



Rewarding Learning

ADVANCED
General Certificate of Education

Centre Number

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Candidate Number

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Biology

Assessment Unit A2 3
assessing
Practical Skills in Biology



[ABY31]

ABY31

Assessment

TIME

1 hour 15 minutes.

Assessment Level of Control:

Tick the relevant box (✓)

Controlled Conditions	
Other	

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.

INFORMATION FOR CANDIDATES

The total mark for this paper is 60.

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.

Statistics Sheets are provided for use with this paper.



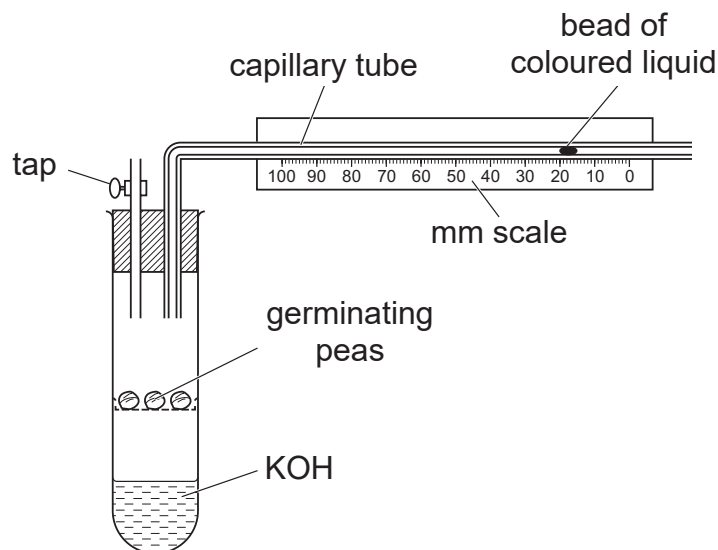
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20ABY3102

- 1 The diagram below represents a simple respirometer which can be set up using either potassium hydroxide (KOH) or water.



- (a) State the function of KOH in a respirometer.

_____ [1]

- (b) The KOH is replaced with water. With reference to the bead of coloured liquid, describe and explain what would be observed if the germinating peas have an RQ value of 1.0.

_____ [2]

- (c) The functioning of this type of respirometer can be affected by changes in air temperature. Describe how you would modify the experimental set-up to ensure that the temperature remained constant throughout the experiment.

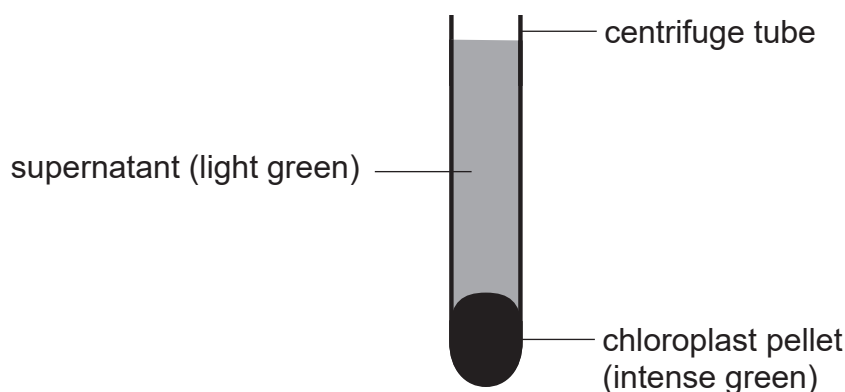
_____ [1]

[Turn over]



- 2 DCPIP solution is deep blue in colour. It acts as a hydrogen acceptor and can be used to monitor the progress of the light-dependent stage of photosynthesis. When DCPIP solution is reduced, it becomes colourless.

Plant leaf tissue and water were homogenised in a blender, filtered and centrifuged. A chloroplast 'pellet' formed in the bottom of the centrifuge tube. The liquid at the top of the tube is known as the supernatant.



The supernatant was poured off into a beaker, and the pellet was mixed with cold buffer solution to form a suspension. Test tube contents and conditions were set up as shown in the table below. The colour of the DCPIP was observed after 15 minutes in these conditions.

