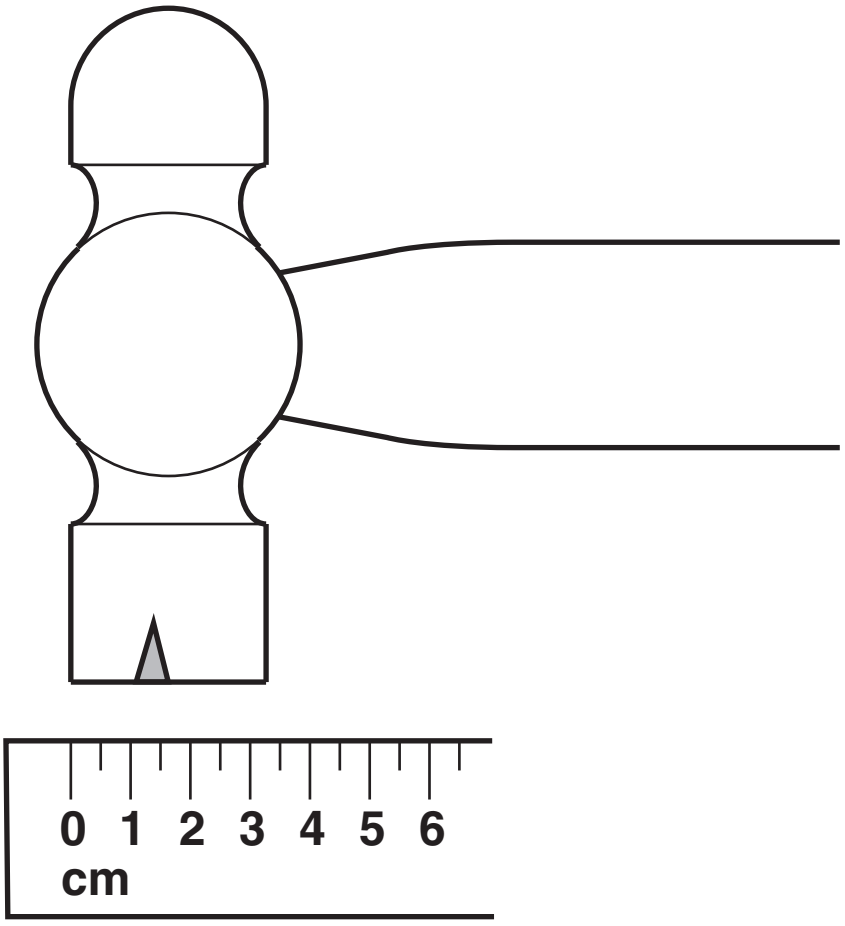
(a) State three different ways in which she can record <u>IMAGES</u>.

1 _____

2 _____

3 _____ **[3]**

(b) The murder weapon is a hammer.
The officer measures the size of the hammer head.



(i) Estimate the distance across the head of the hammer.

You <u>MUST</u> use the ruler in the picture.

_____ **mm [2]**

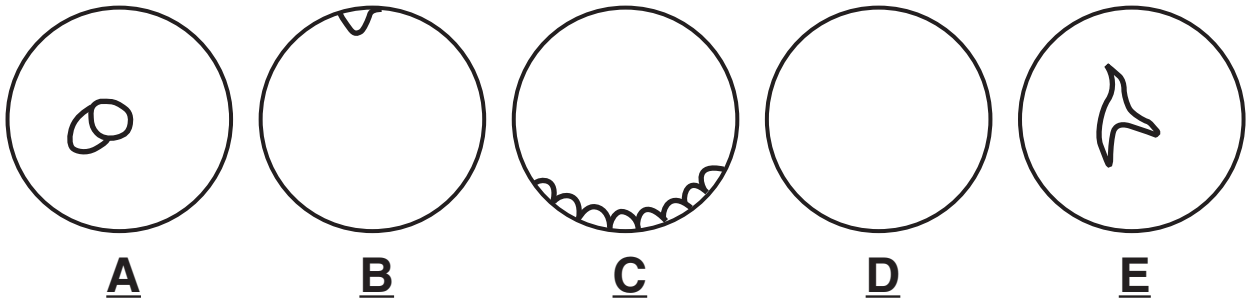
(ii) Identify one important feature that could be used to identify this particular hammer as the murder weapon.

