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Surname

Other names

Pearson Edexcel
International
Advanced Level

Centre Number

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Candidate Number

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Biology

Advanced Subsidiary

Unit 2: Development, Plants and the Environment

Monday 16 October 2017 – Morning

Time: 1 hour 30 minutes

Paper Reference

WBI02/01

You must have:

Calculator, HB pencil, ruler

Total Marks

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Instructions

- Use **black** ink or ball-point pen.
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- Answer **all** questions.
- Answer the questions in the spaces provided
– *there may be more space than you need.*

Information

- The total mark for this paper is 80.
- The marks for **each** question are shown in brackets
– *use this as a guide as to how much time to spend on each question.*
- Questions labelled with an **asterisk** (*) are ones where the quality of your written communication will be assessed
– *you should take particular care with your spelling, punctuation and grammar, as well as the clarity of expression, on these questions.*
- Candidates may use a calculator.

Advice

- Read each question carefully before you start to answer it.
- Keep an eye on the time.
- Try to answer every question.
- Check your answers if you have time at the end.

Turn over ►

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Answer ALL questions.

Some questions must be answered with a cross \boxtimes . If you change your mind about an answer, put a line through the box \boxtimes and then mark your new answer with a cross \boxtimes .

1 Starch and cellulose are two molecules found in plants.

(a) Read through the following passage about starch.

Write on the dotted lines the most appropriate word or words to complete the passage. (4)

Starch is an example of a type of molecule called a

Starch consists of monomers that are joined together by bonds.

In plant cells, starch is found inside structures called

(b) Describe the arrangement of cellulose molecules in plant cell walls.

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(Total for Question 1 = 7 marks)

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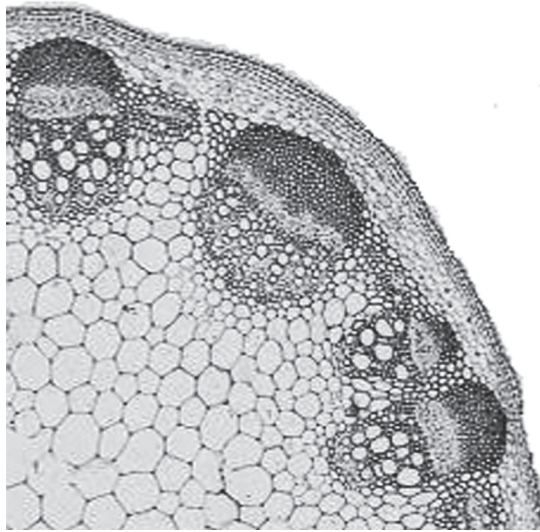
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2 Sclerenchyma fibres and xylem vessels are both found in the stems of plants.

(a) The photograph below shows a section through part of a stem, as seen using a light microscope.



Magnification $\times 25$

(i) Draw a line, labelled **S**, to the sclerenchyma fibres.

(1)

(ii) Draw a line, labelled **X**, to the xylem vessels.

(1)



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(b) Describe the similarities in the structures of sclerenchyma fibres and xylem vessels.

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(c) Explain why sclerenchyma and xylem are examples of tissues.

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(Total for Question 2 = 7 marks)



3 There is a taxonomic group that consists of single-celled eukaryotic organisms, including *Chlamydomonas* and choanoflagellates.

(a) *Chlamydomonas* has structures that are also found in plant cells.

Some choanoflagellates have structures that are also found in animal cells.

Below is a list of some cell structures:

- cell membrane
- cell wall
- mitochondria
- nucleus
- ribosomes.

(i) Put a cross in the box next to the number of these cell structures that are present in **both** *Chlamydomonas* and choanoflagellates. (1)

A 2

B 3

C 4

D 5

(ii) Put a cross in the box next to the number of these cell structures that are present in *Chlamydomonas* but absent in choanoflagellates. (1)

A 1

B 2

C 3

D 4

(iii) Put a cross in the box next to the number of these cell structures that are present in choanoflagellates but absent in *Chlamydomonas*. (1)

A 0

B 1

C 2

D 3



(iv) Put a cross ☒ in the box next to the number of these cell structures that are present in all three of the following: *Chlamydomonas*, choanoflagellates **and** prokaryotes. (1)

- A 0
- B 1
- C 2
- D 3

(b) The evolutionary relationship between species of choanoflagellates has been determined.





(i) Name the study that uses DNA and protein analysis to determine evolutionary relationships between species. (1)

(ii) The table below shows some information about structural features that have been used to determine this evolutionary relationship.