Test tube	DCPIP	Supernatant	Chloroplast suspension	Bright light
1	✓	X	✓	✓
2	✓	✓	X	✓
3	✓	X	X	✓
4	X	X	✓	✓
5	✓	X	✓	X

- (a) The buffer solution used to form the chloroplast suspension maintains a constant pH. Suggest why this is important.

[1]



- (b) Describe the results which would be expected for the DCPIP in test tube **5**, which was in darkness.

[1]

- (c) Describe and explain the results which would be expected for the DCPIP in:

Test tube **1**

Test tube **3**

[4]

- (d) After the observation period, there was a small degree of decolourisation of the DCPIP in test tube **2**. Suggest an explanation for this result.

[1]

[Turn over



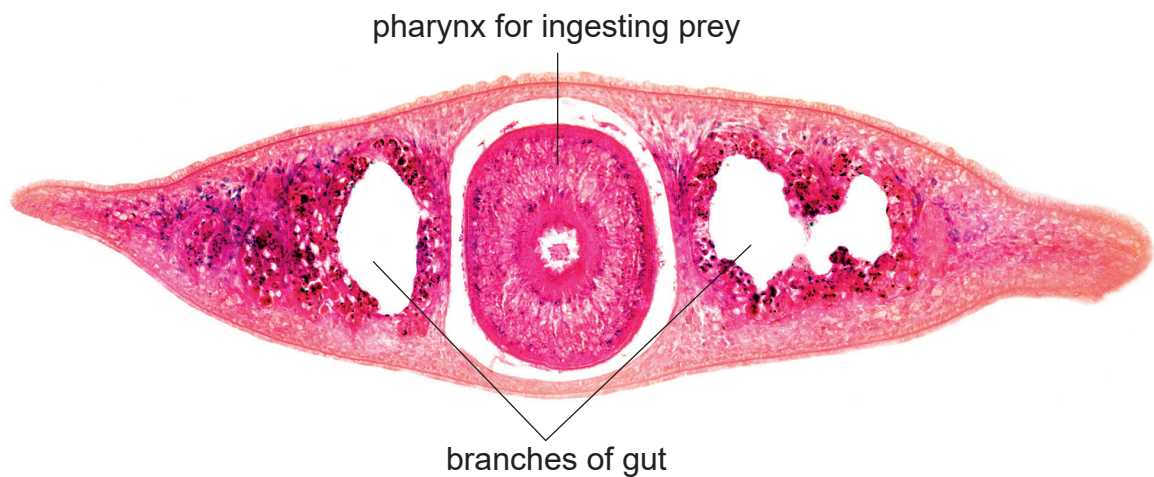
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20ABY3106

- 3 (a) The photograph below shows a transverse section through a planarian flatworm.



© Dr Keith Wheeler / Science Photo Library

- (i) State the name of the phylum to which the planarian flatworm belongs.

_____ [1]

- (ii) Branches of gut are visible in this particular transverse section. Explain why these would not be present in every transverse section of a planarian flatworm.

_____ [1]

- (iii) Apart from a branched gut, identify **one** typical feature of this phylum visible in the photograph.