_____

_____ **[1]**

(iii) **The scientist used the hammer to make a plasticine mould.**

Which of the following moulds, A, B, C, D or E, was made by the hammer?



A **B** **C** **D** **E**

answer _____ **[1]**

[Total: 7]

3 Steve makes a stained temporary slide of blood for microscopic examination.

(a) Explain how he carries out this procedure in four steps.

Use all the words provided in your explanation.

COVERSLIP
MICROSCOPE
SLIDE
SPECIMEN
STAIN

step 1 _____

step 2 _____

step 3 _____

step 4 _____ **[4]**

(b) Steve uses a ×20 objective lens and a ×10 eyepiece lens.

Calculate the magnifying power of the microscope.

Show your working.

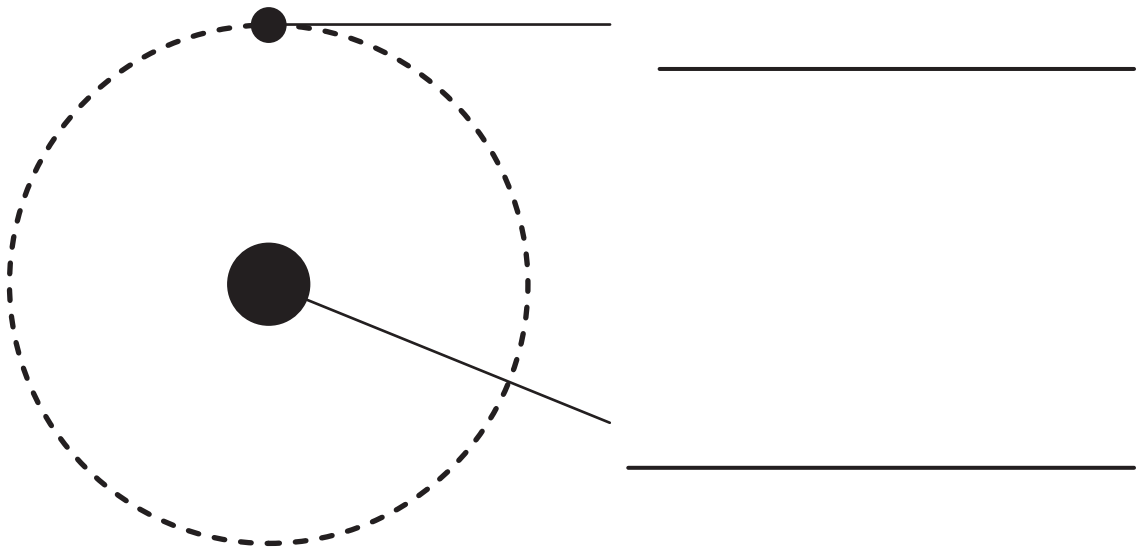
×_____ [1]

[Total: 5]

4 Electron microscopes use a beam of electrons to produce images of a specimen.

The electrons come from atoms.

(a) Label the diagram of an atom.



[1]

(b) Electron microscopes have greater resolving power than light microscopes.

Which of the statements best describes resolving power?

Put a tick (✓) in the box next to the <u>CORRECT</u> answer.

An electron microscope can …

… produce a very focused image.	
… produce separate images of closely spaced details.	
… resolve problems by identifying specimens.	
… magnify thousands of times.	
… resolve problems by identifying the source of the specimen.	

[1]

(c) An electron microscope can produce images with a good depth of field.

Which of the statements best describe depth of field?

Put ticks (✓) in the boxes next to the <u>CORRECT</u> answers.

sharp three dimensional images	
images deep within a substance	
images of fields	
both near and far parts of the specimen in focus	
sharp focus across the width of the specimen	