Species	Structural features				
	Protoplast sheath	Regular veil	Longitudinal costa	Helical costa	Transverse rings
F	+	+	+	-	+
G	+	+	+	-	+
H	+	-	+	+	+

Key + Presence of structural feature - Absence of structural feature

Put a cross ☒ in the box next to the diagram that shows the evolutionary relationship between species **F**, **G** and **H**. (1)

- A 
- B 
- C 
- D 

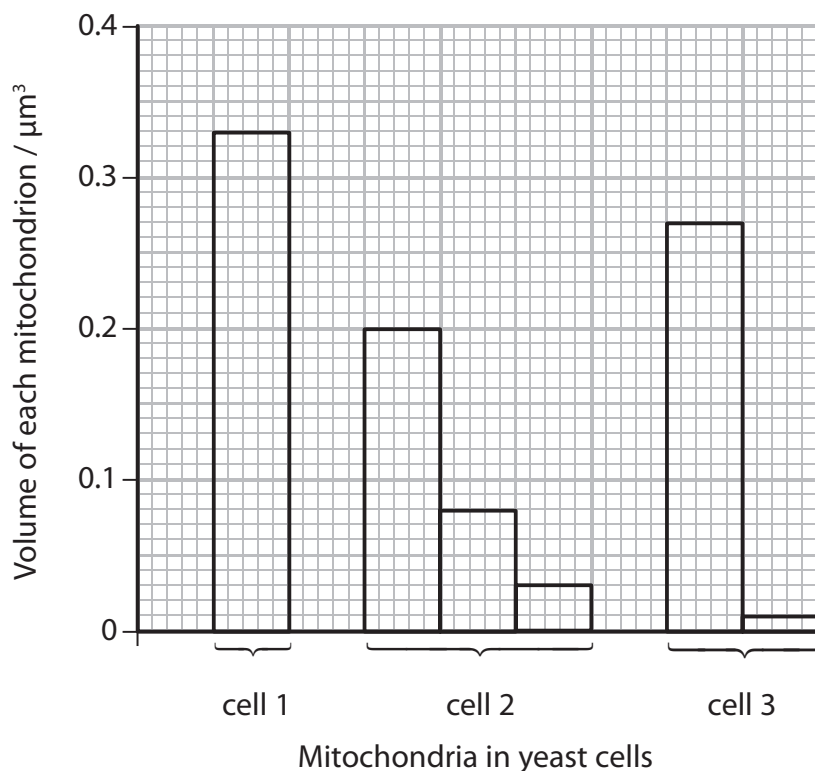
(Total for Question 3 = 6 marks)



4 Yeast is a single-celled organism.

(a) The graph below shows the number and volume of the mitochondria found in three yeast cells: cell 1, cell 2 and cell 3.

Each bar on the graph represents **one** mitochondrion.



(i) Using the information in the graph, state **two** conclusions that can be made about mitochondria in these yeast cells.

(2)

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(ii) Describe the limitations of these conclusions.

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(b) The number of ribosomes in yeast cells can be estimated using electron microscopy.

In an investigation, the following information was collected:

- number of ribosomes in a section of a yeast cell = 20 200
- area of the section of the yeast cell = $11 \mu\text{m}^2$
- thickness of the section of the yeast cell = $0.09 \mu\text{m}$
- total volume of the cytoplasm of the yeast cell = $13.5 \mu\text{m}^3$

(i) Calculate the total number of ribosomes in this yeast cell.

Show your working.

(3)

Answer

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(ii) Suggest why this calculated value is only an estimate of the total number of ribosomes in a yeast cell.

(2)

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(iii) Some of these ribosomes are attached to endoplasmic reticulum.

Describe the role of the rough endoplasmic reticulum in a cell.

(3)

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(c) Using the information given, suggest the domain to which yeast belongs. Give a reason for your answer.

(1)

Domain

Reason

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(Total for Question 4 = 13 marks)

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5 The phenotype of an organism can be the result of an interaction between its genotype and its environment.

(a) Explain the meaning of each of the following terms.

(i) Phenotype

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(ii) Genotype

(1)

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(iii) Environment

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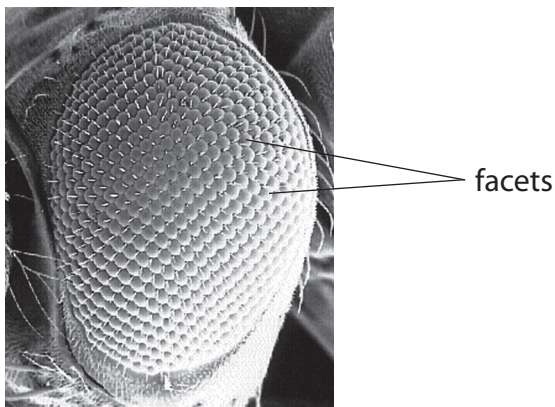
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(b) Temperature affects the phenotype of fruit flies.

