



Rewarding Learning

ADVANCED SUBSIDIARY (AS)
General Certificate of Education
2017

Centre Number

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Candidate Number

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Biology

Assessment Unit AS 1

assessing

Molecules and Cells



[AB111]

AB111

THURSDAY 25 MAY, AFTERNOON

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.

You must answer the questions in the spaces provided.

Do not write outside the boxed area on each page or on blank pages.

Complete in black ink only. **Do not write with a gel pen.**

Answer **all eight** questions.

You are provided with **Photograph 1.3** for use with **Question 3** 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.

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Section A

- 1 Complete the following paragraph using the most appropriate word(s).

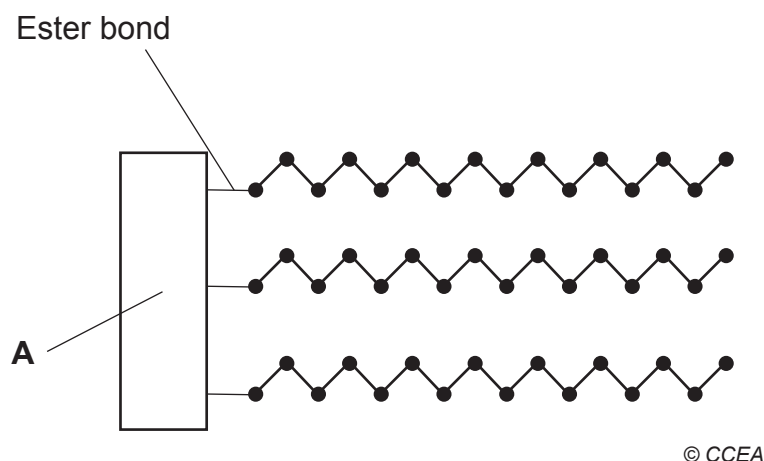
Enzymes are _____ proteins whose role is to lower the
_____ of a reaction. As a substrate
binds, a specific region of the enzyme called the _____
_____ changes shape to become _____ to
the substrate. This is referred to as the _____
_____ model of enzyme action. [5]



- 2 Fatty acids can be saturated or unsaturated. Palmitic acid is a saturated fatty acid ($C_{15}H_{31}COOH$) and α -linolenic acid is an unsaturated fatty acid ($C_{17}H_{29}COOH$).

(a) Define the term 'unsaturated'. _____
 _____ [1]

- (b) The diagram below represents a triglyceride containing three palmitic acid chains.



- (i) Identify the part of the triglyceride labelled **A**.

A _____ [1]

- (ii) Describe how the structure of a phospholipid differs from the triglyceride shown above.

 _____ [1]

[Turn over]



Triglycerides perform several functions in living organisms. They are synthesised in the smooth endoplasmic reticulum of cells and can be broken down in a number of metabolic processes.

- (c) (i) Name the types of reactions that occur during the synthesis and breakdown of triglycerides.

Synthesis _____

Breakdown _____ [2]

- (ii) State **two** functions of triglycerides in living organisms.

1. _____

2. _____

_____ [2]



3 **Photograph 1.3** is a photomicrograph of a section of mammalian (cat) ileum. One tissue layer in the ileum has already been identified.

(a) Identify the tissue layers labelled **A** to **D**.

A _____

B _____

C _____

D _____

[4]

(b) Describe the functions of layers **C** and **D**.

C

D

[2]

(c) Villi are often represented as finger-like projections in diagrams or drawings. Suggest why the villi which can be seen in **Photograph 1.3** do not show this typical appearance.