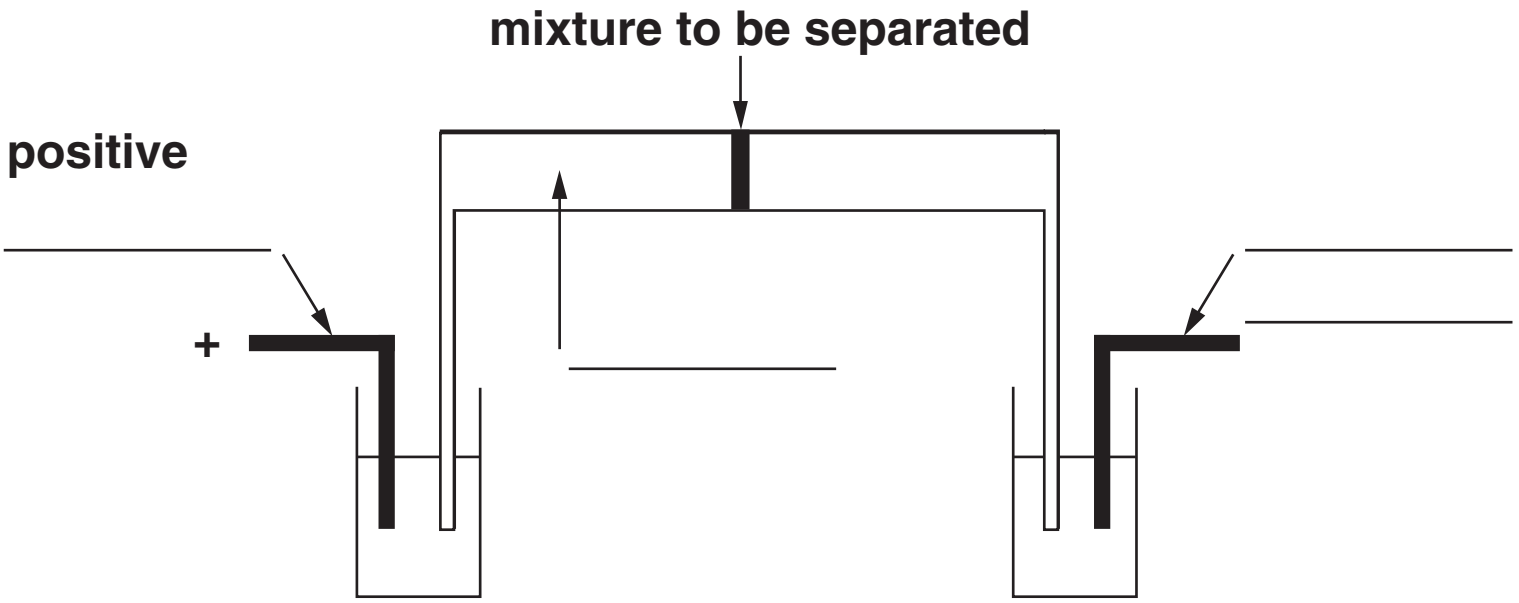
[2]

[Total: 4]

5 DNA profiling is used by forensic scientists.

(a) The diagram shows how electrophoresis is carried out.

Finish labelling the diagram.



[3]

(b) Draw an arrow on the diagram, starting from the 'mixture', to show which way negatively charged particles will move. [1]

(c) State <u>TWO</u> factors that will affect the separation of particles during the procedure.

1 _____

_____

2 _____

_____ **[2]**

[Total: 6]

