Write your name here

Surname	Other names

Pearson Edexcel
International Advanced Level

Centre Number | | | | | |

Candidate Number | | | | |

Biology

International Advanced Subsidiary/Advanced Level
Unit 2: Cells, Development, Biodiversity and Conservation

Sample Assessment Materials for first teaching September 2018

Time: 1 hour 30 minutes

Paper Reference **WBI12/01**

You must have:
Scientific calculator, ruler, HB pencil

Total Marks

Instructions

- Use **black** ink or **black** ball-point pen.
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- Answer **all** questions.
- Answer the questions in the spaces provided
  – *there may be more space than you need.*
- **Show all your working in calculations and include units where appropriate**.

Information

- The total mark for this paper is 80.
- The marks for **each** question are shown in brackets
  – *use this as a guide as to how much time to spend on each question.*
- In questions marked with an **asterisk** (*), marks will be awarded for your ability to structure your answer logically, showing how the points that you make are related or follow on from each other where appropriate.

Advice

- Read each question carefully before you start to answer it.
- Try to answer every question.
- Check your answers if you have time at the end.

Turn over ▶

S58688A

1/1/1/1/

S 5 8 6 8 8 A 0 1 2 8

Pearson

Answer ALL questions.

Write your answers in the spaces provided.

Some questions must be answered with a cross in a box ☒. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.

1 The phenotype of an organism is affected by a number of factors.

(a) State what is meant by the term **phenotype**.

(1)

.....

.....

.....

(b) Coat colour in rabbits is determined by multiple alleles.

The table gives some information about coat colour in rabbits.

Type of rabbit	Coat colour of rabbit	.....
Black 	black all over	CC
Chinchilla 	grey all over	$c^{ch}c^{ch}$
Himalayan 	white body black ears, face, feet and tail	$c^{h}c^{h}$
Albino 	white all over	cc

(i) Complete this table by writing a suitable heading for the right-hand column.

(1)

(ii) Which row of the table gives the correct number of genes and alleles for coat colour in these rabbits?

(1)

	Number of genes for coat colour	Number of alleles for coat colour
☒ **A**	1	1
☒ **B**	1	4
☒ **C**	4	1
☒ **D**	4	4

(c) Height is one phenotype of an elephant.

The photograph shows an African elephant.

Source: Caroline Wilcox

Male African elephants range in height from 3.2 m to 4.0 m.

Female African elephants range in height from 2.2 m to 2.6 m.

(i) Which row of the table names the types of graph that should be drawn to show sex and height variation in a population of African elephants?

(1)

	Sex	Height
☒ **A**	bar chart	bar chart
☒ **B**	bar chart	histogram
☒ **C**	histogram	bar chart
☒ **D**	histogram	histogram

(ii) Calculate how many times bigger the male African elephant is than the female African elephant.

(2)

Answer .....

(Total for Question 1 = 6 marks)

2 There are 18 species of puffer fish found in the Maldives.

The photograph shows one of these species, *Canthigaster valenti*.

Magnification ×0.5

(a) The markings on the skin of *Canthigaster valenti* are warnings to predators. It also protects itself from predators by producing poisons and by inflating its body.

Which row of the table describes these types of adaptations?

(1)

	Markings on the skin	Production of poison	Inflating the body
☒ **A**	anatomical	behavioural	physiological
☒ **B**	anatomical	physiological	behavioural
☒ **C**	physiological	anatomical	behavioural
☒ **D**	physiological	behavioural	anatomical

(b) Another fish found in the Maldives is *Paraluteres prionurus*.

This fish is not poisonous. It grows to about 10 cm in length.

The photograph shows *Paraluteres prionurus*.

Source: http://www.underwaterkwaj.com/uw-misc/file/Paraluteres-prionurus.htm

Explain how the appearance of *Paraluteres prionurus* shows it is adapted to its habitat.

(3)

(c) Explain why *Canthigaster valenti* and *Paraluteres prionurus* are unable to reproduce with each other.

(2)

.....

.....

.....

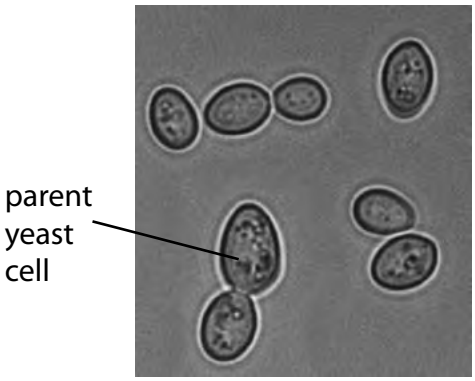
.....