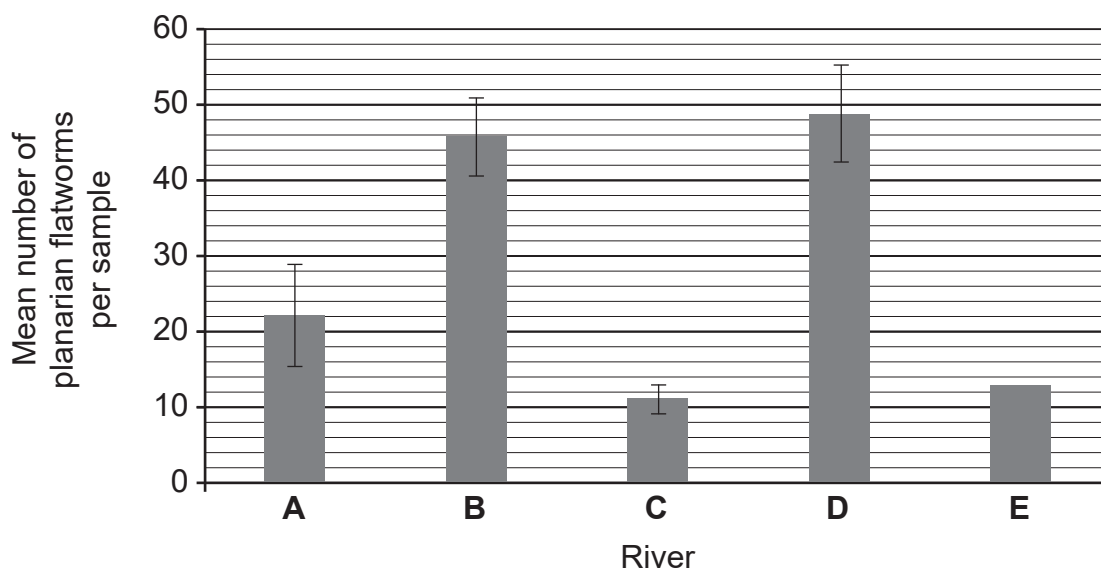
_____ [1]

[Turn over]



- (b) Planarian flatworms are aquatic organisms and are relatively tolerant of the low oxygen levels associated with polluted water. Large populations of planarians may therefore indicate high levels of pollution.

A survey of planarian populations in five rivers (**A–E**) was carried out. In each river, eight sites were sampled and mean results were calculated. These results are shown in the graph below and associated 95% confidence limits have been plotted for rivers **A–D**.



- (i) In river **E**, the mean number of planarians per sample (\bar{x}) was 13 and the standard deviation ($\hat{\sigma}$) was 5.38.

Using the information given, and the Statistics Sheets provided, calculate 95% confidence limits for the mean number of planarians for river **E**. (Show your working.)

Upper limit _____

Lower limit _____ [3]



(ii) Complete the graph by plotting the 95% confidence limits for river **E**. [1]

(iii) Summarise the evidence from the graph which suggests that rivers **B** and **D** are significantly more polluted than rivers **A**, **C** and **E**.

[2]



- 4 A student proposed the following hypothesis:

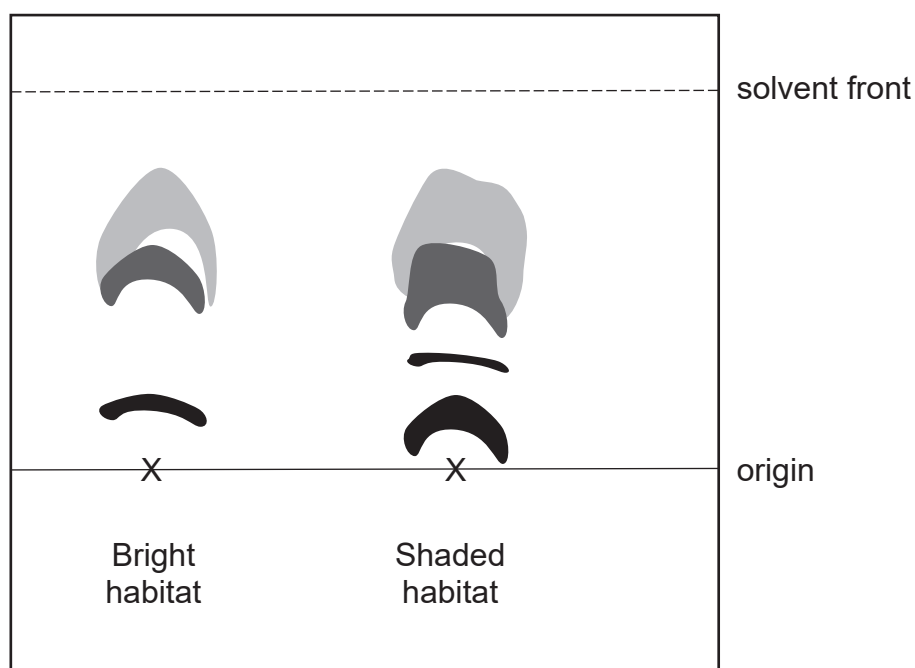
A greater number of photosynthetic pigments is present in the leaves of a plant from a shaded habitat compared to those in the leaves of a plant from a bright habitat.

