WESTMINSTER SCHOOL
THE CHALLENGE 2017

BIOLOGY

Thursday 27 April 2017

Time allowed: 30 minutes

Write your answers in the spaces provided.

Please write in black or blue ink.

For examiner use only

Total Mark	

Answer **all** the questions.

B1 Several students were revising for their Biology exam and discussing some of the topics they had studied. Unfortunately, several people made statements that required corrections or improvements. How would you improve, or correct each of the statements made by students below?

You may write a corrected sentence or add annotations to explain the mistakes, omissions, or misconceptions. There may be more than one error in each sentence.

i) Jack says that fertilisation in plants "happens when the pollen is transferred from the anther of one plant to the stigma of another."

ii) Senkai said that "urine is egested from the body."

iii) Gaspard commented that the "placenta played an important role in protecting the developing foetus from physical knocks and bumps."

iv) Henry said that he would "use soda lime to test for the carbon dioxide produced as a plant photosynthesised."

v) Daniel said that "magnesium ions are taken into the plant via the root hair cells and are used to make essential molecules such as chlorophyll and proteins for growth."

vi) Max thought that "the best way to decide whether an unknown cell could be classified as being part of the fungi kingdom was to check if it has a cell wall as all members of this kingdom have cell walls."

[Total B1: 7]

B2 Hector was an enthusiastic amateur Biologist and purchased a vial of equine blood cells to view under his newly aquired microscope. He noticed that the cells were suspended in a solution of 0.9% sodium chloride. Hector made up a slide and took a picture of the cells under the microscope. This can be seen in **Figure 2.1** below.

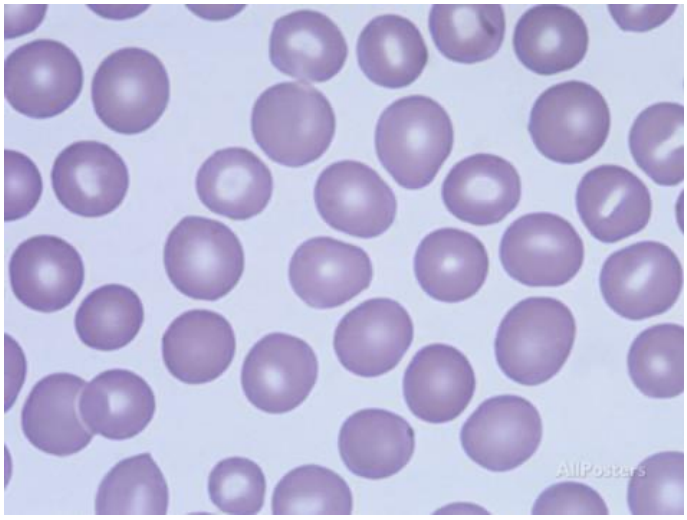


Figure 2.1

i) Using your knowledge and **Figure 2.1** describe the shape of the red blood cells and how they are adapted for their function.

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……[2]

Hector was interested to see what might happen to the cells if they were suspended in different solutions. So he took some cells and dropped some pure water on them and then looked at them under the microscope five minutes later, the result can be seen in **Figure 2.2**. He also dropped some more concentrated sodium chloride solution (4% sodium chloride) on the cells and observed the effect under the microscope after five minutes. His photograph can be seen in **Figure 2.3**. Hector observed that many of the cells in the distilled water looked to have burst.

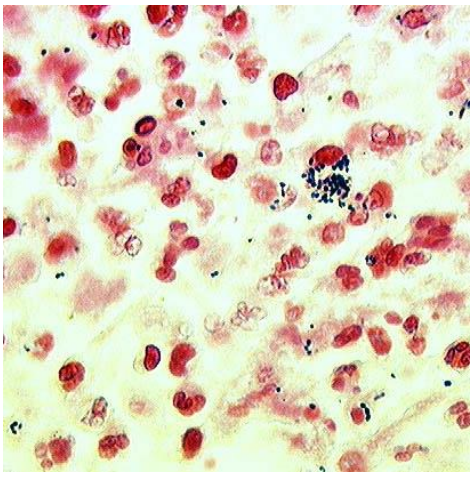


Figure 2.2

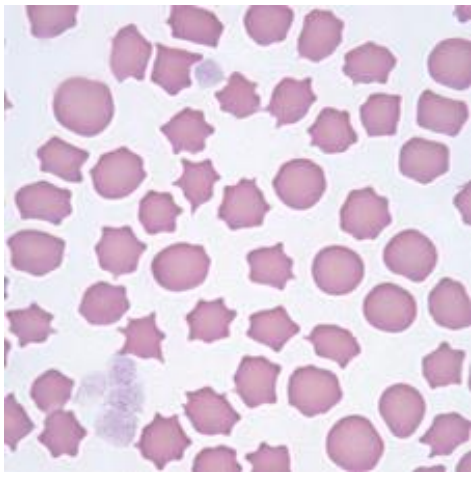


Figure 2.3

ii) Suggest why the cells in **Figure 2.2** and **Figure 2.3** look different from those in **Figure 2.1**.

