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OCR
RECOGNISING ACHIEVEMENT

GENERAL CERTIFICATE OF SECONDARY EDUCATION
TWENTY FIRST CENTURY SCIENCE   **A325/01**
ADDITIONAL APPLIED SCIENCE A
Scientific Detection (Foundation Tier)

Wednesday 19 January 2011
Morning

Duration: 45 minutes

Candidate forename		Candidate surname	

Centre number					Candidate number				

INSTRUCTIONS TO CANDIDATES

* Write your name, centre number and candidate number in the boxes above. 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.
* Do **not** write in the bar codes.

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.

OCR is an exempt Charity

Turn over

Answer **all** the questions.

1 Scientific detectives investigate a wide range of problems.

(a) Draw straight lines to link the **people and organisations** with their correct **role** and their **job**.

role	people and organisations	job
environmental protection	Forensic Scientist	monitoring pollution
consumer protection	Environmental Protection Officer	testing that beer is not watered down in pubs
law enforcement	Food Standards Agency	matching bullets to firearms

[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 of the features **visible in the image** are important to record?

Put ticks (✓) in the boxes next to the **three** most important features.

number of policemen ☐

tyre skid marks ☐

time of day ☐

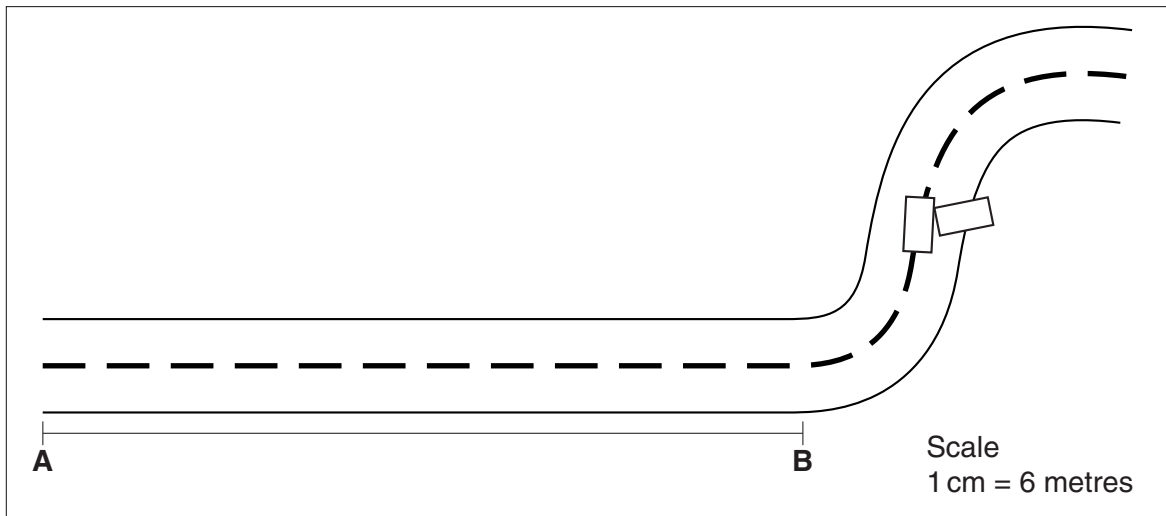that an ambulance has not yet arrived ☐

position of the cars ☐

the house on the corner ☐

the condition of the road ☐

[3]

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

A traffic engineer drew a sketch of the damaged section.

Scale
1 cm = 6 metres

(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]**

[Total: 7]

Turn over

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

A forensic scientist examined the sample using a microscope.

(a) The scientist first uses 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]**

(c) Light microscopes show more detail of a specimen than the eye alone.

Which statement about light microscopes is true?

Put a tick (✓) in the box next to the correct answer.
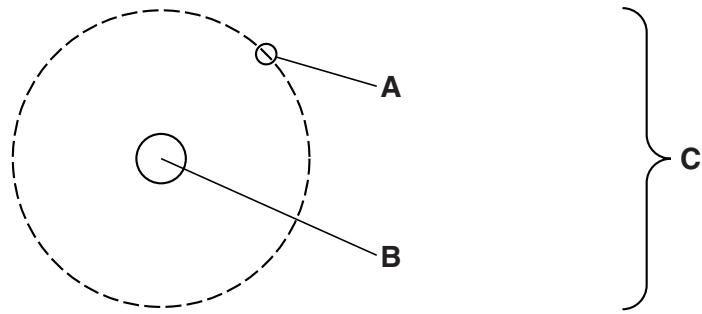
Compared to the eye, light microscopes…

…increase the size of the specimen. ☐

…stop air movements between the eye and the specimen. ☐

…increase the resolution of the image. ☐

…move the image closer to the eye. ☐

[1]

[Total: 6]

4 Scientists use both light microscopes and electron microscopes in their work.

(a) Look at the diagram of an atom.