To test this hypothesis, the student collected leaves from plants in each type of habitat and used chromatography to separate and identify the pigments present.

- (a) Describe a procedure which could be used to **extract** the pigment from leaves.

[3]

- (b) The diagram below shows the chromatogram produced from this investigation. X represents the positions where pigment extracts were applied to the origin line.



- (i) By measuring to the leading edge, calculate the R_f value for the least soluble pigment in the plant leaf extract from the bright habitat.
(Show your working.)

_____ [2]

- (ii) Explain whether or not the chromatogram provides evidence to support the proposed hypothesis.

_____ [2]

- (c) Identify a factor which must have been controlled in each of the following steps in order to make a valid comparison between plants from the two habitats.

- Extraction of pigments

- Preparing the chromatogram

- Determining R_f values

_____ [3]

[Turn over]



5 The procedure outlined below is a simple method for extracting DNA from strawberries using common household materials.

1. Measure 100 ml of water into a glass and add two teaspoons of detergent.
2. Stir in a pinch of salt.
3. Place one strawberry into a sealable plastic bag, and pour in the detergent and salt mixture.
4. Squash the strawberry as much as possible.
5. Pour the contents of the bag through a sieve and into a medium glass bowl.
6. Transfer the contents of the bowl into a clean glass.
7. Carefully pour cold alcohol down the side of the glass so that it forms a layer on the surface of the strawberry extract.
8. DNA will become visible in the alcohol layer.

(a) (i) Suggest the function of the detergent in this procedure.

[1]

(ii) Suggest apparatus which could be used to break up the strawberry more effectively (step 4).

[1]

(iii) Describe the appearance of the DNA which would become visible in step 8.

[2]



- (b) As strawberries ripen they produce an enzyme called cellulase which breaks down cellulose. Strawberries are polyploid fruit which means they have several sets of chromosomes in their cells. Some varieties have up to ten sets of chromosomes in each cell nucleus.

Using the information above, explain why ripe strawberries are ideal for carrying out DNA extraction procedures.

[3]



- (b) A stock culture of *E.coli* was found to be contaminated with another bacterial species. Suggest how a contaminating species could be distinguished visually from the *E.coli* colonies on a streak-plate.

[1]

[Turn over



7 In order to estimate the size of a population of organisms, sampling procedures are carried out.

- (a) Suggest **one** reason why animal population size is estimated by sampling, rather than counting the entire population.

_____ [1]

- (b) It is important that the most appropriate apparatus is selected for such sampling procedures.

Identify the most appropriate apparatus for sampling the following populations:

- Centipedes living in leaf litter on a woodland floor

- Brewer's yeast during the fermentation process in beer production

- Brown trout in a small stream

_____ [3]



- (c) The population of some animals can be estimated using a technique known as 'capture-mark-recapture'. Alaskan polar bears were captured, tranquillised and marked with a small plastic ear-tag, before being released. After 12 months, the population was sampled again.

The data collected from this study is shown below:

Number of polar bears captured in first sample	135
Number of untagged polar bears in second sample	85
Number of tagged polar bears in second sample	31

- (i) Using the data provided, estimate the size of the polar bear population.
(Show your working.)

_____ [3]

- (ii) It is known that polar bears can become 'trap-shy'. This means that, having been captured once, they display more cautious behaviour and are less likely to be captured on future occasions.

Explain fully how this factor could affect the accuracy of the population estimate.

_____ [2]

- (iii) The way in which researchers in this study tried to overcome the problem of trap-shy bears was to leave a 12-month period between samples.

State **one** reason why such a long period between the first and second sample may lead to inaccuracy in estimating population size.

