



Rewarding Learning

ADVANCED SUBSIDIARY (AS)
General Certificate of Education
2024

Centre Number

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Candidate Number

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Biology

StemUp Model Solution

Assessment Unit AS 3

assessing

Practical Skills in AS Biology



[SBY31]

SBY31

WEDNESDAY 29 MAY, MORNING

TIME

1 hour.

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 six** questions.

INFORMATION FOR CANDIDATES

The total mark for this paper is 50.

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.

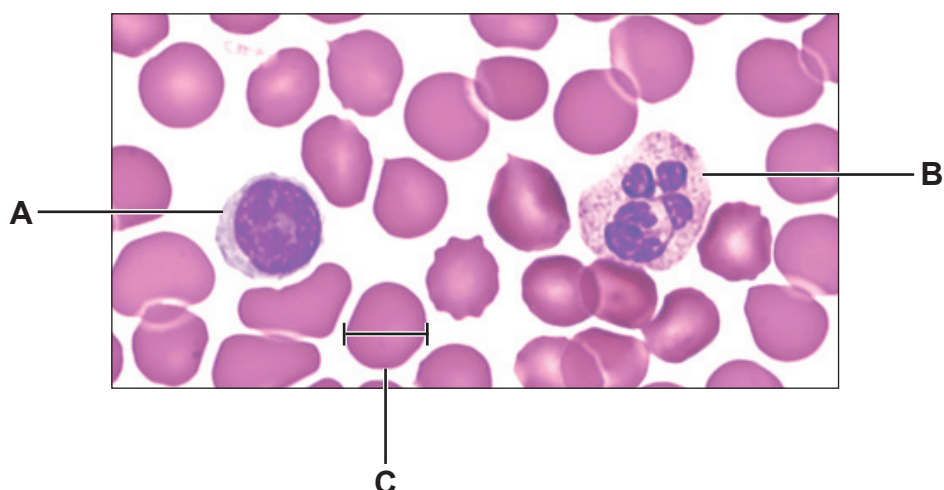


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1 A human blood smear is shown in the photomicrograph below.



(a) Identify the white blood cells labelled **A** and **B**.

A lymphocyte

B polymorph (neutrophil)

[2]

(b) The blood cell labelled **C** is $7\text{ }\mu\text{m}$ in diameter.

Use the lines on cell **C** to calculate the magnification of this image.

Give your answer to the nearest whole number.

(Show your working.)

Measured diameter of C = 11 mm

$11\text{ mm} \times 1000 = 11\text{ }000\text{ }\mu\text{m}$

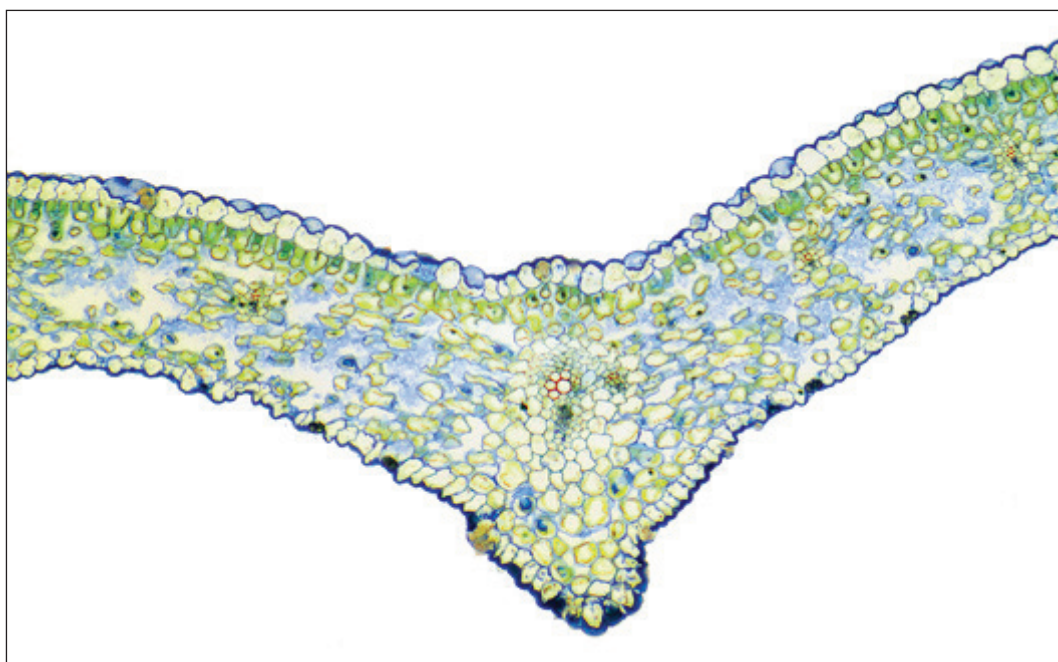
$\text{magnification} = 11\text{ }000\text{ }\mu\text{m} \div 7\text{ }\mu\text{m} = 1571.4$

