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**International**  
**Advanced Level**

Centre Number

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# Biology

**Advanced Subsidiary**

**Unit 2: Development, Plants and the Environment**

Monday 24 October 2016 – Morning

**Time: 1 hour 30 minutes**

Paper Reference

**WBI02/01**

**You do not need any other materials.**

Total Marks

## 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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**PEARSON**

**Answer ALL questions.**

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

- 1** Eukaryotic cells contain structures called organelles. These structures are the sites of specific functions within the cell.

(a) Place a cross ☐ in the box next to the correct words to complete each of the following statements.

(i) The organelle in which aerobic respiration takes place is the

(1)

- ☐ **A** Golgi apparatus  
☐ **B** mitochondrion  
☐ **C** secretory vesicle  
☐ **D** smooth endoplasmic reticulum

(ii) Protein synthesis takes place on the

(1)

- ☐ **A** centrioles  
☐ **B** lysosomes  
☐ **C** ribosomes  
☐ **D** vacuoles

(iii) An organelle that contains thylakoids is

(1)

- ☐ **A** a chloroplast  
☐ **B** a mitochondrion  
☐ **C** a nucleus  
☐ **D** the rough endoplasmic reticulum

(iv) The organelles that are involved in cell division and that are found in pairs in animal cells are

(1)

- ☐ **A** centrioles  
☐ **B** mitochondria  
☐ **C** nucleoli  
☐ **D** vacuoles



(v) The organelles that are surrounded by double membranes are

(1)

- ☐ A chloroplasts, lysosomes and nuclei
- ☐ B chloroplasts, mitochondria and nuclei
- ☐ C lysosomes, mitochondria and nuclei
- ☐ D mitochondria, nuclei and vacuoles

(b) Compare the structure of the rough endoplasmic reticulum with the structure of the smooth endoplasmic reticulum.

(2)

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**(Total for Question 1 = 7 marks)**



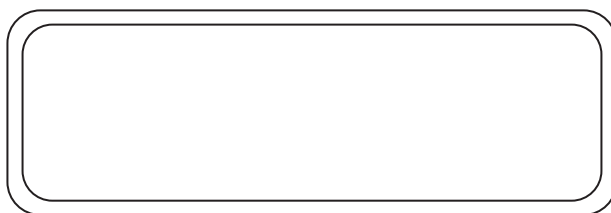
- 2 Organisms can be classified into one of three taxonomic groups called domains.

The Archaea and Bacteria are two of these domains. Organisms belonging to these two domains have prokaryotic cells.

- (a) The diagram below shows the outline of a typical rod-shaped bacterial cell.

Draw and label **three** features on this diagram that may be found in a prokaryotic cell, but **not** in a plant cell.

(3)



- (b) The photograph below shows *Sulfolobus acidicaldarius*, a species of Archaea that lives in hot springs.

*S. acidicaldarius* is irregularly shaped. Its optimal environmental conditions are temperatures of 75 °C to 80 °C and a pH of 2 to 3.



Magnification  $\times 85\,000$

- (i) Using *S. acidicaldarius* as an example, explain what is meant by the term **niche**.

(2)

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- (ii) Suggest how molecular phylogeny could be used to place *Sulfolobus* in the domain Archaea, rather than the domain Bacteria.

(2)

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(Total for Question 2 = 7 marks)



- 3 The photograph below shows a bee collecting nectar from flowers of the Manuka tree.

Bees produce honey from the nectar collected from these flowers. It has been claimed that Manuka honey has antimicrobial properties.



Magnification  $\times 1.7$

An investigation was carried out to test the antimicrobial properties of Manuka honey.

Manuka honey was diluted with sterile water to produce concentrations of 12.5%, 25.0% and 50.0%.

The diluted honey was placed in wells in an agar plate seeded with bacteria. The agar plates were then incubated and the diameters of the zones of inhibition were measured.

The table below shows the results of this investigation.

| Concentration of honey (%) | Diameter of zone of inhibition / mm |
|----------------------------|-------------------------------------|
| 0.0                        | 0                                   |
| 12.5                       | 13                                  |
| 25.0                       | 19                                  |
| 50.0                       | 24                                  |

- (a) (i) Calculate the percentage increase in the diameter of the zone of inhibition when the concentration of honey was increased from 25% to 50%. Show your working.

(2)

Answer .....%



(ii) State the reason for using a concentration of 0.0%.

(1)

(iii) Honey is also made by bees feeding on the nectar from Ulmo trees in Chile.

It has been claimed that Ulmo honey is more effective against bacteria than Manuka honey.