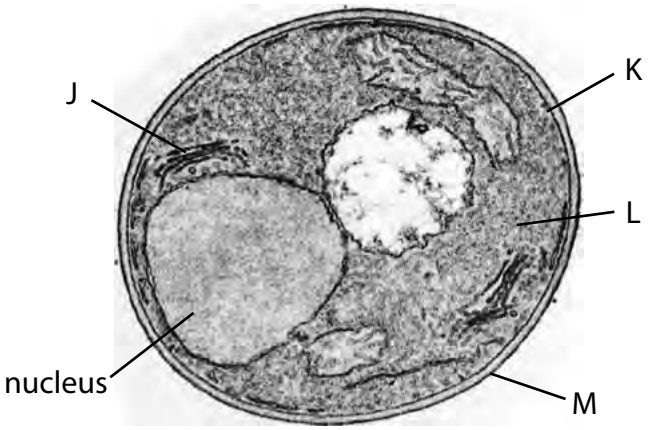
.....

.....

(Total for Question 2 = 6 marks)

3 The photographs show yeast cells, seen using a light microscope and an electron microscope.





Yeast cells seen using a light microscope Yeast cell seen using an electron microscope

Used under CC License from: https://commons.wikimedia.org/wiki/File:Zygosaccharomyces_bailii_cells.jpg

(a) Which structure identifies yeast as a eukaryotic organism?

(1)

☒ **A** J

☒ **B** K

☒ **C** L

☒ **D** M

(b) Explain why structure J can be seen using the electron microscope but not the light microscope.

(2)

.....

.....

.....

.....

.....

.....

(c) Explain why the nuclear envelope cannot be seen as two membranes using this electron microscope.

(2)

(d) Yeast cells reproduce asexually by a process called budding.

The parent yeast cell produces a bud.

(i) Explain the importance of mitosis in budding.

(3)

(ii) Once the bud is large enough, it separates from the parent yeast cell.

The rate at which budding happens depends on the availability of oxygen and nutrients.

Suggest why the availability of oxygen and nutrients determines the rate of budding.

(3)

(Total for Question 3 = 11 marks)

4 The photograph shows a Baird's tapir.

Source: https://www.biolib.cz/IMG/GAL/171566.jpg

(a) Baird's tapir is endemic to countries in Central America.

State what is meant by the term **endemic**.

(1)

.....

.....

.....

(b) Baird's tapir is classified as endangered.

In 2006, it was estimated that there were 5500 Baird's tapirs. This number had fallen to 3000 in 2016.

(i) Calculate the percentage decrease in the number of Baird's tapirs from 2006 to 2016.

(2)

Answer ..... %

(ii) Explain how human activity, other than hunting, could have caused this decrease in the number of Baird's tapirs.

(3)

(c) Preservation of sperm collected from Baird's tapir may help captive breeding programmes.

Scientists investigated the effect of freezing on sperm from Baird's tapir.

The sperm were frozen and then thawed.

The results of this investigation are shown in the table.

Sperm	Percentage of sperm capable of moving (%)	Ability of sperm to swim in a straight line / a.u.	Percentage of sperm with an undamaged acrosome (%)
Freshly collected	63	3.5	80
Frozen and then thawed	38	2.5	48

(i) Describe how each of these effects of freezing could be determined.

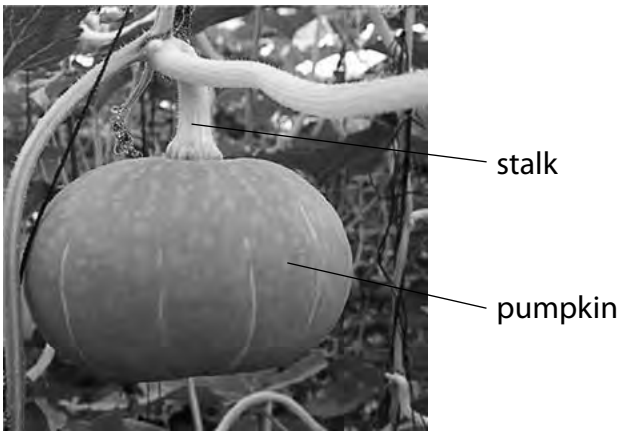
(3)

(ii) Explain how freezing sperm could affect the success of captive breeding programmes.