$\times 1571$ [2]

[Turn over]

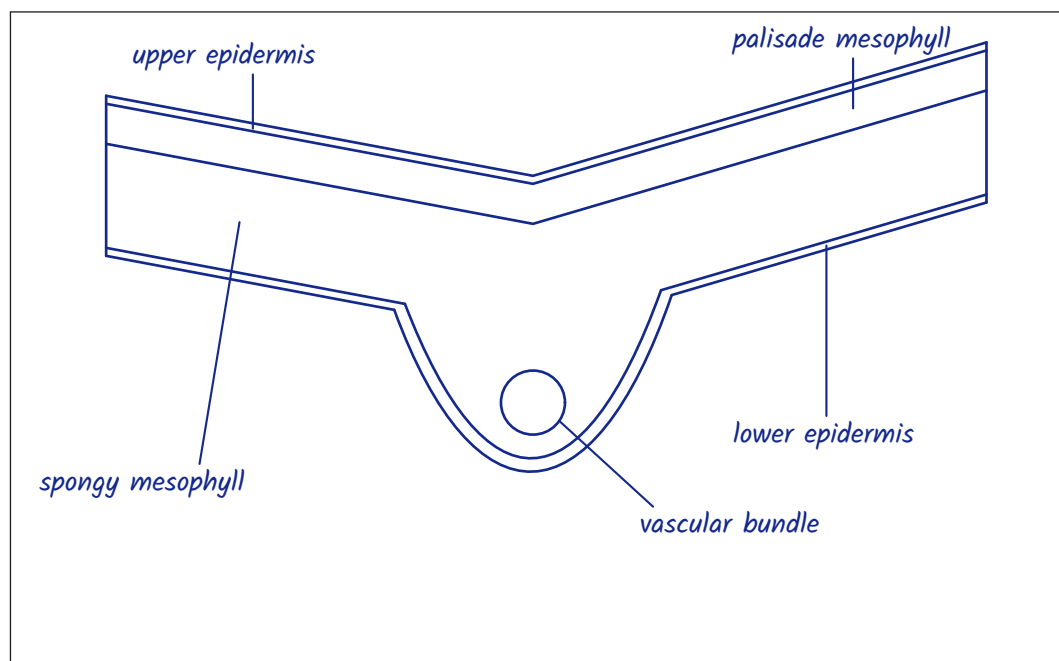


2 The photomicrograph below shows a transverse section through a leaf.



(a) Draw a block diagram of this section in the box below.

Label **three** tissue layers in your drawing.



[5]



- (b) Using the photomicrograph, give **one** piece of evidence which suggests that this leaf is **not** xerophytic.

