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| <i>School</i> | <i>Candidate's Name (PLEASE PRINT)</i> |
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WINCHESTER  
COLLEGE

## **Election**

*Tuesday 26 April 2016*

**Science**

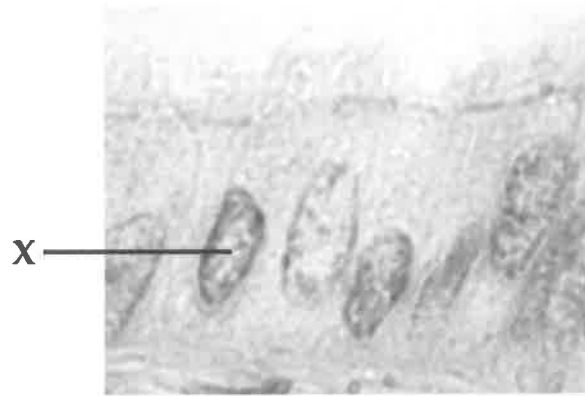
**BIOLOGY**

**THEORY SECTION**

*Recommended time: 20 minutes*

**Write all your answers in the spaces on this question paper**

1



**Figure 1** A light micrograph of ciliated epithelium (T.S. rabbit oviduct), magnification 1000x.<sup>1</sup>

- (a) **Figure 1** shows ciliated epithelium from a rabbit's oviduct seen using a light microscope. Name the structure labelled X and state its functions in these cells.

Structure X: .....

.....  
.....

[3]

- (b) Most multicellular organisms begin life as a single cell that multiplies as the organism develops. This progenitor cell, from which all the other cells of an organism originate, passes on the same set of genetic information to all of its descendants. Hypothesise how cells with the same genome can look very different and perform very different functions.

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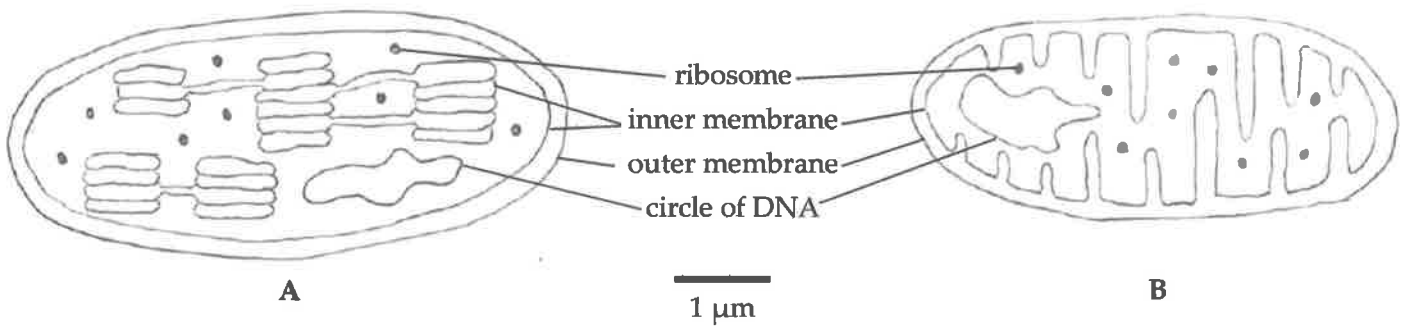
[2]

- 2 (a) Photosynthesis is a process that fixes inorganic carbon from the atmosphere into an organic molecule. Write a balanced symbol equation for photosynthesis.

..... [1]

- (b) Chlorophyll is important in the harvesting of photons at the beginning of photosynthesis. Name the metal ion in chlorophyll.

..... [1]



**Figure 2** Diagrams showing the structure of **A)** a chloroplast and **B)** a mitochondrion.<sup>2</sup>

- (c) **Figure 2 A)** shows a chloroplast found in a palisade mesophyll cell. Explain why the internal membranes of a chloroplast are stacked into many layers.

.....  
..... [2]

(d) The mitochondrion shown in **Figure 2 B)** is a similar size to the chloroplast in **Figure 2 A)**. State one similarity between these two organelles other than size.

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.....

[1]

(e) Explain the global importance of photosynthesis.

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[2]



**Figure 3** A plains zebra (*Equus quagga*).<sup>3</sup>

**Figure 3** shows the conspicuous pattern of stripes possessed by the plains zebra. A definitive explanation as to why zebras are striped has eluded scientists, resulting in several possible explanations.

- (a) Use your understanding of evolution to suggest how the zebra's distinctive pattern could have arisen by natural selection.

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.....

[3]

The lion (*Panthera leo*) is a known predator of both the plains zebra and blue wildebeest (*Connochaetes taurinus*). To understand the impact of lion predation on both species scientists in South Africa's Kruger National Park studied the encounters between lions and their prey. Their observations, made over a four year period, are shown in **Table 3**.

|            | <b>Number of encounters</b> | <b>Kill</b> | <b>Failure</b> | <b>No attempt</b> |
|------------|-----------------------------|-------------|----------------|-------------------|
| Wildebeest | 98                          | 14          | 46             | 38                |
| Zebra      | 140                         | 15          | 94             | 31                |

**Table 3** The vulnerability of wildebeest and zebra populations to lion predation.<sup>4</sup>

- (b) Use the data presented in **Table 3** to explain if there is a difference in the likelihood of a zebra or wildebeest being killed during a lion encounter.

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.....

[2]

4 (a) An egg and a sperm are examples of specialised animal cells. State one similarity and one difference between these two cell types.

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[2]

(b) Explain how an egg and a sperm are adapted for their respective functions.

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[2]

(c) Describe the process of fertilisation.

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.....

[2]

(d) State one way in which fertilisation in flowering plants is similar to fertilisation in animals.

.....  
.....

[1]

(e) State one way in which fertilisation in flowering plants differs from fertilisation in animals.

.....  
.....

[1]

## **Images**

1. Ciliated epithelium. Image taken by Dr A Savory, Winchester College.
2. Chloroplast and mitochondrion. Image drawn by Dr A Savory, Winchester College.
3. Plains zebra. Photo taken by Frederick Stourton (I, 2008-2013).
4. The vulnerability of wildebeest and zebra populations to lion predation. MGL Mills & TM Shenk (1992) *Journal of Animal Ecology*, 61(3); 693-702.

**End of this Section**