SPECIMEN MATERIAL

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 _____

Answer **all** questions in the spaces provided.

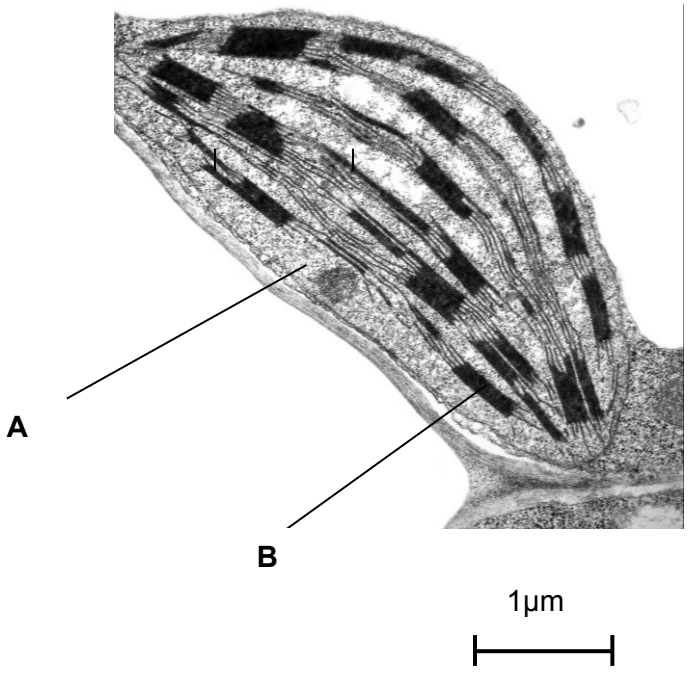
0 1 . 1 Describe how you could use cell fractionation to isolate chloroplasts from leaf tissue.

[3 marks]

[Extra space]

Figure 1 shows a photograph of a chloroplast taken with an electron microscope.

Figure 1



0 1 . 2 Name the parts of the chloroplast labelled **A** and **B**.

[2 marks]

Name of **A** _____

Name of **B** _____

0 1 . 3 Calculate the length of the chloroplast shown in **Figure 1**.

[1 mark]

Answer = _____

0 1 . 4 Name **two** structures in a eukaryotic cell that **cannot** be identified using an optical microscope.

[1 mark]

1 _____

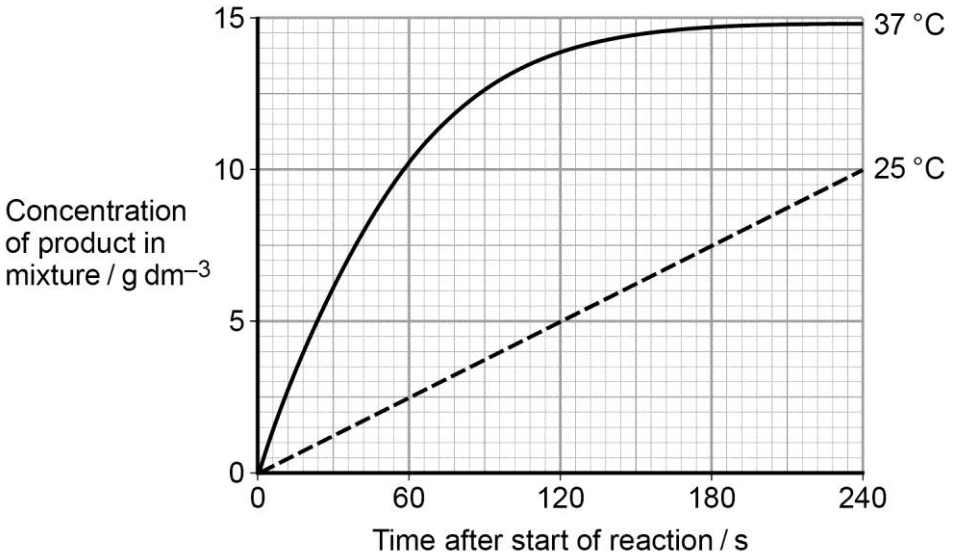
2 _____

Turn over for the next question

2 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.

Figure 2



0 2 . 1 Give **one** other factor the technician would have controlled.

[1 mark]

0 2 . 2 Calculate the rate of reaction at 25 °C.

[2 marks]

Answer = _____

0 2 . 3 Describe and explain the differences between the two curves.

