AS BIOLOGY (7401/1)

Paper 1

Specimen 2014 Session Time allowed: 1 hour 30 minutes

Materials
For this paper you must have:
- a ruler with millimetre measurements
- a calculator.

Instructions
- Use black ink or black ball-point pen.
- Fill in the boxes at the bottom of this page.
- Answer all questions.

Information
- The marks for questions are shown in brackets.
- The maximum mark for this paper is 75.

Please write clearly, in block capitals, to allow character computer recognition.

Centre number  
Candidate number  
Surname  
Forename(s)  
Candidate signature
Describe how you could use cell fractionation to isolate chloroplasts from leaf tissue. 

Figure 1 shows a photograph of a chloroplast taken with an electron microscope.
Name the parts of the chloroplast labelled A and B. [2 marks]

Name of A: ________________________________
Name of B: ________________________________

Calculate the length of the chloroplast shown in Figure 1. [1 mark]

Answer = ________________

Name two structures in a eukaryotic cell that cannot be identified using an optical microscope. [1 mark]

1: ________________________________
2: ________________________________

Turn over for the next question
A technician investigated the effect of temperature on the rate of an enzyme-controlled reaction. At each temperature, he started the reaction using the same volume of substrate solution and the same volume of enzyme solution. 

**Figure 2** shows his results.

Give one other factor the technician would have controlled.

[1 mark]

Calculate the rate of reaction at 25°C.

[2 marks]

Answer = ________________
Describe and explain the differences between the two curves. [5 marks]

[Extra space]

Turn over for the next question
Describe and explain the appearance of one of the chromosomes in cell X. [3 marks]
Describe what has happened during division 1 in Figure 3. [2 marks]

Identify one event that occurred during division 2 but not during division 1. [1 mark]

Name two ways in which meiosis produces genetic variation. [2 marks]

1
2

Turn over for the next question
Figure 4 shows one base pair of a DNA molecule.

**Figure 4**

Name part F of each nucleotide.

[1 mark]

Scientists determined that a sample of DNA contained 18% adenine.

What were the percentages of thymine and guanine in this sample of DNA?

[2 marks]

Percentage of thymine

Percentage of guanine
During replication, the two strands of a DNA molecule separate and each acts as a template for the production of a new strand.

**Figure 5** represents DNA replication.

![Figure 5]

**04.3** Name the enzyme shown in **Figure 5**.

[1 mark]

The arrows in **Figure 5** show the directions in which each new DNA strand is being produced.

**04.4** Use **Figure 4**, **Figure 5** and your knowledge of enzyme action to explain why the arrows point in opposite directions.

[4 marks]
Table 1 shows the taxons and the names of the taxons used to classify one species of otter. They are not in the correct order.

<table>
<thead>
<tr>
<th>Taxon</th>
<th>Name of taxon</th>
</tr>
</thead>
<tbody>
<tr>
<td>J</td>
<td>Family</td>
</tr>
<tr>
<td>K</td>
<td>Kingdom</td>
</tr>
<tr>
<td>L</td>
<td>Genus</td>
</tr>
<tr>
<td>M</td>
<td>Class</td>
</tr>
<tr>
<td>N</td>
<td>Order</td>
</tr>
<tr>
<td>O</td>
<td>Phylum</td>
</tr>
<tr>
<td>P</td>
<td>Domain</td>
</tr>
<tr>
<td>Q</td>
<td>Species</td>
</tr>
</tbody>
</table>

Table 1

Put letters from Table 1 into the boxes in the correct order. Some boxes have been completed for you.

0 5 1

Give the scientific name of this otter.

0 5 2

Scientists investigated the effect of hunting on the genetic diversity of otters. Otters are animals that were killed in very large numbers for their fur in the past.

The scientists obtained DNA from otters alive today and otters that were alive before hunting started.

For each sample of DNA, they recorded the number of base pairs in alleles of the same gene. Mutations change the numbers of base pairs over time.

Figure 6 shows the scientists’ results.
The scientists obtained DNA from otters that were alive before hunting started.

Suggest one source of this DNA.

[1 mark]

What can you conclude about the effect of hunting on genetic diversity in otters? Use data from Figure 6 to support your answer.

[2 marks]

Question 5 continues on the next page
Some populations of animals that have never been hunted show very low levels of genetic diversity.

Other than hunting, suggest two reasons why populations might show very low levels of genetic diversity. [2 marks]

1. 

2. 

Figure 7 represents a capillary surrounded by tissue fluid. The values of the hydrostatic pressure are shown.

