



22146017

**BIOLOGY**
STANDARD LEVEL
PAPER 2

Candidate session number

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Friday 9 May 2014 (afternoon)

Examination code

1 hour 15 minutes

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INSTRUCTIONS TO CANDIDATES

- Write your session number in the boxes above.
- Do not open this examination paper until instructed to do so.
- Section A: answer all questions.
- Section B: answer one question.
- Write your answers in the boxes provided.
- A calculator is required for this paper.
- The maximum mark for this examination paper is [50 marks].



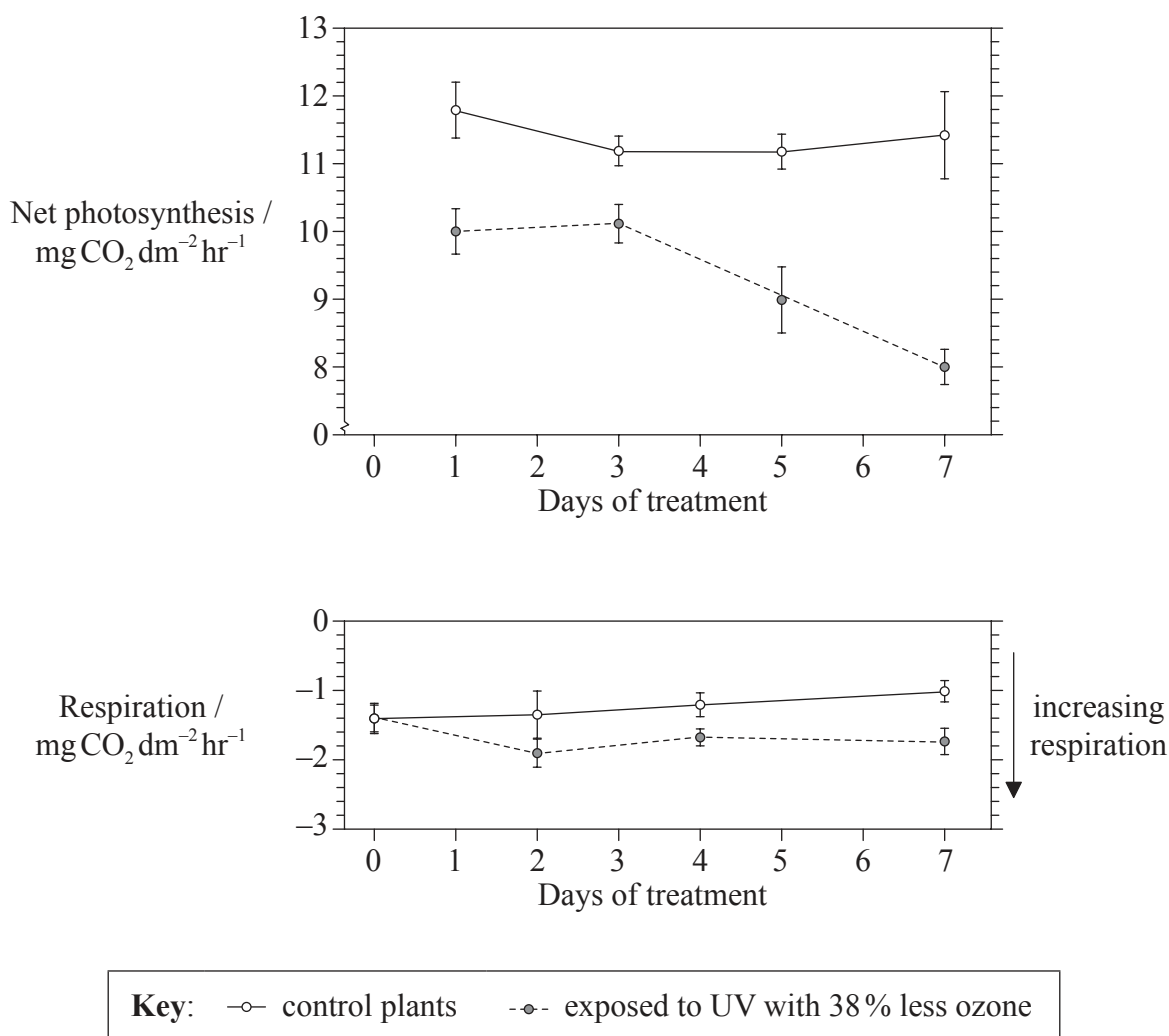
20EP01

SECTION A

Answer **all** questions. Write your answers in the boxes provided.

- Ozone gas in the atmosphere helps to block high-energy ultraviolet light (UV) from reaching the Earth's surface. Over the past few decades, the ozone layer has been decreasing, thus allowing through more UV.