The leaf is flat (not rolled or curled) and has no hairs or sunken

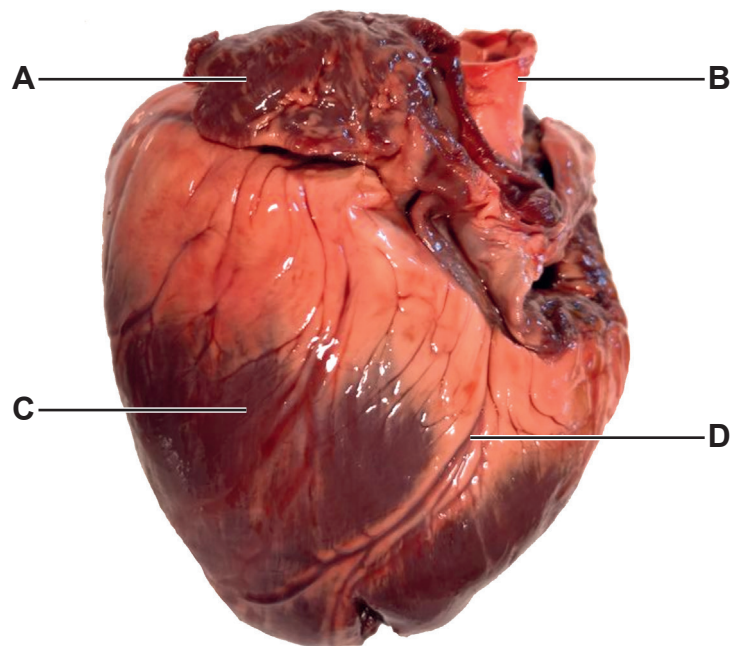
stomata on the lower epidermis.

[1]

[Turn over]



- 3 (a) The photograph below shows a lamb's heart before dissection.



Source: Principal Examiner

- (i) Identify the parts of the heart labelled **A** to **C**.

A right atrium

B aorta

C ventricle

[3]

- (ii) An atheroma in blood vessel **D** is found in people with heart disease.

Name blood vessel **D**.

D coronary artery

[1]



- (b) (i) During dissection, a vertical cut was made through part C.

Name **two** internal structures which would now be visible and state their function in the circulation of blood through the heart.

1 atrioventricular (A-V) valve

Function Closes to prevent the backflow of blood from the ventricle
into the atrium when the ventricle contracts.

2 valve tendons (chordae tendineae)

Function Attach the A-V valve flaps to the papillary muscles,
preventing the valves turning inside out (opening back into the
atria). [4]

- (ii) Describe **one** safety precaution necessary when carrying out a dissection.

Wear gloves and use a dissection board, cutting away from the
body and taking care with the sharp scalpel.

[1]

[Turn over



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4 Chromatography can be used to identify amino acids.

- (a) After amino acid solutions have been applied to chromatography paper, the next stages are 'running' and 'developing' the chromatogram.

Describe each of these stages.

Running Make sure the origin line is above the level of the solvent in the tank.

Allow the solvent to run up the paper (lid on the tank).

Remove the paper before the solvent reaches the top and mark the solvent front in pencil.

Developing Dry the paper.

Spray it with ninhydrin in a fume cupboard and dry it again: the amino acids show up as purple spots.