Describe how a valid investigation could be carried out to test this claim.

(5)

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- (b) When bees collect nectar from flowers, they also collect pollen. The honey produced by the bees contains pollen grains from these flowers.

DNA can be extracted from this pollen to determine the origin of the honey.

- (i) Name a structure in the pollen grain that contains DNA.

(1)

- (ii) Describe how pollen is involved in the fertilisation of a flower.

(4)

(Total for Question 3 = 13 marks)



- 4 Experiments have been carried out to investigate the properties of embryonic stem cells.

Human intestine tissue was produced by placing human embryonic stem cells into mice.

- (a) State **three** differences between a group of embryonic stem cells and the cells in a tissue.

(3)

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- \* (b) Some of the cells in the human intestine tissue, produced in the mice, secreted digestive enzymes.

Describe the roles of the rough endoplasmic reticulum and the Golgi apparatus in the modification and secretion of enzymes by these cells.

(5)



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(c) Discuss how regulatory authorities control the use of embryonic stem cells in research.

(3)

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**(Total for Question 4 = 11 marks)**



- 5 Rice plants produce seed heads containing grains that are harvested for food.

Rice plants need to be grown in flooded fields, as shown in the photograph below. These flooded fields may be deficient in some mineral ions.



- (a) An investigation was carried out to determine the effects of calcium ion and magnesium ion deficiency on rice plants in three fields.

The results are shown in the table below.

| Field               | Mean plant height / cm | Mean shoot dry mass / g | Mean number of seed heads per plant | Mean number of grains per seed head | Mean grain yield per plant / g |
|---------------------|------------------------|-------------------------|-------------------------------------|-------------------------------------|--------------------------------|
| Control             | 132.5                  | 30.4                    | 6.3                                 | 150.7                               | 16.1                           |
| Calcium deficient   | 119.1                  | 15.3                    | 4.2                                 | 122.7                               | 9.0                            |
| Magnesium deficient | 119.5                  | 16.7                    | 5.1                                 | 125.7                               | 10.4                           |

- (i) Using information from the table, compare the effects of calcium deficiency with the effects of magnesium deficiency on the production of grain.

(2)



(ii) Suggest why magnesium deficiency affects the growth of rice plants.

(2)

(iii) Suggest why calcium deficiency affects the height of rice plants.

(2)

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

(b) Rice plants are grown as a food crop because their grains contain starch.

Explain how the structure of starch is related to its function as a storage molecule in rice grains.

(4)

(Total for Question 5 = 10 marks)



6 Genetic diversity accounts for up to 80% of the variation in human height.

- (a) (i) Using height in humans as an example, explain what is meant by the term **genetic diversity**.

(2)

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- (ii) Genes have been identified that affect height. Some of these genes affect the growth of the bones in the arms and legs.

Place a cross ☐ in the box next to the correct words to complete the following statement.

During puberty, hormones are produced that may stimulate an increase in height by

(1)

- ☐ A activating these genes that are then transcribed to produce mRNA
- ☐ B activating these genes that are then translated to produce mRNA
- ☐ C switching off these genes and transcribing mRNA
- ☐ D switching off these genes and translating mRNA

- (iii) Explain why differential gene expression determines the structure and function of cells.

(2)

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(b) The growth of bones during childhood may also be affected by environmental factors such as the amount of protein in the diet.

- (i) Suggest **two** environmental factors, other than diet, that affect the height of humans.

(2)

1 .....

2 .....

- (ii) A study was conducted into the effect of consuming milk on growth in children.

The heights of 45 girls and 47 boys were measured when these children were 9 years old. When these children were 12 years old, their heights were measured again.

The children were asked how much milk they consumed each day.

The results of this study are shown in the table below.

| Milk consumed per day / cm <sup>3</sup> | Mean change in height / cm | Standard deviation of change in height |
|-----------------------------------------|----------------------------|----------------------------------------|
| < 500                                   | 18.8                       | 0.5                                    |
| > 500                                   | 21.3                       | 1.1                                    |

Using the data in the table, describe the relationship between milk consumption and height in children.

(3)

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(iii) Suggest why any conclusions from this study may not be valid.

(2)

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(Total for Question 6 = 12 marks)



- 7 The roots of young plants are constantly growing and are a good source of cells undergoing mitosis.

\*(a) Describe how tissue from a root can be prepared to observe cells undergoing mitosis.

(4)

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- (b) Plants take up mineral ions from the soil through their roots.

Place a cross ☐ in the box next to the correct words to complete the following statement.