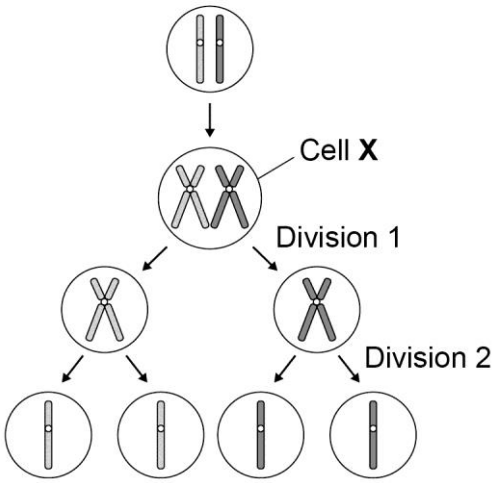
[5 marks]

[Extra space]

Turn over for the next question

3 **Figure 3** summarises the process of meiosis. The circles represent cells and the structures within each cell represent chromosomes.

Figure 3



0 3 . 1 Describe and explain the appearance of **one** of the chromosomes in cell **X**.

[3 marks]

[Extra space]

0 3 . 2 Describe what has happened during division 1 in **Figure 3**.

[2 marks]

0 3 . 3 Identify **one** event that occurred during division 2 but **not** during division 1**.**

[1 mark]

0 3 . 4 Name **two** ways in which meiosis produces genetic variation.

[2 marks]

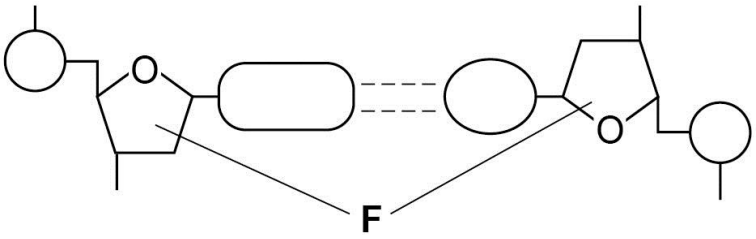
1 _____

2 _____

Turn over for the next question

4 **Figure 4** shows one base pair of a DNA molecule.

Figure 4



0 4 . 1 Name part **F** of each nucleotide.

[1 mark]

0 4 . 2 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]

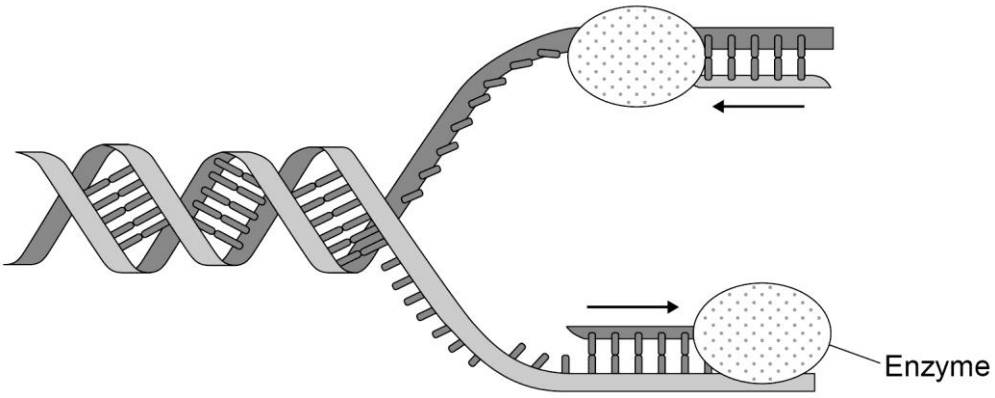
Percentage of thymine

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



0 4 . 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.

0 4 . 4 Use **Figure 4**, **Figure 5** and your knowledge of enzyme action to explain why the arrows point in opposite directions.

[4 marks]

5 **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 1

	Taxon	Name of taxon
J	Family	Mustelidae
K	Kingdom	Animalia
L	Genus	Lutra
M	Class	Mammalia
N	Order	Carnivora
O	Phylum	Chordata
P	Domain	Eukarya
Q	Species	lutra

0 5 . 1 Put letters from **Table 1** into the boxes in the correct order. Some boxes have been completed for you.

[1 mark]

		O	**M**			**L**	**Q**

0 5 . 2 Give the scientific name of this otter.