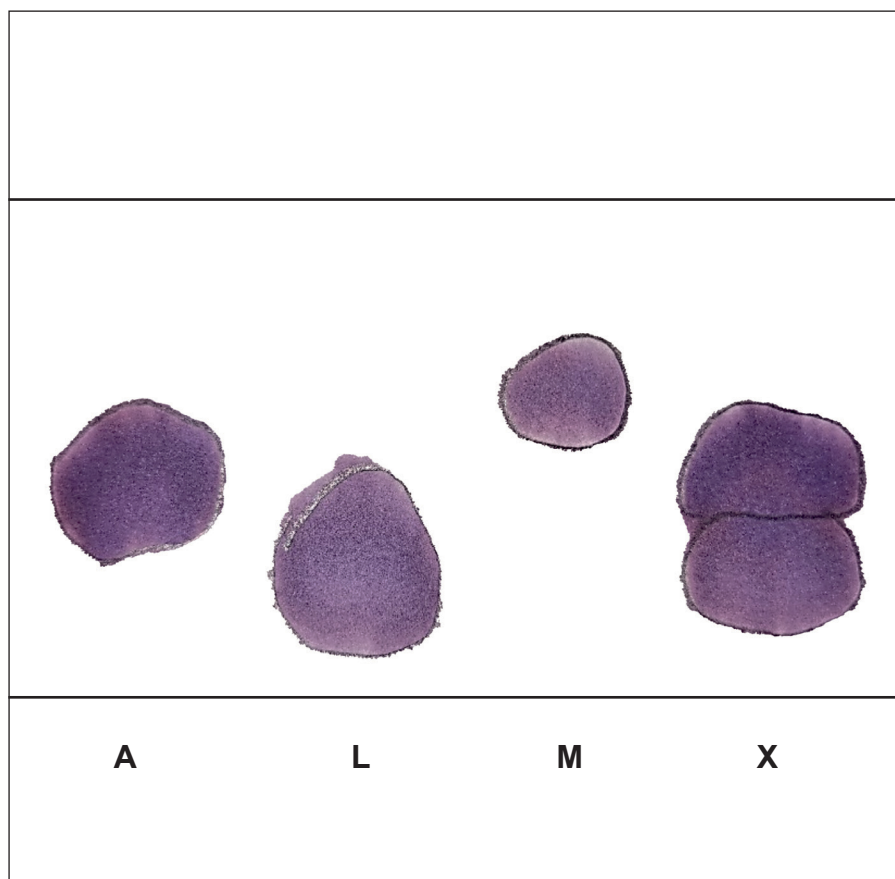
[4]

[Turn over]



- (b) Paper chromatography was carried out with three known amino acids – alanine (**A**), lysine (**L**), and methionine (**M**). In addition, a mixture of amino acids (**X**) was analysed.

The developed chromatogram is shown below.



Source: Principal Examiner

- (i) Use the letter **S** to label the solvent front on this chromatogram. [1]
- (ii) Using the chromatogram, state the number and identity of amino acids in mixture **X**.

Number 2

Identity of amino acids alanine (A) and lysine (L)

_____ [2]



(iii) The accepted R_f value for alanine is 0.38.

The R_f value for alanine calculated using this chromatogram was 0.42.

Suggest a reason why the R_f value obtained here would have differed from the accepted value.

A different solvent or type of paper was used, or it was not left to
run long enough.

[1]



- 5 An interrupted belt transect was used to sample five species of seaweed on a rocky shore.

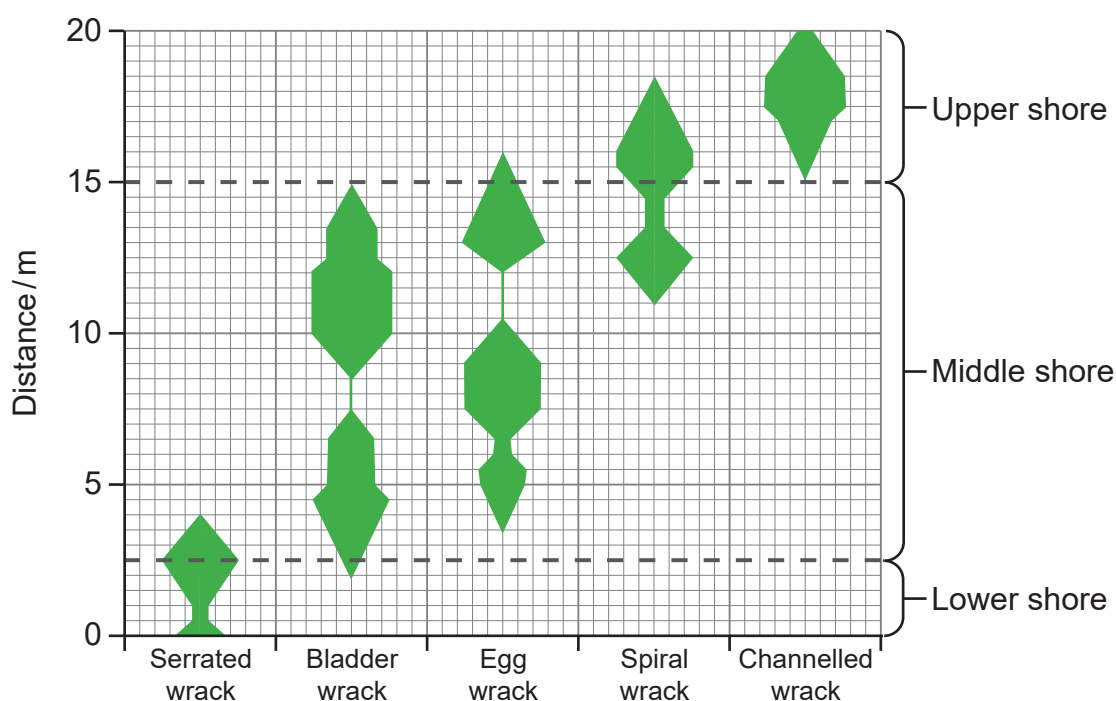
A 20 m transect was placed from the lower shore to the upper shore and quadrats were placed at 2 m intervals.

