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Centre number						Candidate number				
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**OXFORD CAMBRIDGE AND RSA EXAMINATIONS
GENERAL CERTIFICATE OF SECONDARY EDUCATION**

A325/02

**TWENTY FIRST CENTURY SCIENCE
ADDITIONAL APPLIED SCIENCE**

**Scientific Detection
(Higher Tier)**

WEDNESDAY 19 JANUARY 2011: 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

INSTRUCTIONS TO CANDIDATES

- **Write your name, centre number and candidate number in the boxes on the first page. Please write clearly and in capital letters.**
- **Use black ink. Pencil may be used for graphs and diagrams only.**
- **Read each question carefully. Make sure you know what you have to do before starting your answer.**
- **Write your answer to each question in the space provided. Additional paper may be used if necessary but you must clearly show your candidate number, centre number and question number(s).**
- **Answer ALL the questions.**

INFORMATION FOR CANDIDATES

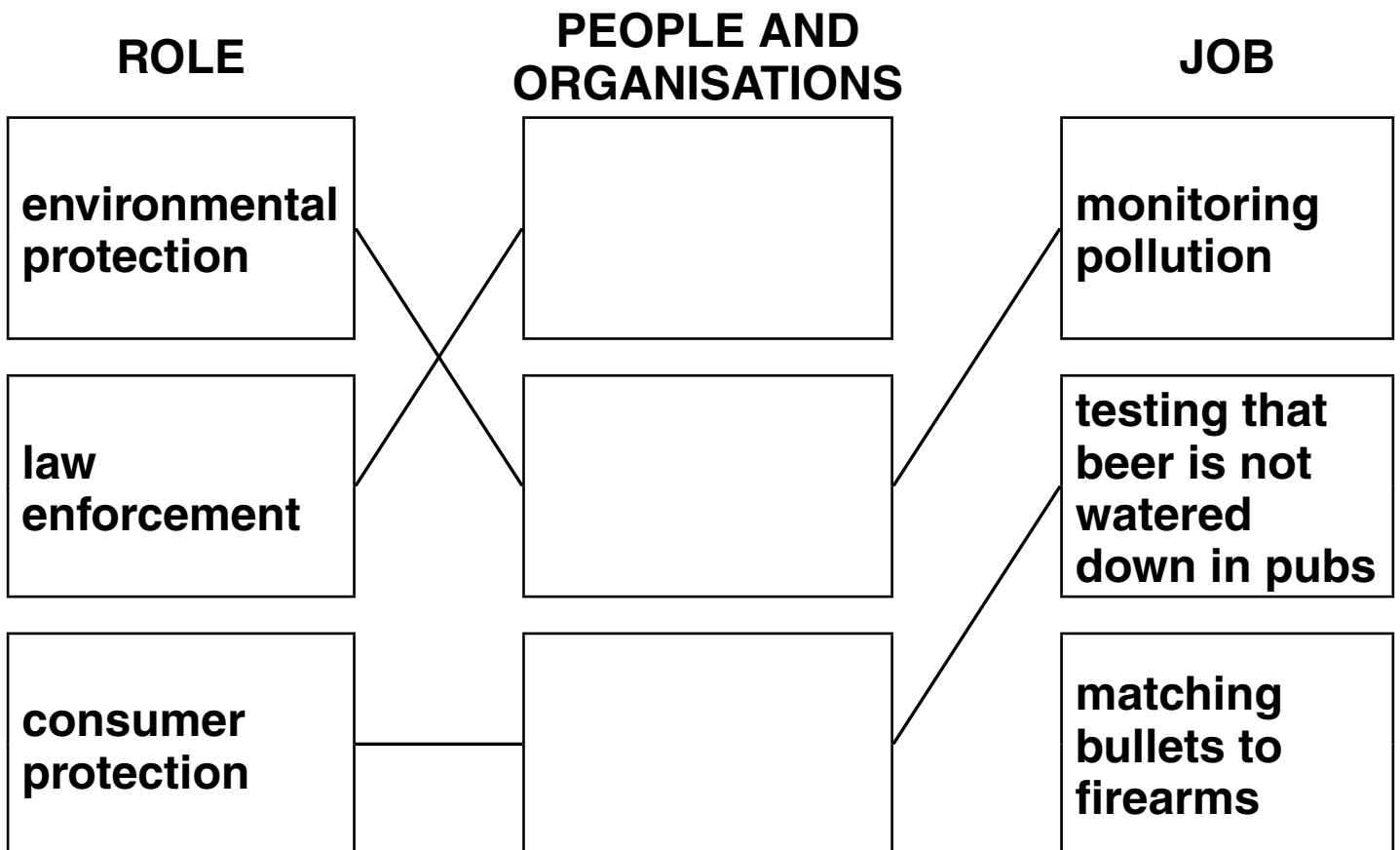
- **The number of marks is given in brackets [] at the end of each question or part question.**
- **The total number of marks for this paper is 36.**

Answer ALL the questions.

1 Scientific detectives investigate a wide range of problems.

(a) Straight lines have been drawn to link the PEOPLE AND ORGANISATIONS with their correct ROLE and their JOB.

Complete the three boxes for the people and organisations.



[2]

(b) Public laboratories have a system of accreditation to ensure good practice.

(i) Which of these statements explains why accreditation is important?

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

ensures reliability

increases sales

monitors ordering

reduces waste

[1]

(ii) Which of the following is increased by using a system of common practice and procedures?

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

profit

speed of production

staff promotion

reliability

[1]

(iii) Why do scientists carry out proficiency tests?