[1 mark]

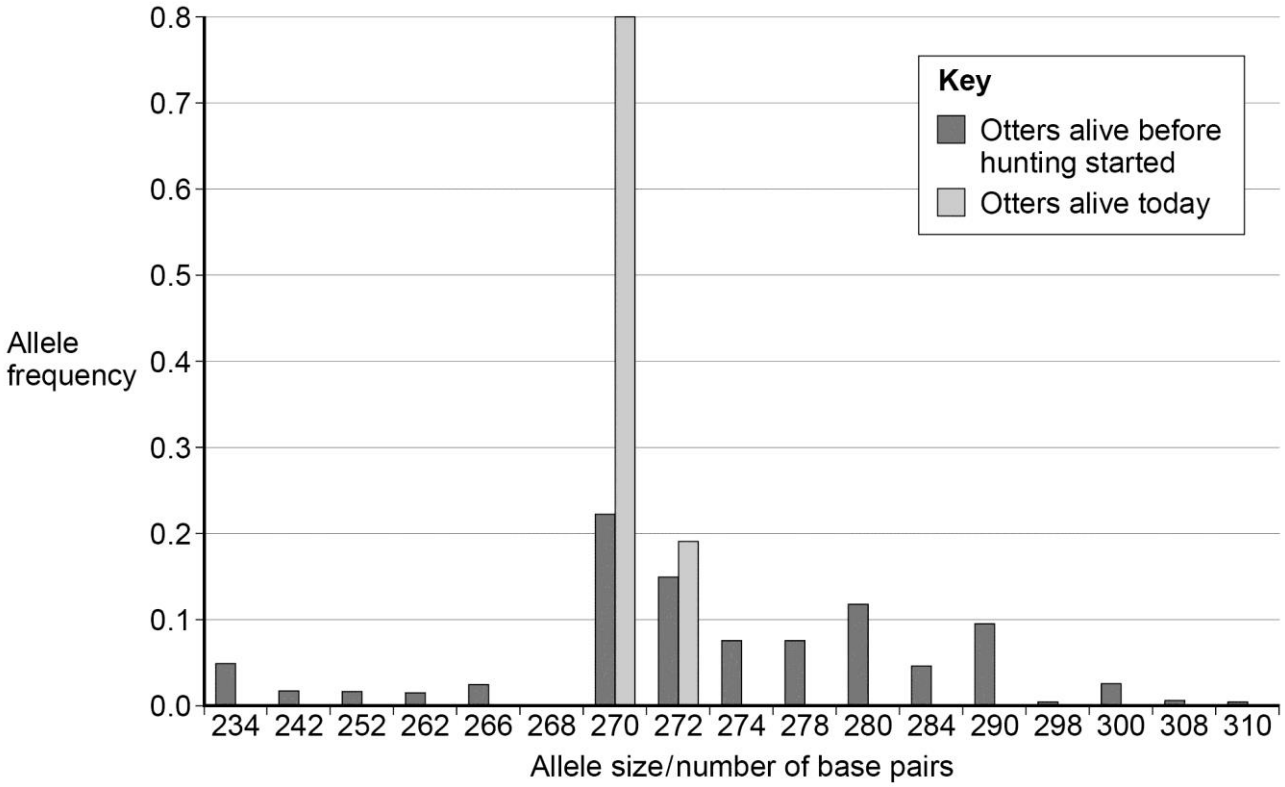
Scientists investigated the effect of hunting on the genetic diversity of otters. Otters are animals that were killed in very large numbers for their fur in the past.

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.

Figure 6



0 5 . 3 The scientists obtained DNA from otters that were alive before hunting started.

Suggest **one** source of this DNA.

[1 mark]

0 5 . 4 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

0 5 . 5 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 _____

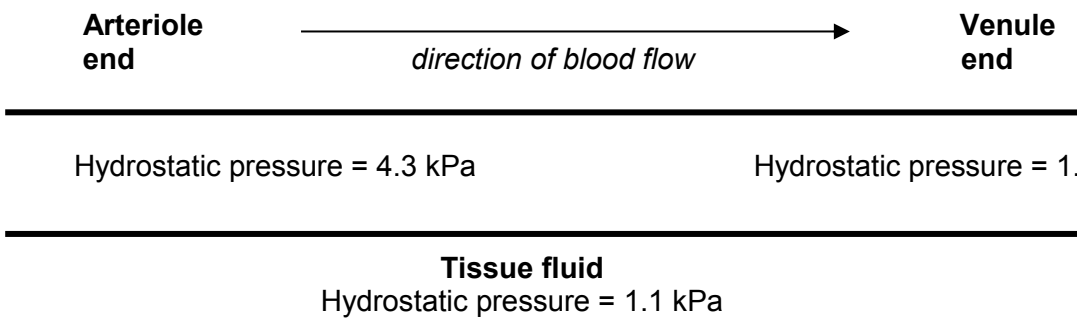
_____

2 _____

_____

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

Figure 7



0 6 . 1 Use the information in **Figure 7** to explain how tissue fluid is formed.