- (a) Explain why this was the most appropriate method of sampling this habitat.

There is an environmental gradient from the lower to the upper shore.

[1]

- (b) The results of the transect are shown in the kite diagram below. The shaded areas represent the abundance of each species at a particular distance on the shore (the larger the area, the greater the abundance).



- (i) Using the results shown, describe the distribution of seaweed species on this rocky shore.

Lower shore: 2 species, serrated wrack and bladder wrack, with serrated wrack dominant.

Middle shore: 4 species, serrated, bladder, egg and spiral wrack; this zone has the highest abundance of seaweed (mainly bladder and egg wrack).

Upper shore: 3 species, egg, spiral and channelled wrack; it is dominated by spiral and channelled wrack, and channelled wrack is only found on the upper shore.

[3]

- (ii) Name **one** biotic factor that would influence the distribution of the seaweed species along this shore.

grazing (or competition for space/light)

[1]

- (iii) None of the five species of seaweed were found beyond 20 m.

Suggest **one** abiotic factor that would account for this and explain how this factor prevents seaweed growth beyond 20 m.

Temperature too high / not enough seawater: beyond 20 m the shore is covered by seawater for too short a time, so the seaweed would dry out (desiccation).

[2]

[Turn over]



- (c) Sea snails are small invertebrates which were also sampled along this belt transect.

Name the most suitable apparatus for sampling sea snails.

Explain your answer.

Apparatus quadrat

Explanation Sea snails move slowly, so they will not move outside the quadrat while being counted.

[2]





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[Turn over



- 6 Enzymes can be extracted from plant tissue. Plants store glucose as starch and an enzyme is involved in the conversion of glucose to starch in cells. An extract containing the enzyme, as well as other cell components, can be produced by crushing raw potato tissue with water and filtering this mixture.

To use this extract in investigations, any starch in the mixture should be removed. This is achieved using centrifugation, where the enzyme remains in the liquid component at the top of the centrifuge tube after spinning and the starch is found in the 'pellet' at the bottom.

- (a) (i) From the information provided, state your conclusion regarding the **size** of starch molecules relative to the enzyme molecules.

Starch molecules are larger (heavier) than the enzyme molecules.

[1]

- (ii) Describe how iodine can be used to show that no starch remains in the enzyme extract.

Add iodine solution to a sample of the extract: it remains

yellow-brown and does not turn blue-black, so no starch is

present.

[1]

- (b) Although not a pure enzyme extract, the solution obtained can be used in enzyme investigations. In such investigations, the production of starch is used as a measure of enzyme activity. This is done using iodine and a colorimeter.

- (i) Suggest and explain which colour of filter is most appropriate for this investigation.

Colour *red*

Explanation *The starch-iodine solution is blue-black, so it reflects*

blue light and absorbs red light; a red filter gives the biggest

change in readings.