(4)

(Total for Question 4 = 13 marks)

5 The photograph shows a pumpkin.



Source from: https://www.aliexpress.com/price/winter-outdoor-plants_price.html

The scientists Crafts and Lorenz investigated the rate of translocation through the phloem in pumpkins.

The flow chart shows the method used in this investigation.

Step 1

The mean increase in dry mass of a pumpkin after 792 hours of growth was estimated

↓

Step 2

The cross-sectional area of the phloem tissue in the stalk was determined

↓

Step 3

The cross-sectional area of the sieve tubes in the stalk was estimated

↓

Step 4

The rate of translocation was calculated

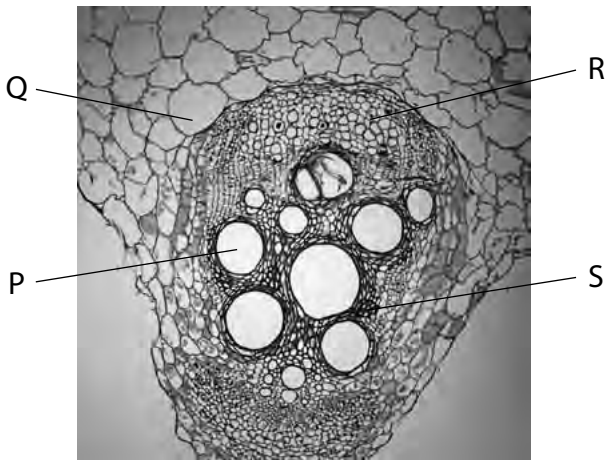
(a) (i) Suggest how the mean increase in dry mass of a pumpkin could be estimated in **Step 1**.

(3)

(ii) Explain why Crafts and Lorenz used dry mass in this investigation.

(2)

(b) (i) The photograph shows a cross-section through part of a stalk, as seen using a light microscope.



Which letter is pointing to the phloem?

(1)

- ☒ **A** P
- ☒ **B** Q
- ☒ **C** R
- ☒ **D** S

(ii) Describe a method that could be used to determine the cross-sectional area of the phloem in **Step 2**.

(2)

(c) Give a reason why only the cross-sectional area of the sieve tubes, rather than the phloem tissue, was estimated in **Step 3**.

(1)

.....

.....

.....

.....

(d) What are the units for the rate of translocation calculated in **Step 4**?

(1)

☒ **A** $g\,cm^{-2}\,hr^{-1}$

☒ **B** $g\,cm^{2}\,hr^{-1}$

☒ **C** $g\,cm^{-3}\,hr^{-1}$

☒ **D** $g\,cm^{3}\,hr^{-1}$

(Total for Question 5 = 10 marks)

6 Organisms can be classified into one of three domains.

(a) Organisms belonging to two of these domains have prokaryotic cells.

(i) Bacteria are one of these domains.

Name the other domain that has prokaryotic cells.

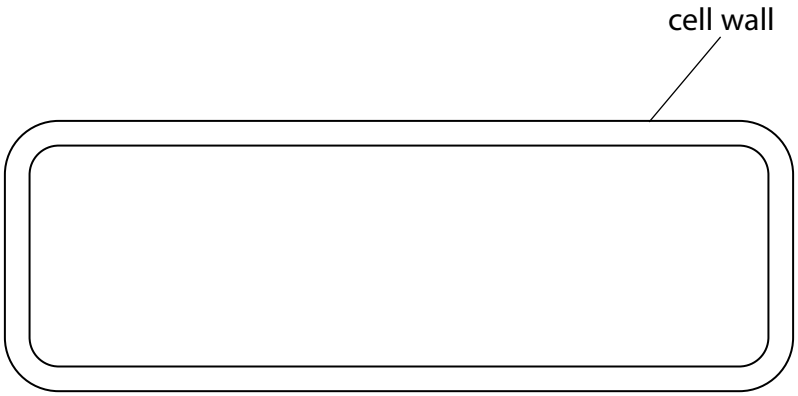
(1)

.....

(ii) The diagram shows the outline of a bacterial cell.