[1]

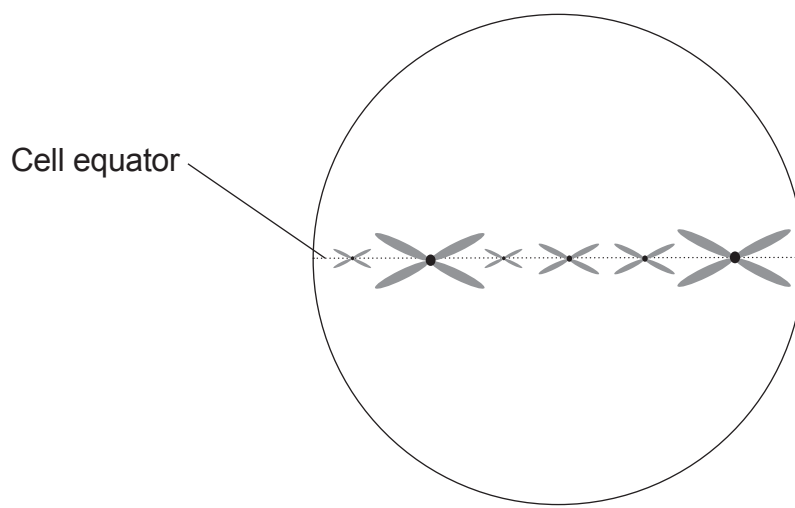
[Turn over]



- 4 The Indian muntjac deer (*Muntiacus muntjak*) is a small deer that was introduced to England in the early 20th Century. This species has the lowest number of chromosomes recorded for any mammal.

The nuclei of diploid cells in the female *M. muntjak* contain six chromosomes ($2n=6$).

The simplified diagram below represents a stage of mitosis in such a cell, where the six chromosomes are aligned at the cell equator.

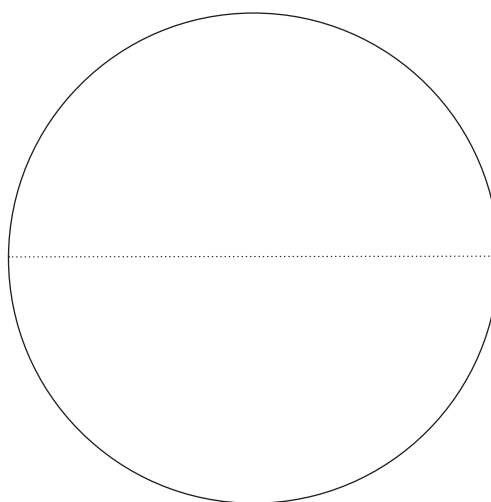


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- (a) State the stage of mitosis represented.

[1]

- (b) Complete the diagram below to show how chromosomes align at the equator during the **second** division of meiosis, in a cell from the same species.



[2]



(c) Describe and explain **two** features of meiosis that contribute to genetic variation.

1. _____

2. _____

[4]

(d) Nuclear division by mitosis or meiosis is followed by cytokinesis. Describe precisely how cytokinesis occurs in animal cells.

[1]

[Turn over]



- 5 (a) Plants require a number of inorganic ions in order to synthesise biologically important compounds. State the name of one biologically important compound in plants which contains calcium and one which contains magnesium.

Calcium _____

Magnesium _____ [2]

- (b) Plant cell walls are composed of cellulose. Explain how the structure of cellulose provides plant cell walls with high tensile strength.

[2]

The tobacco mosaic virus (TMV) is a virus which infects a wide range of plants, including the tobacco plant. The virus usually enters through an open wound in the plant. Once it enters, it multiplies rapidly and spreads quickly from cell to cell.

- (c) (i) The virus cannot pass through plant cell walls. Suggest how it spreads from cell to cell.

[1]



- (ii) Plants that are infected with TMV often have chloroplasts in the palisade layer that have an unusual shape. The chloroplasts appear to contain a large vacuole-like structure within the stroma.

Suggest and explain how the presence of this structure might affect the functioning of the chloroplast.

[2]

- (d) Plant cells contain mitochondria as well as chloroplasts. State **two** similarities between the structures of mitochondria and chloroplasts.

1.

2.