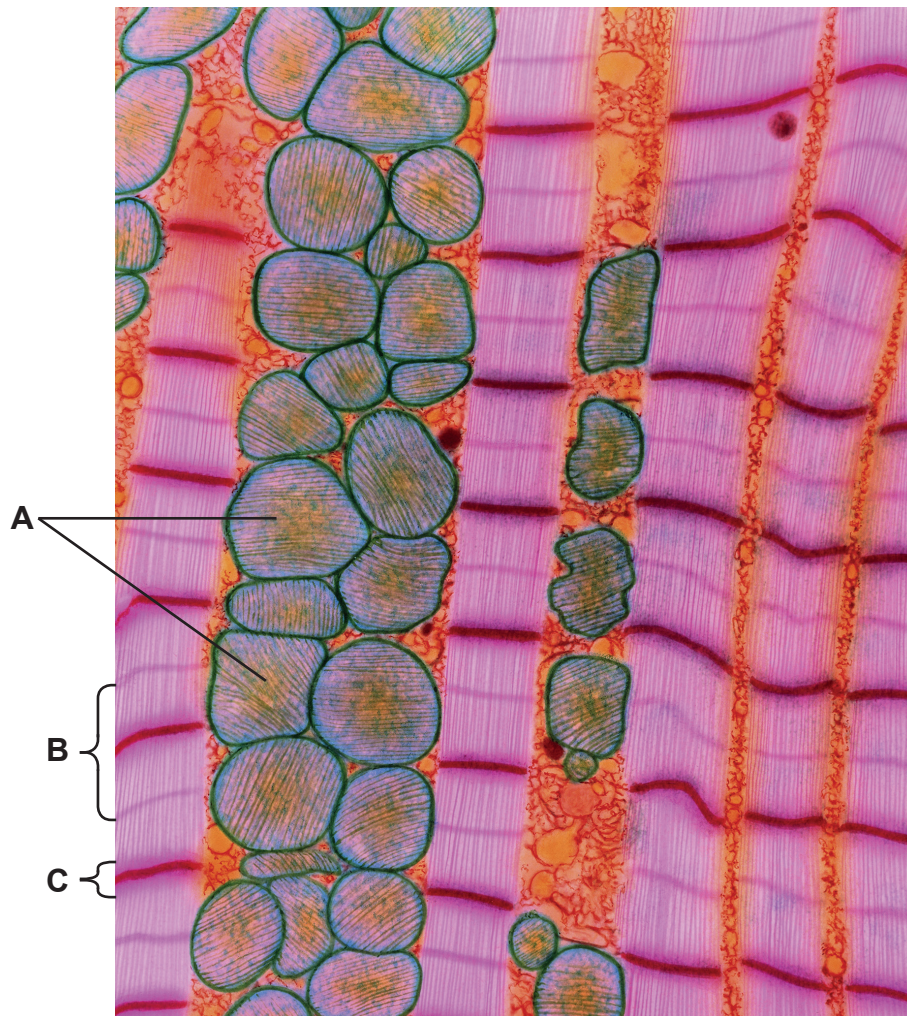
_____ [1]

[Turn over]



- 8 A researcher investigating the effect of alcohol on cardiac muscle was asked to present her findings at a conference. She was invited to deliver a presentation and to produce a poster which would be displayed at the conference.

Shown below is a transmission electron micrograph of cardiac muscle which she used to illustrate her presentation.



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- (a) The researcher included a bibliography section on her poster. State **two** pieces of information which should be included in a bibliography entry.

1. _____
2. _____ [2]

- (b) (i) Identify the components of cardiac muscle labelled **B** and **C**.

B _____

C _____ [2]

- (ii) State **one** distinguishing feature of cardiac muscle which is not visible in this photograph.

_____ [1]

- (iii) The structures labelled **A** are much more numerous in cardiac muscle than skeletal muscle. Identify these structures and suggest why they are so numerous in cardiac muscle.

_____ [2]

THIS IS THE END OF THE QUESTION PAPER



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For Examiner's use only	
Question Number	Marks
1	
2	
3	
4	
5	
6	
7	
8	

Total Marks	
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Examiner Number

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