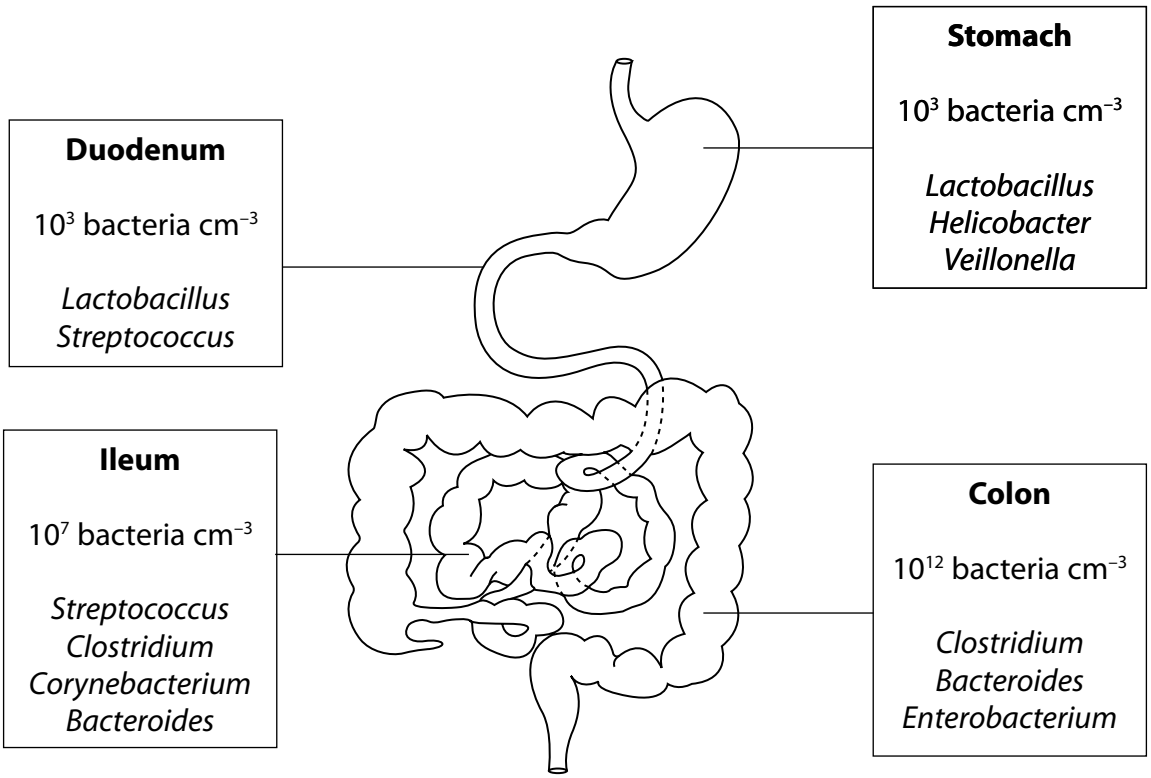
Draw **three** labelled features on this diagram that may be found in a prokaryotic cell.

(3)



*(b) A variety of different types of bacteria is found in the human digestive system.

The diagram shows part of the human digestive system and the number and types of bacteria that can be found in each organ.



The table gives some information about conditions in the digestive system.

Organ	pH	Oxygen content
Stomach	1 to 3	High ↓ Low
Duodenum	6 to 7	
Ileum	6 to 8	
Colon	5 to 7	

Explain the distribution of bacteria in the digestive system. Use the information in the diagram and table to support your answer.

(6)

(Total for Question 6 = 10 marks)

7 Red blood cells are produced from pluripotent stem cells found in bone marrow.

(a) Which statement about these stem cells is correct?

(1)

☒ **A** they can produce all types of cell

☒ **B** they can produce all types of cell except extraembryonic cells

☒ **C** they can produce some types of cell

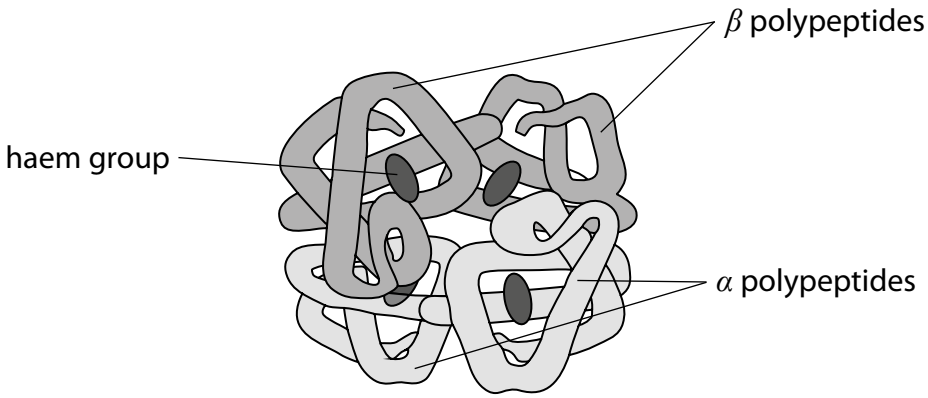
☒ **D** they can produce red blood cells only

(b) Red blood cells contain haemoglobin.