Differences in temperature during development affect the number of facets in the eyes of fruit flies.

The photograph below shows the eye of a fruit fly.

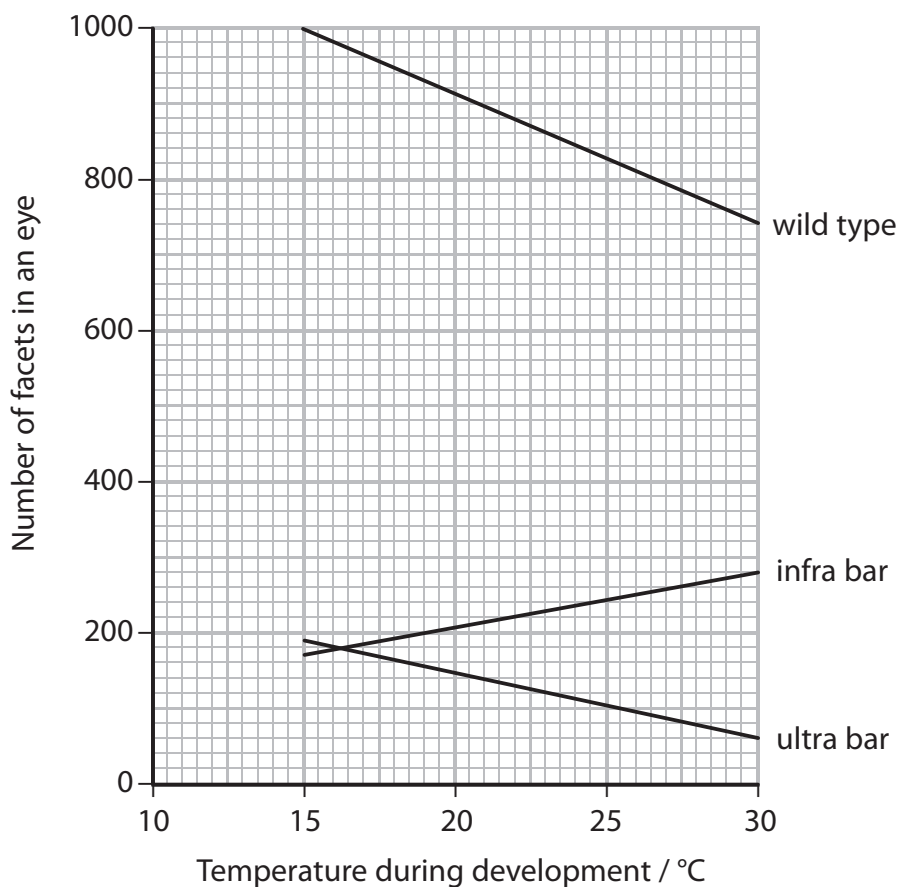


[https://snowbio.wikispaces.com/Drosophila+\(Insect\)](https://snowbio.wikispaces.com/Drosophila+(Insect))

Magnification $\times 80$

The effect of temperature during the development of three types of fruit fly was investigated. The types of fruit fly were a wild type, an infra bar and an ultra bar.

The graph below shows the results of this investigation.



(i) Using the information in the graph, compare the effect of temperature during development on these three types of fruit fly.

(2)

(ii) Explain why the results of this investigation indicate that phenotype can result from an interaction between the genotype and the environment.

(2)

(iii) Temperature affects the frequency of crossing over in meiosis between some of the chromosomes of these flies.

Describe the process of crossing over.

(3)

(Total for Question 5 = 11 marks)

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P 5 0 7 4 3 A 0 1 3 2 4

- 6 Plant fibres are being developed to provide a sustainable alternative to conventional building materials, particularly in tropical regions.

One source of suitable fibres is the banana plant. Another source is bagasse, a waste product of the sugar cane industry.

The effect of different treatments on the tensile strength of these fibres was investigated.

The table below shows the results.

Treatment of fibres	Mean tensile strength of fibres from banana plants / MPa	Mean tensile strength of fibres from bagasse / MPa
No treatment	80	160
Alkali treatment	120	130
Acidic treatment	30	50
Heat treatment	350	410

- (a) Using the information in the table, describe the effect of these treatments on the tensile strength of banana plant fibres.