The effect of this decrease in the ozone has been studied in different plants. An early study was undertaken on patience dock plants (*Rumex patientia*) to test the effect of atmospheric ozone levels decreasing by 38%. The net photosynthesis (total photosynthesis minus total respiration) and respiration of the plants were measured during seven days of exposure to UV. The rates of photosynthesis and respiration are given in rates of carbon dioxide uptake per unit area of leaf.



[Source: Adapted from W. Sisson and M. Caldwell (1976), 'Morphological responses of crop and weed species of different growth forms to Ultraviolet-B radiation', *Plant Physiology*, 58, pages 563-568. www.plantphysiol.org © American Society of Plant Biologists.]

(This question continues on the following page)



20EP02

(Question 1 continued)

- (a) Calculate the decrease in the net photosynthesis from day 1 to day 7 in the plants exposed to UV. Workings should be shown and units given. [1]

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- (b) Distinguish between the results for the plants exposed to UV and the controls without UV in

- (i) net photosynthesis. [2]

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- (ii) respiration. [2]

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(This question continues on the following page)



(Question 1 continued)

- (c) The rate of photosynthesis can be measured by the rate of carbon dioxide uptake. State **two** other ways that the rate of photosynthesis may be measured. [2]

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Some recent measurements indicate a 60% thinning of the ozone layer in some parts of the atmosphere.

- (d) Predict the possible effect on *R. patientia* plants. [2]

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(This question continues on page 6)



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Answers written on this page
will not be marked.

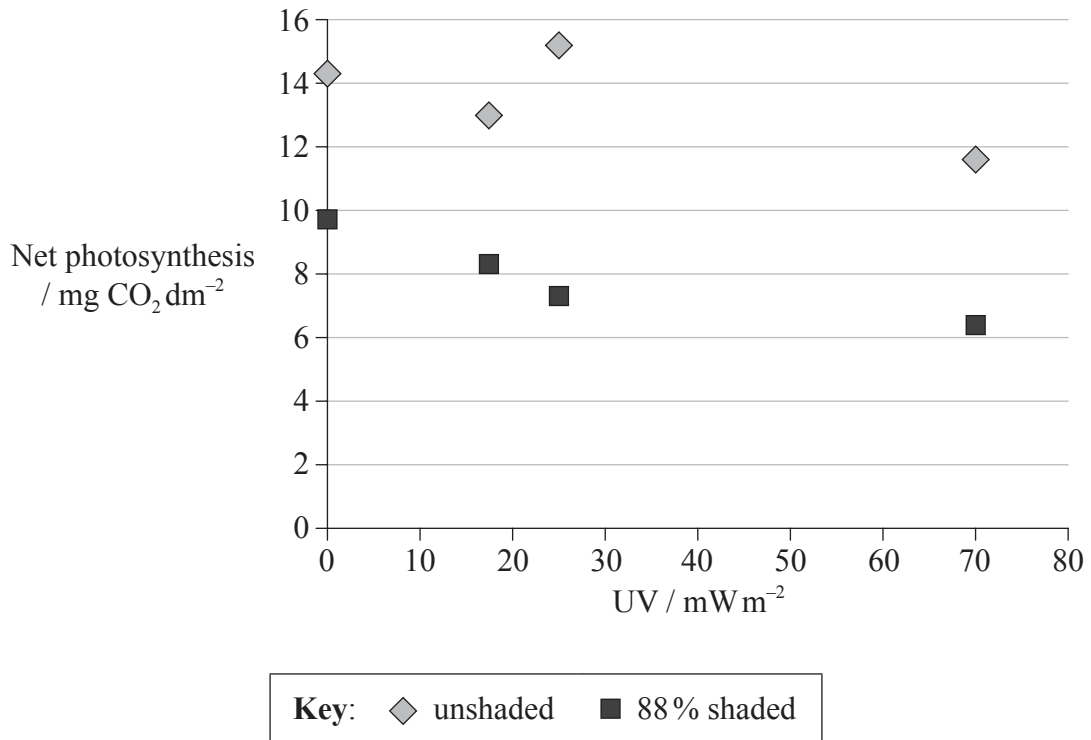


20EP05

Turn over

(Question 1 continued from page 4)

Another study was undertaken to investigate the cumulative effects of different levels of UV over a six week period on net photosynthesis in soybean (*Glycine max*). One set of plants was in full sunlight (unshaded) and the other set received only 12% of full sunlight (88% shaded). UV was given using lamps above all of the plants.



[Source: Adapted from A. Teramura *et al.* (1980), 'Effects of Ultraviolet-B Irradiances on Soybean', *Plant Physiology*, 65, pages 483–488. www.plantphysiol.org © American Society of Plant Biologists.]