**Figure 7**

<table>
<thead>
<tr>
<th>Arteriole end</th>
<th>direction of blood flow</th>
<th>Venule end</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hydrostatic pressure = 4.3 kPa</td>
<td>Hydrostatic pressure = 1.6 kPa</td>
<td></td>
</tr>
</tbody>
</table>

Tissue fluid

Hydrostatic pressure = 1.1 kPa

Use the information in **Figure 7** to explain how tissue fluid is formed. [2 marks]

The hydrostatic pressure falls from the arteriole end of the capillary to the venule end of the capillary. Explain why. [1 mark]

**Question 6 continues on the next page**
High blood pressure leads to an accumulation of tissue fluid. Explain how.

The water potential of the blood plasma is more negative at the venule end of the capillary than at the arteriole end of the capillary. Explain why.
Describe how you would test a piece of food for the presence of lipid.

[2 marks]

Figure 8 shows a phospholipid.
The part of the phospholipid in Figure 8 labelled A is formed from a particular molecule. Name this molecule. [1 mark]

Name the type of bond between A and fatty acid X. [1 mark]

Which of the fatty acids, X or Y, in Figure 8 is unsaturated? Explain your answer. [1 mark]
Scientists investigated the percentages of different types of lipid in plasma membranes from different types of cell. **Table 2** shows some of their results.

**Table 2**

<table>
<thead>
<tr>
<th>Type of lipid</th>
<th>Percentage of lipid in plasma membrane by mass</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Cell lining ileum of mammal</td>
</tr>
<tr>
<td>Cholesterol</td>
<td>17</td>
</tr>
<tr>
<td>Glycolipid</td>
<td>7</td>
</tr>
<tr>
<td>Phospholipid</td>
<td>54</td>
</tr>
<tr>
<td>Others</td>
<td>22</td>
</tr>
</tbody>
</table>

The scientists expressed their results as **Percentage of lipid in plasma membrane by mass**. Explain how they would find these values.

[2 marks]

Cholesterol increases the stability of plasma membranes. Cholesterol does this by making membranes less flexible.

Suggest one advantage of the different percentage of cholesterol in red blood cells compared with cells lining the ileum.

[1 mark]
**E. coli** has no cholesterol in its cell-surface membrane. Despite this, the cell maintains a constant shape. Explain why.

[2 marks]

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Turn over for the next question
A group of students carried out an investigation to find the water potential of potato tissue.

The students were each given a potato and 50 cm$^3$ of a 1.0 mol dm$^{-3}$ solution of sucrose.

- They used the 1.0 mol dm$^{-3}$ solution of sucrose to make a series of different concentrations.
- They cut and weighed discs of potato tissue and left them in the sucrose solutions for a set time.
- They then removed the discs of potato tissue and reweighed them.

Table 3 shows how one student presented his processed results.

<table>
<thead>
<tr>
<th>Concentration of sucrose solution / mol dm$^{-3}$</th>
<th>Percentage change in mass of potato tissue</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.15</td>
<td>+4.7</td>
</tr>
<tr>
<td>0.20</td>
<td>+4.1</td>
</tr>
<tr>
<td>0.25</td>
<td>+3.0</td>
</tr>
<tr>
<td>0.30</td>
<td>+1.9</td>
</tr>
<tr>
<td>0.35</td>
<td>– 0.9</td>
</tr>
<tr>
<td>0.40</td>
<td>– 3.8</td>
</tr>
</tbody>
</table>

Explain why the data in Table 3 are described as processed results. [1 mark]
Describe how you would use a 1.0 mol dm\(^{-3}\) solution of sucrose to produce 30 cm\(^3\) of a 0.15 mol dm\(^{-3}\) solution of sucrose.

[2 marks]

Explain the change in mass of potato tissue in the 0.40 mol dm\(^{-3}\) solution of sucrose.

[2 marks]

Describe how you would use the student’s results in Table 3 to find the water potential of the potato tissue.

[3 marks]
Herpes simplex virus (HSV) infects nerve cells in the face, including some near the lips. Like many other viruses, HSV can remain inactive inside the body for years. When HSV becomes active, it causes cold sores around the mouth.

Human cells infected with a virus may undergo programmed cell death. While HSV is inactive inside the body, only one of its genes is transcribed. This gene is the latency-associated transcript (LAT) gene that prevents programmed cell death of an infected nerve cell.

Scientists have found that transcription of the LAT gene produces a microRNA. This microRNA binds to some of the nerve cell’s own mRNA molecules. These mRNA molecules are involved in programmed cell death of nerve cells. The scientists concluded that production of this microRNA allows HSV to remain in the body for years.

Use information from the passage and your own knowledge to answer the following questions.

HSV infects nerve cells in the face (line 1). Explain why it infects only nerve cells. [3 marks]
HSV can remain inactive inside the body for years (lines 2–3). Explain why this virus can be described as **inactive**. [2 marks]

The scientists concluded that production of this microRNA allows HSV to remain in the body for years (lines 10–12). Explain how this microRNA allows HSV to remain in the body for years. [4 marks]

Suggest one advantage of programmed cell death (line 4). [1 mark]

[Extra space]
There are no questions printed on this page