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(b) Compare the effects of these treatments on fibres from banana plants with the effects on fibres from bagasse.

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*(c) Describe an investigation that could be carried out to confirm the results shown in the table.

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(d) Suggest why using fibres from banana plants and fibres from bagasse could provide a sustainable source of building materials.

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(Total for Question 6 = 12 marks)

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7 The Galapagos Islands are a group of volcanic islands more than 900 km from the coast of South America.

There are at least 13 species of finches on the Galapagos Islands.

All these finches are endemic to the Galapagos Islands and each occupies a different niche. They all evolved from one species.

Geospiza fortis is one of the species. It feeds mostly on seeds.

The photograph below shows *G. fortis*.



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(a) Explain the meaning of each of the following terms, using finches as an example.

(i) Species richness

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(ii) Endemic

(2)

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(iii) Niche

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*(b) Changes in ecological conditions, such as drought, have taken place in the Galapagos Islands.

Changes in seeds and also in *G. fortis* have been recorded.

These changes include:

- a decrease in the supply of seeds
- an increase in the size and hardness of seeds
- a decrease in the numbers of *G. fortis*
- *G. fortis* has a more powerful beak.

Explain how these changes demonstrate that natural selection has led to the adaptation and evolution of *G. fortis*.

(6)

(Total for Question 7 = 12 marks)

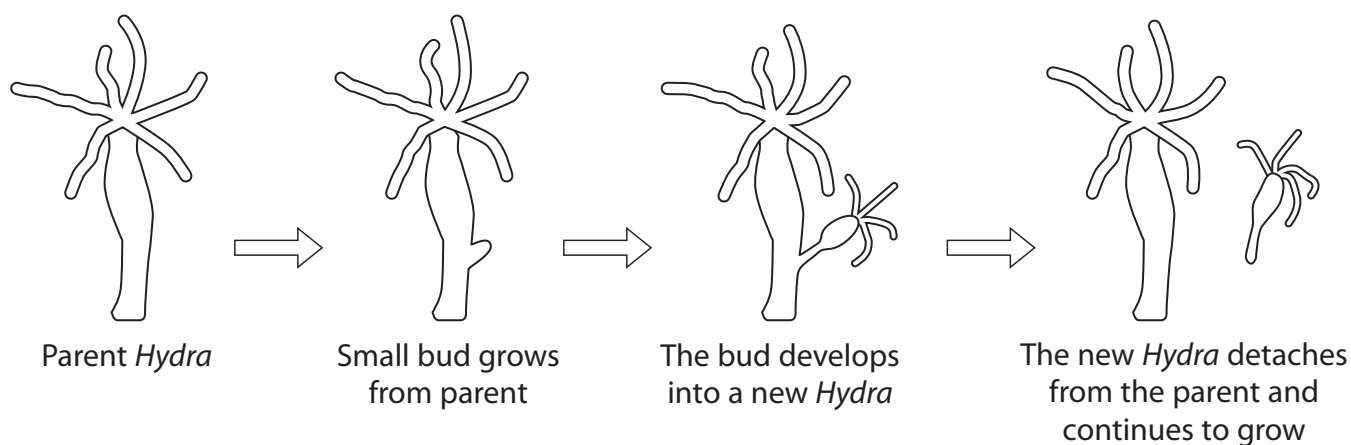


8 *Hydra* is a small animal found in fresh water.

Hydra can reproduce by both sexual and asexual reproduction.

Asexual reproduction is through a process called budding.

The diagram below shows the process of budding.



(a) The parent *Hydra* has 30 chromosomes in each cell.

State the number of chromosomes in each cell of the new *Hydra*.

(1)

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(b) *Hydra* reproduce by sexual reproduction when the environmental conditions are poor. *Hydra* then reproduce by asexual reproduction when the environmental conditions become favourable.

Explain the advantages to *Hydra* of being able to reproduce both sexually and asexually.

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(c) Reproduction and growth of *Hydra* involve mitosis.

- (i) The table below shows the number of chromosomes and chromatids that may be present in a cell in different stages of mitosis.

Put a cross in the appropriate box, in each row of the table, to show the number of chromosomes or chromatids in **one** cell from a *Hydra* in different stages of mitosis.

(3)

Stage of mitosis	0	15	30	60
Number of chromosomes in prophase	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Number of chromatids in metaphase	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Number of chromatids in telophase	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

- (ii) Describe what happens to a cell during cytokinesis and early interphase.

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(Total for Question 8 = 12 marks)

TOTAL FOR PAPER = 80 MARKS



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