[2]

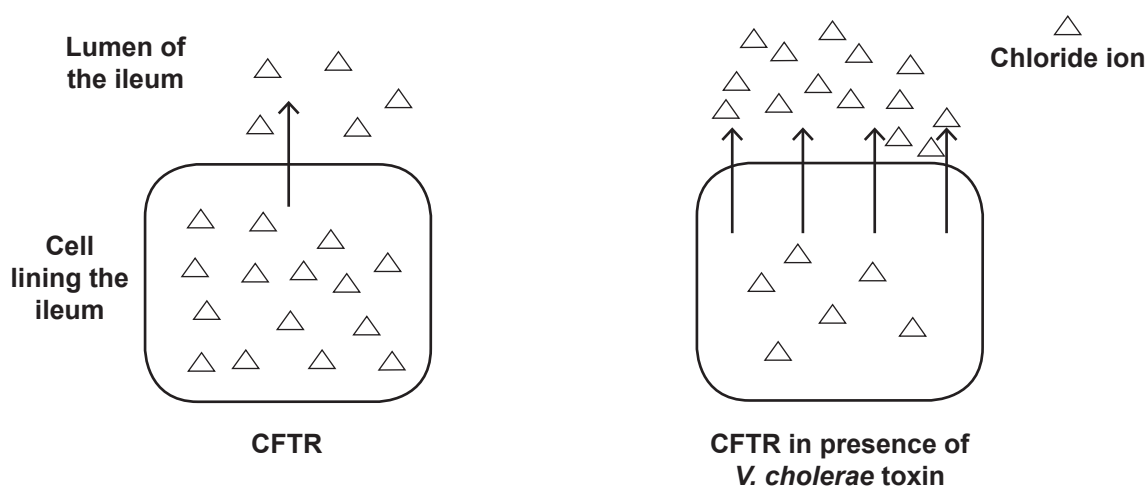
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- 6 Cholera is a disease caused by the bacterium *Vibrio cholerae* and is transmitted through drinking contaminated water.

In the ileum, *V. cholerae* produces a toxin which activates a type of membrane glycoprotein called CFTR.

The presence of the toxin causes the CFTR glycoprotein to pump excessive levels of chloride ions out of the cells and into the gut lumen. This in turn affects the osmotic balance.



- (a) (i) Describe how the structure of a glycoprotein differs from a typical protein.

_____ [1]

- (ii) Define the term 'osmosis'.

_____ [1]



(b) (i) Using the information provided and your knowledge, suggest an explanation for this.

[4]

(ii) Treatments such as *Dioralyte* can help replace the chloride ions lost from the cells lining the ileum. Suggest how this will reduce dehydration of these cells.

[2]

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The CFTR glycoprotein is also involved in the condition cystic fibrosis. Cystic fibrosis affects several systems in the body, including the respiratory system.

In individuals with cystic fibrosis the CFTR glycoprotein does not form correctly and therefore does not function normally. The mucus in the respiratory system is normally thin and watery. However, in patients with cystic fibrosis, it becomes thick and sticky.

- (c) Using the information provided (including the diagram at the start of this question), suggest how the mucus becomes thick and sticky in individuals with cystic fibrosis.

[2]



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(a) Describe the process used to prepare a chromatogram **before** it is placed in the solvent.

[4]

