



ADVANCED SUBSIDIARY (AS)
General Certificate of Education
January 2012

Centre Number

71

Candidate Number

Biology
Assessment Unit AS 1
assessing
Molecules and Cells
[AB111]



WEDNESDAY 11 JANUARY, MORNING

TIME

1 hour 30 minutes.

INSTRUCTIONS TO CANDIDATES

Write your Centre Number and Candidate Number in the spaces provided at the top of this page.
 Write your answers in the spaces provided in this question paper.
 There is an extra lined page at the end of the paper if required.
 Answer **all nine** questions.
 You are provided with **Photograph 1.5** for use with Question 5 in this paper.
 Do not write your answers on this photograph.

INFORMATION FOR CANDIDATES

The total mark for this paper is 75.
 Section A carries 60 marks. Section B carries 15 marks.
 Figures in brackets printed down the right-hand side of pages indicate the marks awarded to each question or part question.
 You are reminded of the need for good English and clear presentation in your answers.
 Use accurate scientific terminology in all answers.
 You should spend approximately **20 minutes** on Section B.
 You are expected to answer Section B in continuous prose.
 Quality of written communication will be assessed in **Section B**, and awarded a maximum of 2 marks.

For Examiner's use only

Question Number	Marks
1	
2	
3	
4	
5	
6	
7	
8	
9	

Total Marks

- Carbohydrates which, when heated with Benedict's reagent, cause the formation of a brick-red precipitate.

- A cell which has two homologous copies of each chromosome.

- A short strand of fluorescently labelled DNA, with a known order of bases, used to locate a specific sequence of nucleotides within a DNA molecule.

- A fatty acid chain which contains a number of double-bonded carbon atoms along its length.

- The enzyme used by HIV to synthesise viral DNA from RNA.

[5]

Examiner Only	
Marks	Remarks

- 2** The restriction enzyme *EcoR1* recognises a specific sequence of bases in DNA and cuts the DNA at that site. This is shown in the diagram below.

(a) (i) Name the type of bond which is broken between the bases **A** and **T**.

[1]

(ii) State the type of reaction which occurs when the DNA backbone is broken between the nucleotides containing **A** and **G**.

[1]

When a particular bacteriophage DNA is exposed to *EcoR*I, 6 fragments of DNA are obtained.

Another restriction enzyme called *HindIII* works in a similar way to *EcoR1* but acts on a different recognition site. *HindIII* produces 8 fragments of DNA from the same bacteriophage.

(b) (i) Determine the number of *EcoR*I recognition sites on the bacteriophage DNA.

[1]

(ii) Assuming that the recognition sites of the two enzymes do not overlap on the bacteriophage DNA, determine the number of fragments produced if both *EcoR*I and *Hind*III were used together. (Show your working.)

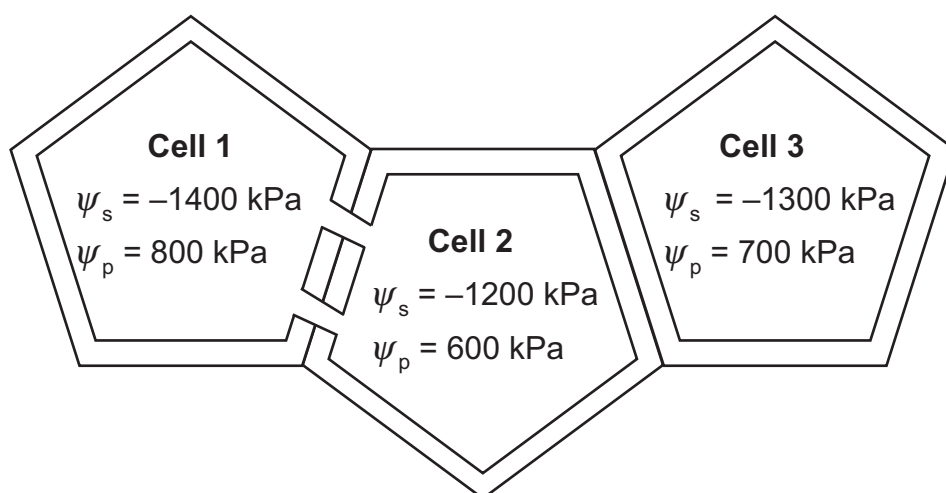
Answer [1]

The graph plots the percentage inhibition of mitosis against the concentration of taxane. The x-axis represents the concentration in arbitrary units (0 to 8), and the y-axis represents the percentage inhibition (0 to 100%). The data points are connected by a smooth curve, showing a sigmoidal relationship. The inhibition remains low (below 10%) for concentrations up to 3 units, then increases sharply between 4 and 6 units, and finally plateaus near 100% inhibition for concentrations of 7 units and above.

Concentration of taxane/arbitrary units	Inhibition of mitosis/%
1	3
2	4
3	6
4	21
5	78
6	94
7	96
8	97

- (a)** Describe, as fully as possible, the effect of increasing taxane concentration on the % inhibition of mitosis.

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- (i) State the name of the strands of cytoplasm which interconnect cells **1** and **2**.