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iii) Suggest why plant cells placed in distilled water, unlike the red blood cells, do not burst.

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Hector discussed his observations with his friend Akshey who commented that it reminded him of an experiment he had carried out in school last week. Akshey had taken five potato cylinders and measured their mass, he had then submerged them in solutions of differing sodium chloride concentrations for twenty minutes, and he then re-measured their masses. Akshey's data can be seen in **Table 2.1**.

Sodium chloride solution /%	Initial mass /g	Final mass / g	Change in mass /g	Percentage change in mass
20	2.3	2.4	+ 0.1	+ 4.3
15	2.5	2.0	- 0.5	
10	2.0	1.9	- 0.1	
5	2.4	2.5	+ 0.1	
0	2.5	3.0	+ 0.5	

Table 2.1

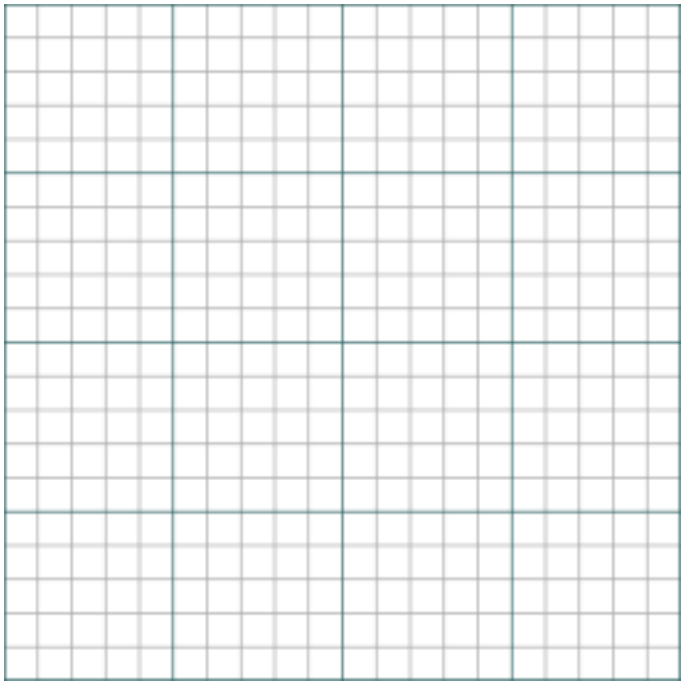
iv) Complete the Table 2.1 to show the percentage change in mass for each potato chip. [1]

v) Why was it necessary for Akshey to calculate the percentage change in mass as well as the actual change in mass.

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vi) Plot Akshey's data in the space below.



[4]

vii) Using **Table 2.1** describe the results that Akshey observed at sodium chloride concentrations of **below 15%**.

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viii) Akshey said that he thought the result at 20% sodium chloride was an anomaly (and incorrect result). What could Akshey do check whether this result is valid, or whether it is an anomaly?

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The blood forms an important part of the circulatory system. The heart and blood vessels are also other important parts of this organ system in humans.

ix) Explain why the heart is not an antagonistic muscle.

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x) State one structural difference between arteries and veins.

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[Total B2: 16]

B3 Charles Darwin visited the Galápagos Islands in 1835 on his expedition to collect samples and specimens on HMS Beagle, all of which helped him to develop his theory of natural selection.

Darwin made the following observations when he was on this expedition:

A: Offspring are more numerous than their parents

B: There is variation among a population of organisms

C: Offspring tend to resemble their parents

D: Populations tend to remain constant over time

i) He also made the following deductions from these observations. For each deduction state which observation supports it. You may use the observations multiple times. One has been completed for you.

Deductions	**Observations**
There is a struggle to survive	
Only the best adapted individuals survive	
Characteristics can be passed on to offspring. Over time, favourable characteristics accumulate and may give rise to a new species	**A; B; C; D;**

[2]

ii) Humans populations also exhibit variation and this can be categorised as either continuous or discontinuous variation. Using named examples explain what is meant by the terms 'continuous' and discontinuous' variation and suggest possible causes for the variation described.

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[Total B3: 6]

B4 Thomas was a keen gardener and wanted to investigate the best conditions to grow his sunflowers this year. He knew that it would be important to ensure the rate of photosynthesis remained high after the seeds had germinated.

i) Design an experiment to investigate the effect of changing the temperature on the growth of Thomas's sunflowers and predict the results Thomas might expect from his experiment.

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Prediction ……

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[Total B4: 4]

[Total marks Biology: 33]