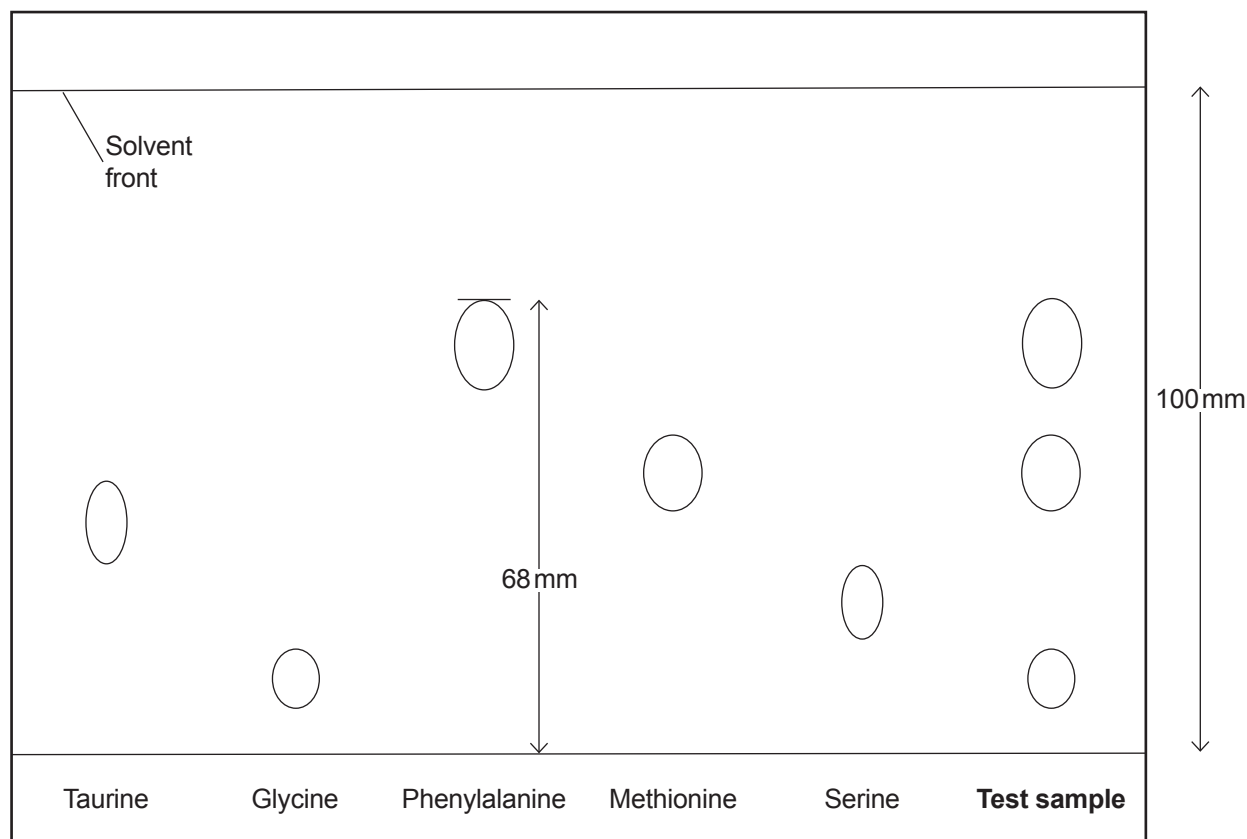
[4]

(b) A lack of the amino acid taurine in the body may contribute to the onset of the condition epilepsy.

An individual showing early symptoms of epilepsy was tested for the presence of various amino acids using chromatography.

The resulting chromatogram is shown on the next page. (Not drawn to scale.)





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The mass of an amino acid can be measured in Daltons (Da). The table below shows the mass of the amino acids in the chromatogram and their R_f values.

Amino Acid	Mass/Da	R_f value
Taurine	125	0.33
Glycine	75	0.16
Phenylalanine	165	
Methionine	149	0.55
Serine	105	0.27

- (i) Using the values provided on the chromatogram, calculate the R_f value for phenylalanine.
(Show your working.)

[2]

[Turn over]



- (ii) In another investigation it was found that the amino acid serine had an R_f value of 0.31. Suggest an explanation for the different values for serine.

[1]

- (iii) Identify evidence from the chromatogram to support the suggestion that the individual is at risk of developing epilepsy.

[1]