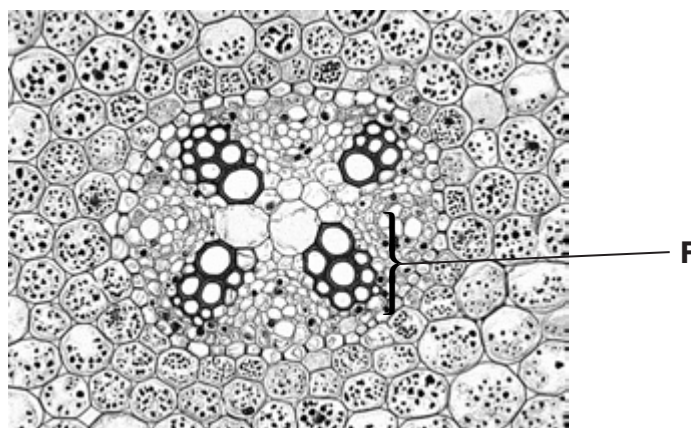
Nitrate ions are required because nitrogen is a component of

(1)

- ☐ **A** amino acids, DNA and starch
- ☐ **B** amino acids, ATP and DNA
- ☐ **C** ATP, DNA and glucose
- ☐ **D** ATP, protein and starch



- (c) The photograph below shows part of a cross section of a root of a buttercup, *Ranunculus*, as seen with a light microscope.



Magnification  $\times 30$

- (i) Use the photograph to explain how the tissue labelled **F** can be identified as xylem. (2)

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- (ii) Describe the functions of xylem in plants. (2)

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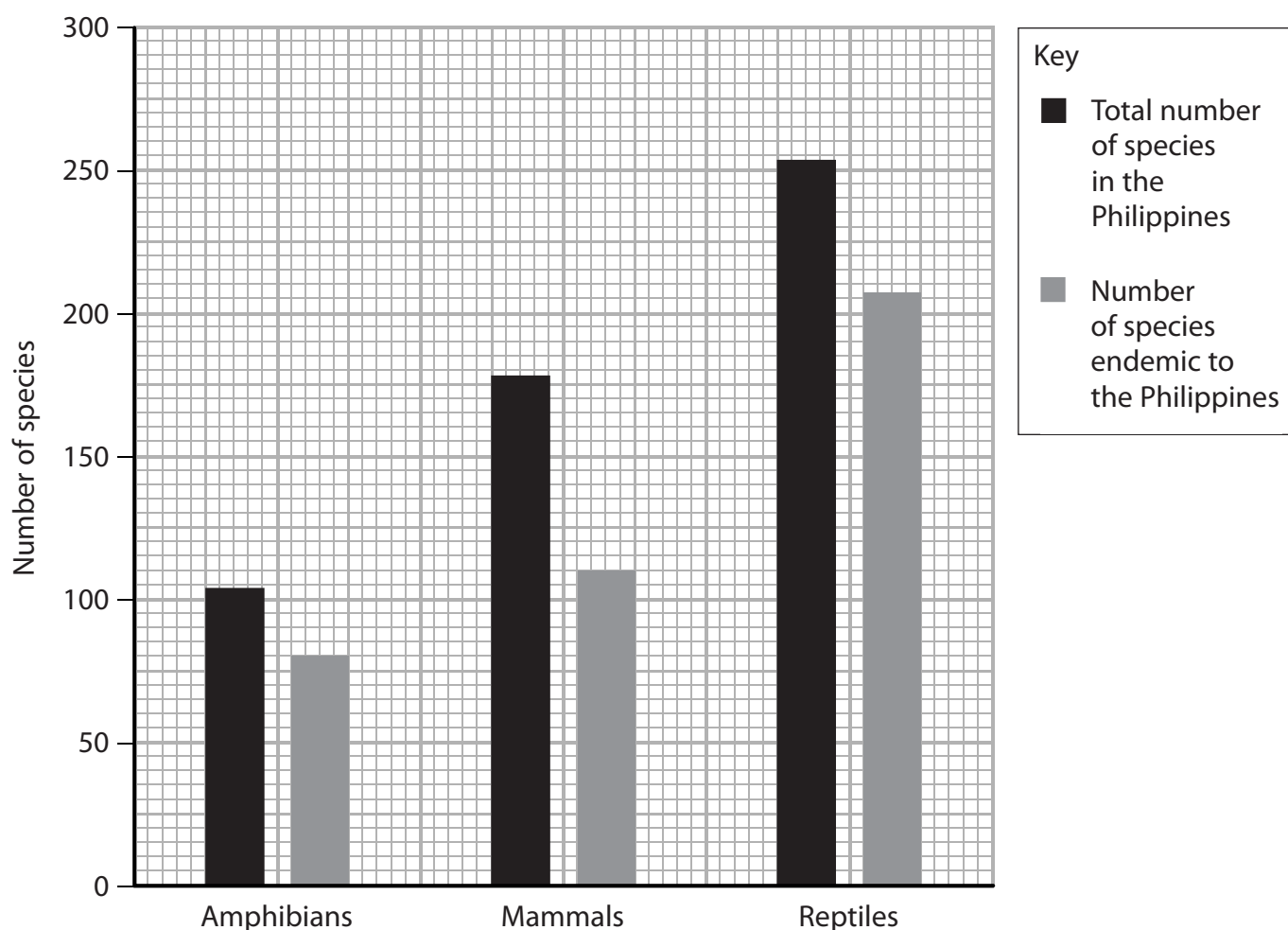
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(Total for Question 7 = 9 marks)