[2 marks]

0 6 . 2 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

0 6 . 3 High blood pressure leads to an accumulation of tissue fluid. Explain how.

[3 marks]

[Extra space]

0 6 . 4 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.

[3 marks]

[Extra space]

Turn over for the next question

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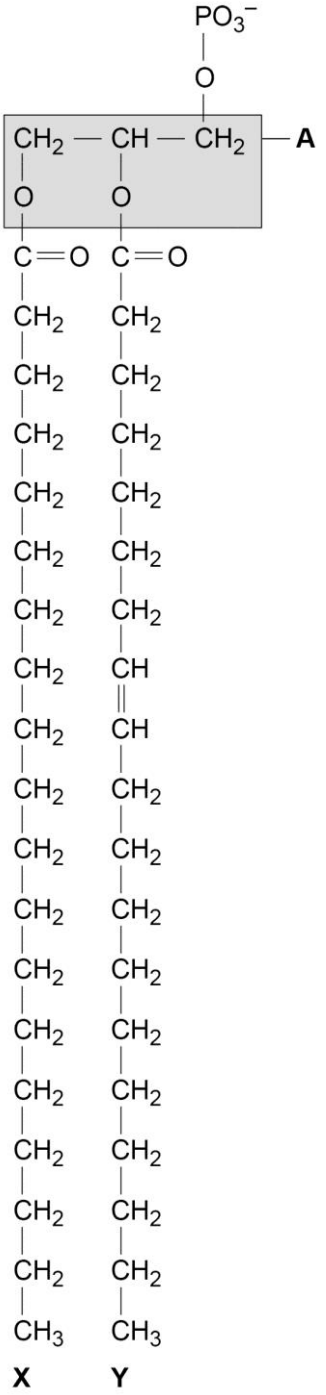
0 7 . 1 Describe how you would test a piece of food for the presence of lipid.

[2 marks]

Figure 8 shows a phospholipid.

Figure 8



0 7 . 2 The part of the phospholipid in **Figure 8** labelled **A** is formed from a particular molecule. Name this molecule.

[1 mark]

_____

0 7 . 3 Name the type of bond between **A** and fatty acid **X**.

[1 mark]

_____

0 7 . 4 Which of the fatty acids, **X** or **Y**, in **Figure 8** is unsaturated? Explain your answer.

[1 mark]

_____

_____

_____

_____

Question 7 continues on the next page

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

Type of lipid	**Percentage of lipid in plasma membrane by mass**		
	Cell lining ileum of mammal	**Red blood cell of mammal**	**The bacterium *Escherichia coli***
Cholesterol	17	23	0
Glycolipid	7	3	0
Phospholipid	54	60	70
Others	22	14	30

0 7 . 5 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.

0 7 . 6 Suggest **one** advantage of the different percentage of cholesterol in red blood cells compared with cells lining the ileum.

[1 mark]

0 7 . 7 *E. coli* has no cholesterol in its cell-surface membrane. Despite this, the cell maintains a constant shape. Explain why.

[2 marks]

Turn over for the next question

8 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 3

Concentration of sucrose solution / mol dm^{-3}	**Percentage change in mass of potato tissue**
0.15	+4.7
0.20	+4.1
0.25	+3.0
0.30	+1.9
0.35	– 0.9
0.40	– 3.8

0 8 . 1 Explain why the data in **Table 3** are described as **processed** results.

[1 mark]

0 8 . 2 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]

0 8 . 3 Explain the change in mass of potato tissue in the 0.40 mol dm^{-3} solution of sucrose.

[2 marks]

0 8 . 4 Describe how you would use the student's results in **Table 3** to find the water potential of the potato tissue.

[3 marks]

[Extra space]

9 Read the following passage.

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.

0 9 . 1 HSV infects nerve cells in the face (line 1). Explain why it infects **only** nerve cells.

[3 marks]

[Extra space]

0 9 . 2 HSV can remain inactive inside the body for years (lines 2–3). Explain why this virus can be described as **inactive**.

[2 marks]

0 9 . 3 Suggest **one** advantage of programmed cell death (line 4).

[1 mark]

0 9 . 4 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]

[Extra space]

END OF QUESTIONS

There are no questions printed on this page

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