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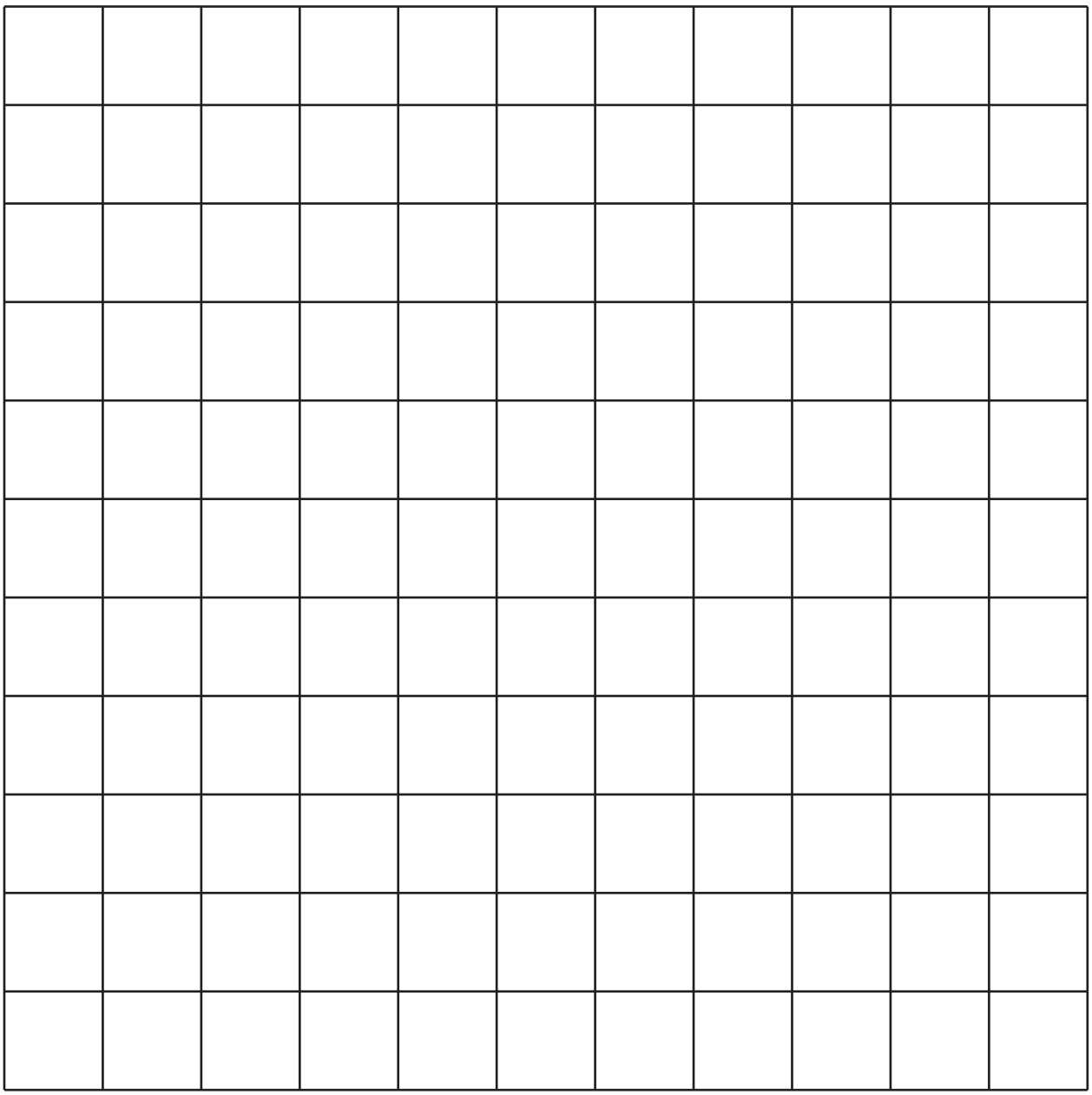
6 Colorimeters are used in analysis.

This data was collected for solutions of a coloured substance.

CONCENTRATION g/dm^3	ABSORBANCE
0.1	0.08
0.2	0.16
0.3	0.24
0.4	0.32
0.5	0.40
0.6	0.48
0.7	0.62
0.8	0.64
0.9	0.72
1.0	0.80

(a) Use the data to plot the calibration graph.

Draw the line of best fit.



[3]

(b) Put a (ring) around the outlier in the data.

Which of the following is a possible cause for the outlier?

Put a tick (✓) in the box next to the <u>CORRECT</u> answer.

The solution is more concentrated than it should be.	
Some material was spilt when making up this solution.	
All readings show a systematic error.	
Some water was left in the sample holder after a previous test.	

[1]

(c) A scientist tests a solution of the coloured substance with an unknown concentration. It has an absorbance of 0.28.

He concludes that its concentration is 0.34 g/dm^3.

(i) Draw lines on the graph to show how this was determined. [1]

(ii) State and explain whether his conclusion was <u>VALID</u>.

_____

_____

_____ **[1]**

[Total: 6]

7 A scientist measures the purity of a drug.
She states the drug is 89.9% ± 0.2% pure.

(a) What are the limits of uncertainty for this measurement?

from_____ % to _____% [1]

(b) Uncertainty is caused by errors in the investigation.

(i) One type of error is <u>RANDOM ERROR</u>.

Which of the following best describes random error?

Put a tick (✓) in the box next to the <u>CORRECT</u> answer.

the scientist is not sure how to carry out the procedure	
repeating the same experiment several times gives different values	
the error is calculated by averaging all of the results	
the results are consistent but not accurate	
all of the results are accurate and precise	

[1]

(ii) Name one <u>OTHER</u> type of error and explain what it means.

_____

_____

_____ **[2]**

[Total: 4]

END OF QUESTION PAPER