 [1]

- (ii) Describe and explain the net flow of water between cells 2 and 3.**

[2]

- (b)** Osmosis involves the movement of water through a selectively permeable membrane.
Describe the pathway by which water molecules move through the cell-surface membrane and contrast this with the movement of small hydrophilic molecules such as glucose.

[2]

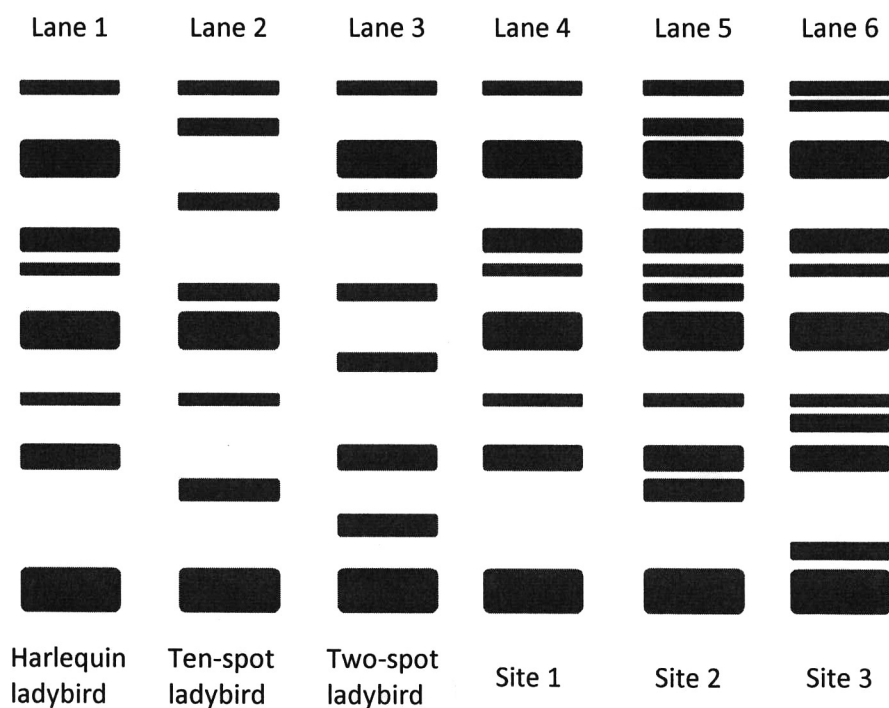
Examiner Only	
Marks	Remarks

- 6 The harlequin ladybird (*Harmonia axyridis*) was first recorded in the UK in 2004 and has since spread widely over the South East of England. It may prey on smaller ladybirds, such as the ten-spot and two-spot ladybirds, populations of which have subsequently declined. The techniques of PCR and gel electrophoresis have been used to analyse DNA extracted from the gut of harlequin ladybirds to determine which other ladybird species have been preyed upon.

- (a) Suggest why PCR is a necessary technique in investigations such as that outlined above.

[2]

- (b) DNA samples from each of the three ladybird species were cut using restriction endonucleases and the resulting fragments were separated by gel electrophoresis. The diagram below shows the DNA profile of each species in the first 3 lanes. The next 3 lanes contained DNA extracted from the guts of 8 harlequin ladybirds trapped at each of 3 sites in SE England. The extract from the gut will contain DNA from the prey of the harlequin ladybird along with its own DNA.



[2]

- ## Site 1

[2]