- 8 The Philippines is a country that is composed of many islands. There are many species found on these islands that are endemic to the Philippines.

(a) The graph below shows the number of species of amphibians, mammals and reptiles found in the Philippines.



Using the information in the graph, compare the biodiversity of endemic and non-endemic species in the Philippines.

(2)



- (b) There are 576 species of birds in the Philippines and 196 of these are endemic species.

Place a cross ☐ in the box next to the correct answer.

The percentage of bird species that are endemic to the Philippines is

(1)

- ☐ A 32%
- ☐ B 34%
- ☐ C 64%
- ☐ D 66%

- (c) The photograph below shows a tamaraw. This is a mammal endemic to the Philippines.



Magnification  $\times 0.04$

The tamaraw feeds on grasses and bamboo.

The tamaraw naturally feeds during the day, but some are beginning to feed at night.

- (i) Place a cross ☐ in the box next to the correct word to complete the following statement.

The type of adaptation the tamaraw is adopting to help it survive is

(1)

- ☐ A anatomical
- ☐ B behavioural
- ☐ C physiological
- ☐ D selective



(ii) Over time, tamaraw that feed at night may evolve better night vision.

Suggest how evolution may result in tamaraw with better night vision.

(4)

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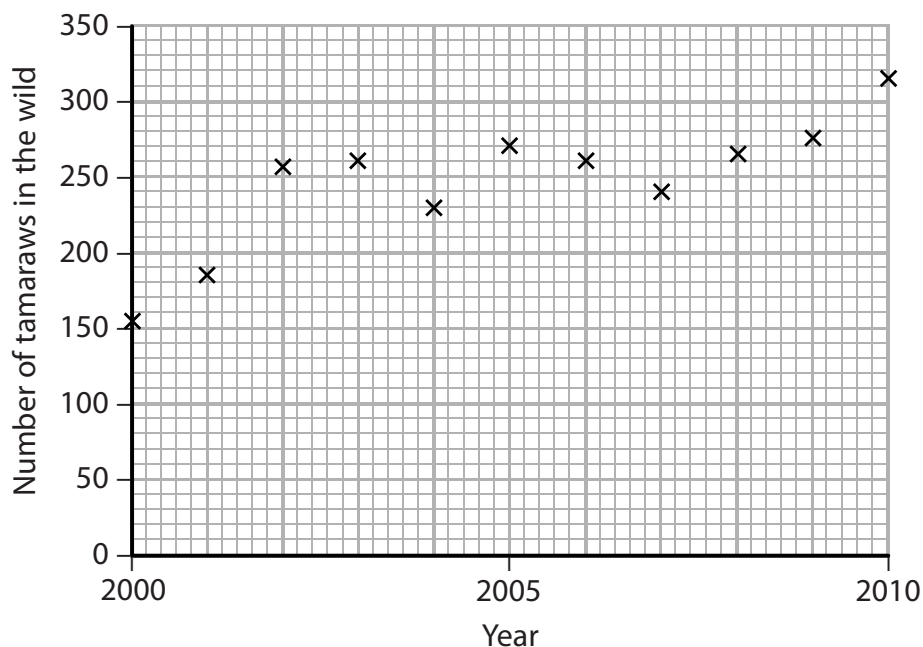
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- (iii) The tamaraw has become an endangered species due to loss of habitat and as a result of hunting.

Zoos in the Philippines have been involved in the conservation of the tamaraws.

The graph below shows the number of tamaraws found in the wild from 2000 to 2010.



Suggest explanations for the change in population of tamaraws in the wild.

(3)

(Total for Question 8 = 11 marks)

TOTAL FOR PAPER = 80 MARKS



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