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

to act as an incentive to work harder

to check the quality of their work

to get extra qualifications

to check the equipment is working properly

[1]

[Total: 5]

2 The picture shows the scene of a road traffic accident.



(a) Which three features VISIBLE IN THE IMAGE are important to record?

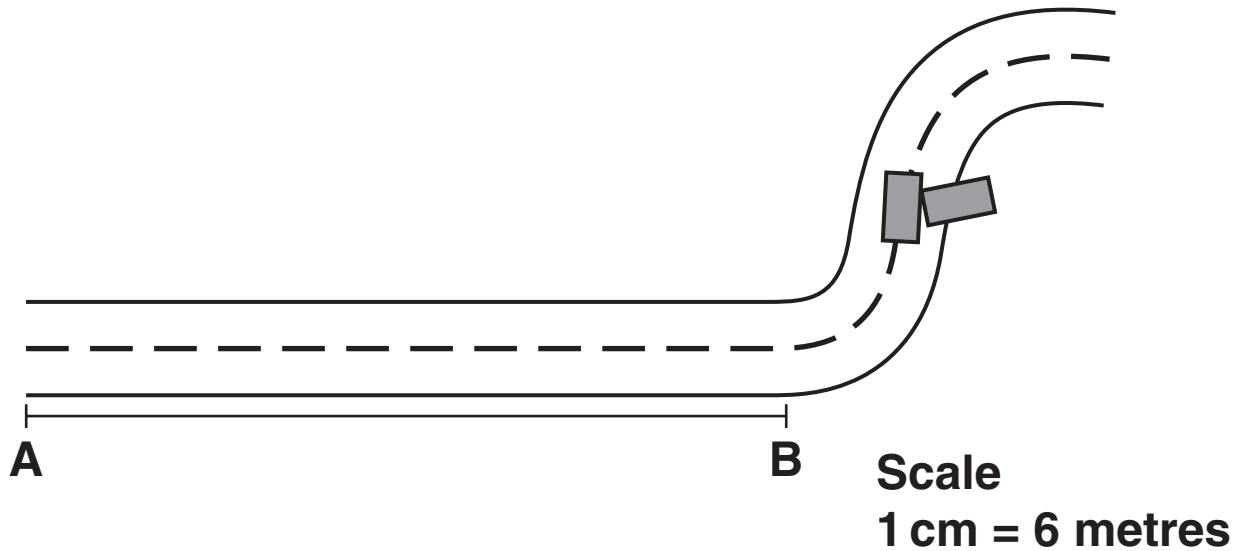
1 _____

2 _____

3 _____ **[3]**

(b) A section of the road was damaged by the accident.

A traffic engineer drew a sketch of the damaged section.



(i) Use a ruler to calculate the length of the damaged section between point A and point B.

Show your working.

answer = _____ metres [2]

- (ii) A different stretch of the road was 200 m long and 9 m wide.

Calculate the surface area of this stretch of road.

Show your working.

answer = _____ m² [2]

- (iii) The calculated AREA of the damaged section has a greater uncertainty than the measured LENGTH and WIDTH of the damaged section.

Explain why.

_____ [2]

[Total: 9]

3 A sample of blood was taken from a crime scene.

A forensic scientist examined the sample using a microscope.

(a) The scientist first used a standard procedure to prepare a temporary microscope slide of the sample.

There were three steps in the standard procedure.

Use these words to help you describe the three steps in the order they are carried out.

blood sample

slide

staining reagent

cover slip

step 1 _____

step 2 _____

step 3 _____

_____ **[3]**

(b) The scientist wants to calculate the magnifying power of the microscope. He knows the magnification of each lens.

Explain how the scientist would do this.

[2]

[Total: 5]

4 Forensic scientists analyse the purity of a sample of heroin.

(a) They determine the purity is $99.1 \pm 0.2\%$.

Which two values does the actual purity of the drug lie between?

_____ % and _____ % **[2]**

(b) Scientists give indications of the limits of accuracy of their results (e.g. $\pm 0.2\%$) to allow for uncertainty due to random or systematic errors.

Explain what is meant by each of the terms SYSTEMATIC ERROR and RANDOM ERROR.

systematic error _____

random error _____

_____ **[2]**

[Total: 4]

5 There are different types of chromatography.

(a) Which TWO of the following best describe the advantages of gas chromatography over paper chromatography?

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

It shows the results in different colours.

It has greater separating power than paper chromatography.

It can produce quantitative results.

It is easier to use than paper chromatography.

The equipment is cheaper than for paper chromatography.

[2]

(b) State TWO differences between paper chromatography and gas chromatography.

[2]

[Total: 4]

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Question 6 begins on page 14.

6 Scientists use colour in analysis.

(a) Give one example in each case of a colour test which is...

...qualitative. _____

...semi quantitative. _____

...quantitative. _____ [3]

(b) This data was collected using a colorimeter.

It gives the **ABSORBANCE** of a solution of a coloured substance at different **CONCENTRATIONS**.

CONCENTRATION g/dm³	ABSORBANCE
0.08	0.10
0.22	0.28
0.38	0.48
0.52	0.66
0.68	0.80
0.72	0.92

- (i) Use the data to plot a calibration graph on the grid provided on the separate sheet.

Fully label the axes. [4]

- (ii) Draw the line of best fit and put a **ring** around the result that appears to be the least reliable (outlier). [1]

- (iii) An unknown concentration of the substance has an absorbance of 0.95.

Use the graph to find the concentration of the coloured substance in this solution.

Include the unit in your answer.

concentration = _____ [1]

[Total: 9]

END OF QUESTION PAPER



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