[Turn over

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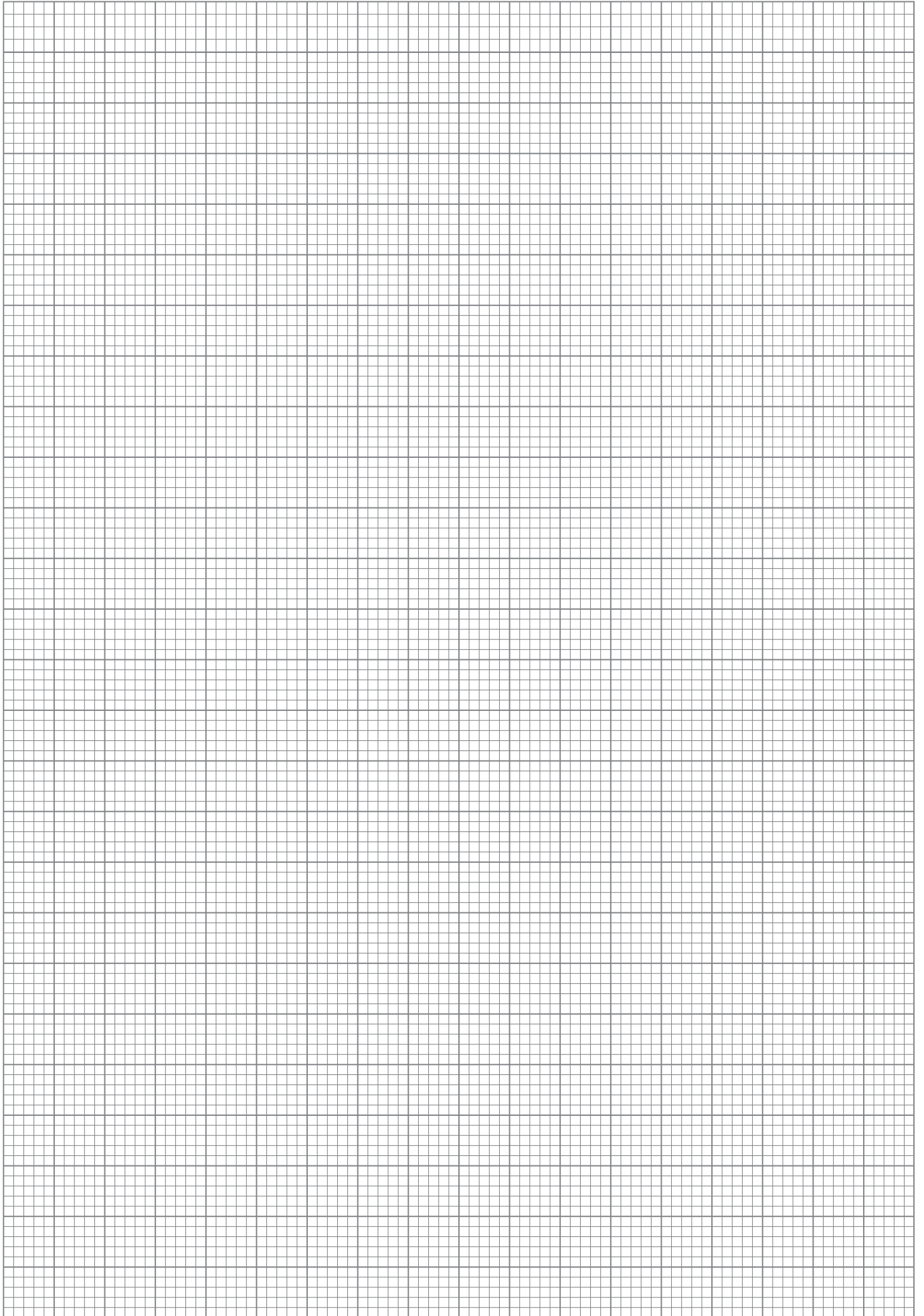
The method used was as follows:

1. Using measuring cylinders add 4 cm^3 of apple extract and 1 cm^3 of distilled water to a clean test tube.
2. Add 10 cm^3 of 0.1 M catechol solution to the test tube, and shake thoroughly.
3. After 5 minutes decant some of the liquid into a clean cuvette.
4. Using a colorimeter, with a blue filter, measure the % transmission through the mixture.
5. Repeat steps 1–4 with fresh solutions, but replace the distilled water with 1 cm^3 of decolourised lemon juice.
6. Repeat step 5, but replace the lemon juice with 1 cm^3 of decolourised orange juice.

[1]

[1]

Marks	Remark
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(a) (i) Complete the grid below by placing a tick (✓) or cross (X) in the appropriate cell.

	Haemoglobin	Myoglobin
Has a secondary structure		
Has a quaternary structure		
Is a conjugated protein		

[3]

2.

[2]

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- (i) Given a concentrated solution of amino acids produced by the hydrolysis of myoglobin, outline the procedure used for preparing and running the chromatogram. (Do not describe how to develop or analyse the chromatogram.)

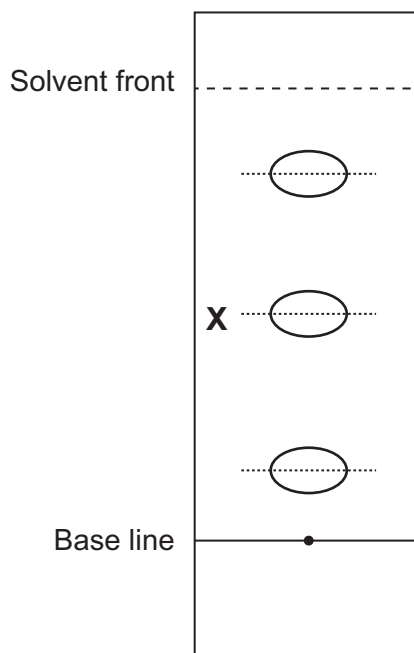
[illegible]

- (ii) The substance used to develop the spots on the chromatogram is ninhydrin.
State **one** safety precaution specific to the use of this substance, apart from the use of goggles.

[1]

Examiner Only	
Marks	Remarks

Amino acid	R _f value
alanine	0.38
arginine	0.20
asparagine	0.50
glutamic acid	0.30
leucine	0.73
lysine	0.14
valine	0.61



Using the table of R_f values shown above, identify amino acid **X** on the chromatogram. (Show your working.)

Amino acid **X** _____ [3]

Examiner Only	
Marks	Remarks

Examiner Only	
Marks	Remark

THIS IS THE END OF THE QUESTION PAPER

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GCE Biology Advanced Subsidiary (AS)
Assessment Unit AS 1: Molecules and Cells
January 2012

Photograph 1.5 (for use with Question 5)