[2]



- (ii) Describe fully the steps involved when using a colorimeter to determine accurately the % transmission of light through a single sample from this investigation.

Switch on the colorimeter, let it warm up and fit the red filter.

Fill a clean cuvette with a blank of water and iodine, insert it and

calibrate the colorimeter to 100% transmission.

Fill a clean cuvette (to the same level) with the sample, handling

it only by its ridged sides.

Insert it the correct way round, with the clear sides in the light

path, close the lid and read the % transmission from the display.

Recalibrate with the blank between samples and repeat to give a

mean.

[4]



- (c) The table below shows results for an investigation using this enzyme extract. Samples were removed and tested at 5-minute intervals.

Time/minutes	% transmission of light
0	45
5	36
10	29
15	22
20	17
25	15
30	13
35	11
40	10

- (i) Using the information provided, describe and explain what causes the change in the percentage transmission of light through the solution between 0 and 15 minutes.

The % transmission falls from 45% to 22%, decreasing quickly.

This is because the concentration of starch is increasing as the enzyme converts glucose to starch.

More starch gives more blue-black complex with iodine, so more light is absorbed and less light is transmitted through the solution.

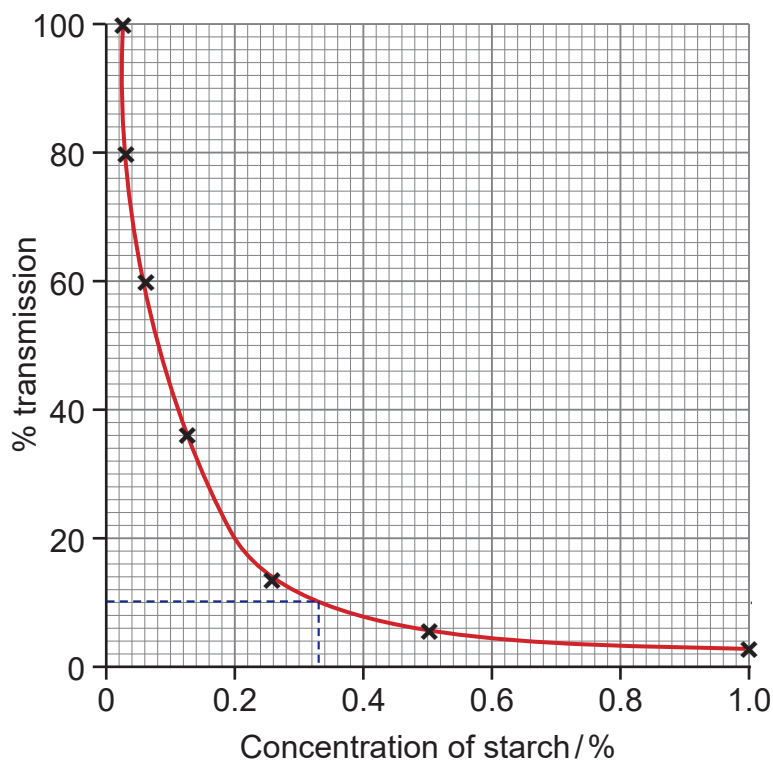
There are many successful collisions between enzyme and substrate, so many enzyme-substrate complexes form and starch is made rapidly.

[3]



- (ii) Use the table opposite and the calibration graph below to determine the concentration of starch at 40 minutes.

0.33 % [1]



- (iii) Suggest how the concentration of starch after 40 minutes would have differed if a diluted preparation of the enzyme extract had been used.

Explain your answer.

The concentration of starch would be lower.

There would be fewer enzyme molecules, so fewer active sites and
fewer enzyme-substrate complexes, so less product (starch) forms
in 40 minutes.

[2]



Sources: .

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Q5b and Q6c(ii)....."© CCEA AS/A2 Unit 3: Biology Student Guide: Practical Skills in Biology by John Campton (2018)

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Question Number	Marks
1	
2	
3	
4	
5	
6	

Total Marks	
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Examiner Number

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