Which part, **A**, **B** or **C**, is **used** by an electron microscope?

answer .... **[1]**

(b) Sometimes an electron microscope cannot be used.
For which of these examples would a scientist **not** be able to use an electron microscope?

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

viewing very thin material ☐

viewing material from plants ☐

viewing living material ☐

viewing material from animals ☐

viewing at very high magnification ☐

[1]

(c) Electron microscopes show more detail than light microscopes.
Which statement explains why?

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

Compared to light microscopes, electron microscopes…

…have greater magnification. ☐

…have a more powerful light source. ☐

…have a larger screen on which to view the image. ☐

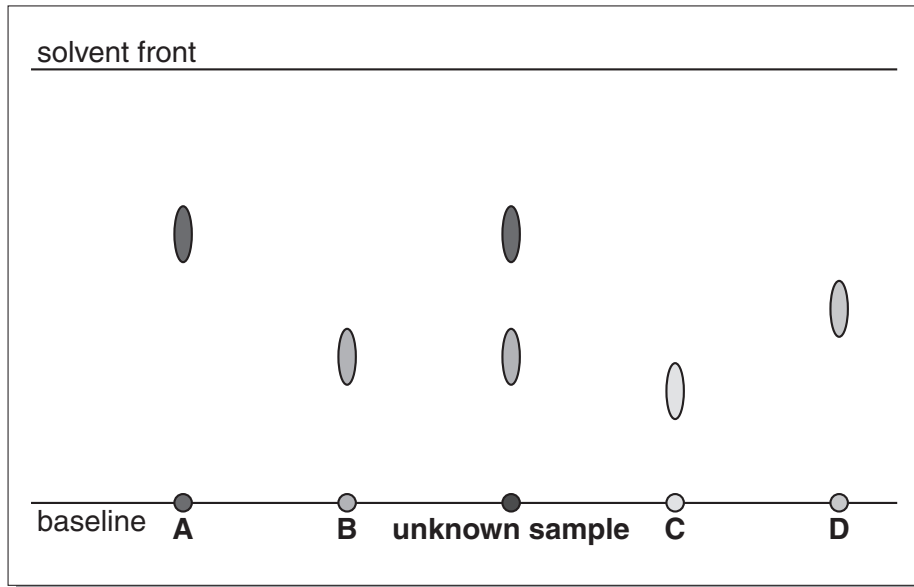…examine the specimen for longer. ☐

…are a more modern invention. ☐

[1]

[Total: 3]

5 Chromatography is a technique for analysing an unknown sample.

Look at the paper chromatogram.

(a) Which substance or substances, from **A**, **B**, **C** and **D**, are in the unknown sample?

answer .... **[1]**

(b) Which of the following is the correct term for the solvent?

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

stationary phase ☐

reference material ☐

retention factor ☐

mobile phase ☐

[1]

(c) Which of the following best describes the paper?

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

stationary phase ☐

reference material ☐

retention factor ☐

mobile phase ☐

[1]

(d) A student tries to explain how the coloured dyes move up the paper.

Which statement best describes this process?

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

The dye soaks up the paper.

The dye goes up the paper by capillary action.

Evaporation from the top of the paper pulls the dye up.

The dye moves between the two phases.

[1]

(e) Standard reference materials are used in chromatography.

Explain why.

....

....

....

.... **[2]**

[Total: 6]

Turn over

6 Scientists use colour in analysis.

(a) Litmus, Universal Indicator and colorimeters are all methods of analysis which use colour.

Draw straight lines linking the **analysis method** to the **type of test**.

analysis method	type of test

| litmus | qualitative |

| Universal Indicator | semi quantitative |

| colorimeter | quantitative |

[2]

(b) The normal pH of human blood is between 7.35 and 7.45.