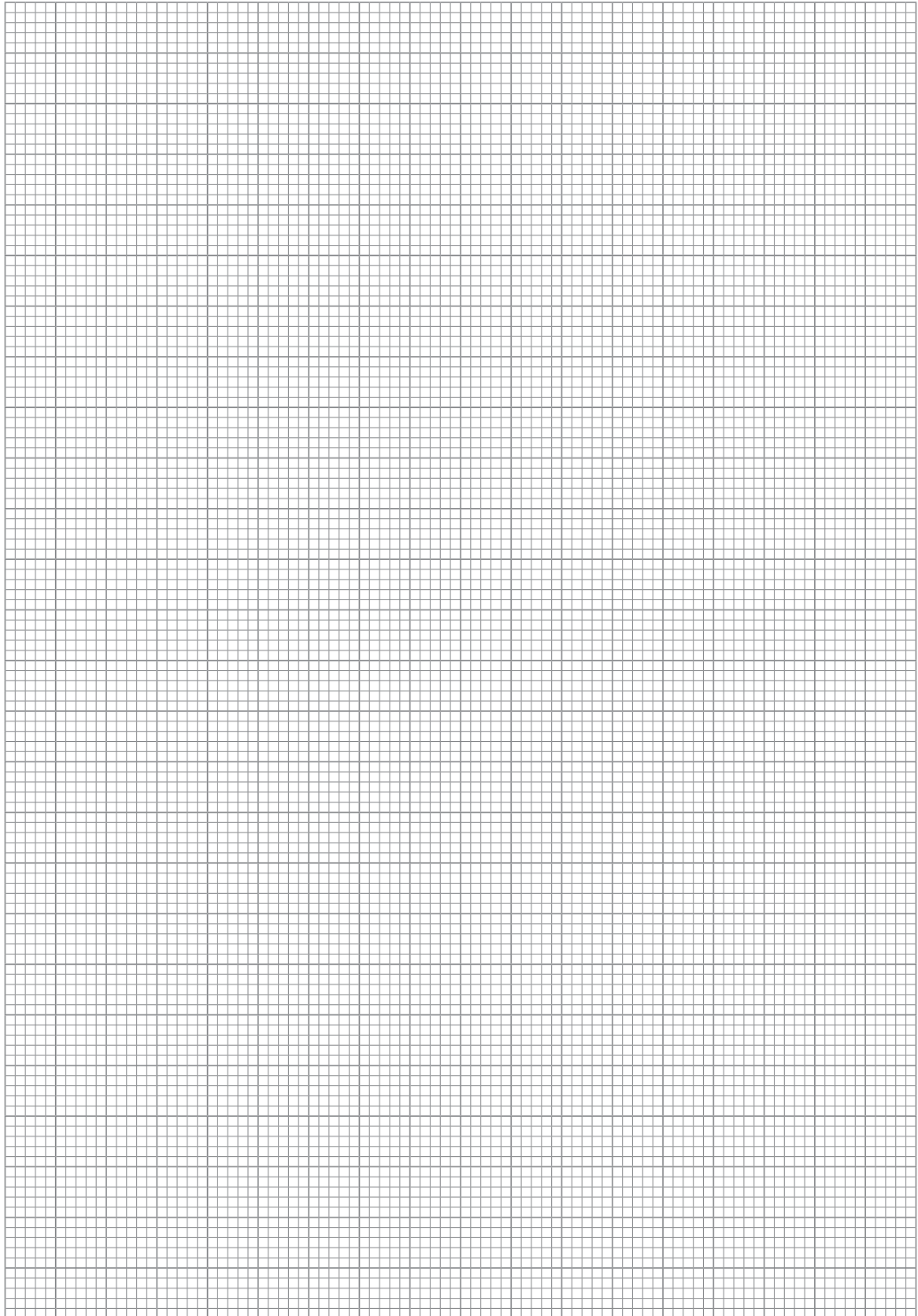
- (c) (i) Using the information for mass and R_f values in the table, including your answer to (b) (i), plot a scatter diagram on the graph paper provided. (Include a caption.)

[4]

- (ii) Describe and suggest an explanation for the trend shown in the scatter diagram.

[2]





[Turn over

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Section B

Quality of written communication is awarded a maximum of 2 marks in this section.

- 8** At a crime scene, small amounts of sweat, hair or saliva may be found.

DNA can be extracted from these biological materials and amplified to produce sufficient quantities for forensic analysis. Amplified DNA can then be used to produce a genetic fingerprint which can be compared with samples taken from potential suspects.

- (a)** Give an account of the technique used to amplify small amounts of DNA. Describe how the amplified DNA can then be used to produce a genetic fingerprint in order to compare DNA found at a crime scene with DNA from a potential suspect. [10]

- (b)** Suggest how a forensics laboratory could improve the validity and reliability of its results. [3]

Quality of written communication [2]

- (a)** Give an account of the technique used to amplify small amounts of DNA. Describe how the amplified DNA can then be used to produce a genetic fingerprint in order to compare DNA found at a crime scene with DNA from a potential suspect.