(e) Compare the results of the unshaded and shaded plants. [2]

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20EP06

(Question 1 continued)

- (f) Predict with a reason, whether the effects of UV on plants will increase **or** decrease the greenhouse effect. [1]

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- (g) Discuss where in the world plants will be harmed most by the effects shown in the graph, given that ozone depletion is greatest near the north and south poles and light intensity is highest near the equator. [2]

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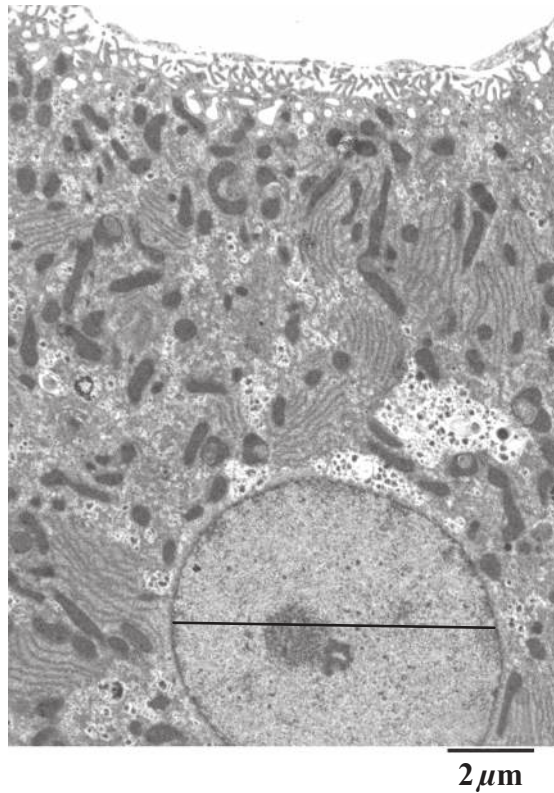
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2. The following shows an electron micrograph of a liver cell.



[Source: Adapted from J. L. Baratta et al. (2009), 'Cellular organization of normal mouse liver: a histological, quantitative immunocytochemical, and fine structural analysis', *Histochemistry and Cell Biology*, 131 (6), pages 713–726.]

(a) Calculate the

(i) magnification of the liver cell.

[1]

.....

(ii) actual diameter of the nucleus as marked on the electron micrograph.

[1]

..... μm

(This question continues on the following page)



20EP08

(Question 2 continued)

(b) The electron micrograph is a higher magnification of a liver cell.



[Source: www.histology.leeds.ac.uk/cell/assets/rough_ER2.gif. Used with the permission of the Faculty of Biological Sciences, University of Leeds.]

(i) State the name of the organelle labelled X. [1]

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(ii) State its main function. [1]

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20EP09

Turn over

(Question 2 continued)

(c) Outline the significance of the relationship between the surface area and volume of a cell. [2]

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(d) Liver cells store extra glucose as glycogen. Explain **two** steps that have to occur to release energy from glycogen during aerobic respiration. [2]

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3. (a)



[Source: <http://en.wikipedia.org/wiki/File:Sa-fern.jpg> (by Sanjay agh)]

State the phylum of the plant shown above.

[1]

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(b)



[Source: http://en.wikipedia.org/wiki/Sponge_reef#mediaviewer/File:Aphrocallistes_vastus.jpg]

State the phylum of the animal shown above.

[1]

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20EP11

Turn over

4. Hemophilia is a rare inherited human disease when the blood does not clot properly.

Two non-hemophiliac parents have a hemophiliac son.

(a) State the genotype of the parents. [2]

Father:
Mother:

(b) Using a Punnett grid, determine the possible genotypes of future children. [2]

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(c) Predict the genotypic and phenotypic ratios of the offspring in the following table, based on your calculations in the Punnett grid. Each genotype should be included. [2]

	Sons		Daughters	
Ratio of genotypes				
Phenotypes				



SECTION B

*Answer **one** question. Up to two additional marks are available for the construction of your answer. Write your answers in the boxes provided.*

5. (a) Draw a labelled diagram of the molecular structure of DNA, comprising of **four** nucleotides. [5]
- (b) Outline the therapeutic use of stem cells. [5]
- (c) Giving **one** specific example, discuss genetic modification in organisms including the potential benefits and possible harmful effects. [8]
6. (a) List **four** functions of membrane proteins. [4]
- (b) Explain the process of translation leading to polypeptide formation. [8]
- (c) Describe the production of antibodies. [6]
7. (a) State the source, substrate, products and optimum pH conditions for **one named** amylase. [4]
- (b) Outline the energy flow between trophic levels in a food chain. [6]
- (c) Explain the control of blood glucose concentrations in humans. [8]



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