A scientist tests the blood from a suffocated murder victim.

When a person is suffocated, the amount of carbon dioxide in the blood increases.

An increase in carbon dioxide in the blood makes the blood more acidic.

Put a ring around the most likely pH of the victim's blood.

7.30   **7.50**   **7.70**   **7.90**

[1]

(c) Colour test kits are also used in medical diagnosis.

Name two examples of colour test kits used in medical diagnosis.

test kit 1 ....

test kit 2 .... [2]
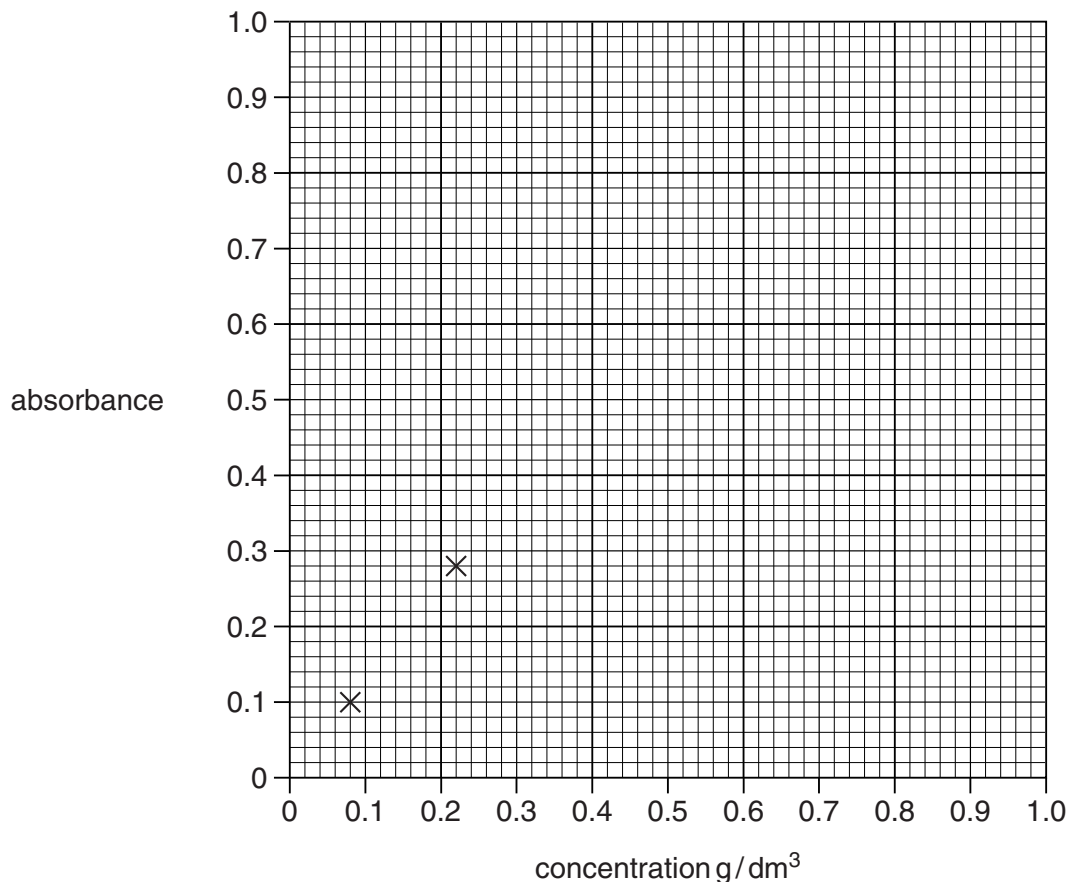
(d) This data was collected using a colorimeter.

It gives the **absorbance** of a solution of a coloured substance at different **concentrations**.

concentration g/dm^3	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.

The first two points are plotted for you. **[1]**

absorbance

concentration g/dm^3

(ii) Draw the line of best fit. **[1]**

(iii) Put a ring around the result that appears to be the least reliable (an outlier). **[1]**

(iv) An unknown concentration of the substance has an absorbance of 0.40.

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

concentration = ... g/dm^3 **[1]**

[Total: 9]

END OF QUESTION PAPER

PLEASE DO NOT WRITE ON THIS PAGE