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Question Number	Marks
1	
2	
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8	

Total Marks	
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Examiner Number

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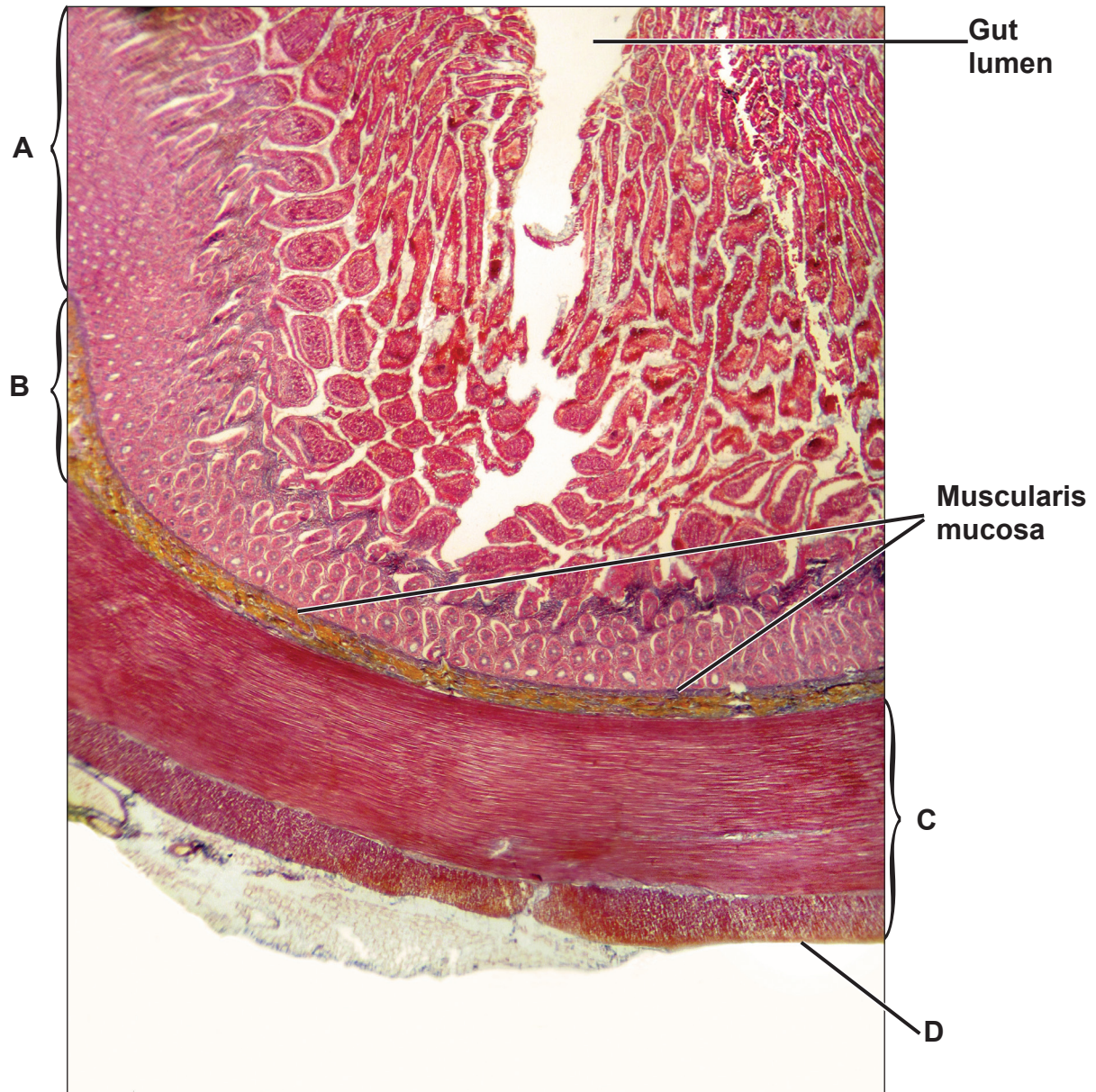
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GCE Biology Advanced Subsidiary (AS)
Assessment Unit AS 1
Molecules and Cells
Summer 2017

Photograph 1.3
(for use with Question 3)



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