A molecule of haemoglobin is made of four polypeptides. Each polypeptide has a haem group attached to it. The haem group is **not** made of amino acids.

In most adult haemoglobin, there are two α polypeptides and two β polypeptides.

The diagram shows the structure of adult haemoglobin.

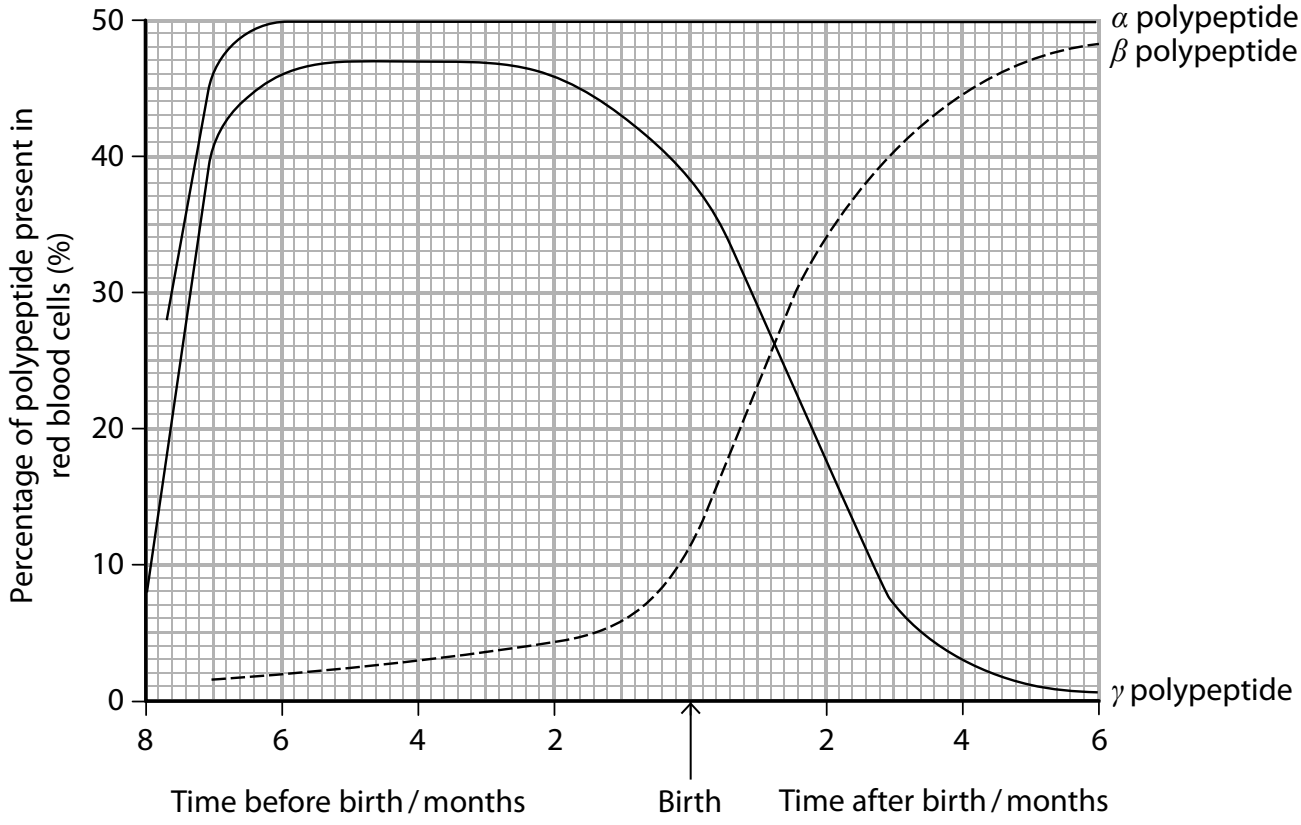


Describe the role of the rough endoplasmic reticulum in the synthesis of haemoglobin.

(3)

(c) Fetal haemoglobin has a similar structure to adult haemoglobin. Fetal haemoglobin has two α polypeptides and two γ polypeptides.

The graph shows the percentage of each polypeptide present in red blood cells in an individual before and after birth.



(i) Describe the changes in the percentages of polypeptides present in red blood cells. Use the information in the graph to support your answer.

(3)

(ii) Explain how epigenetic modification could result in these changes.

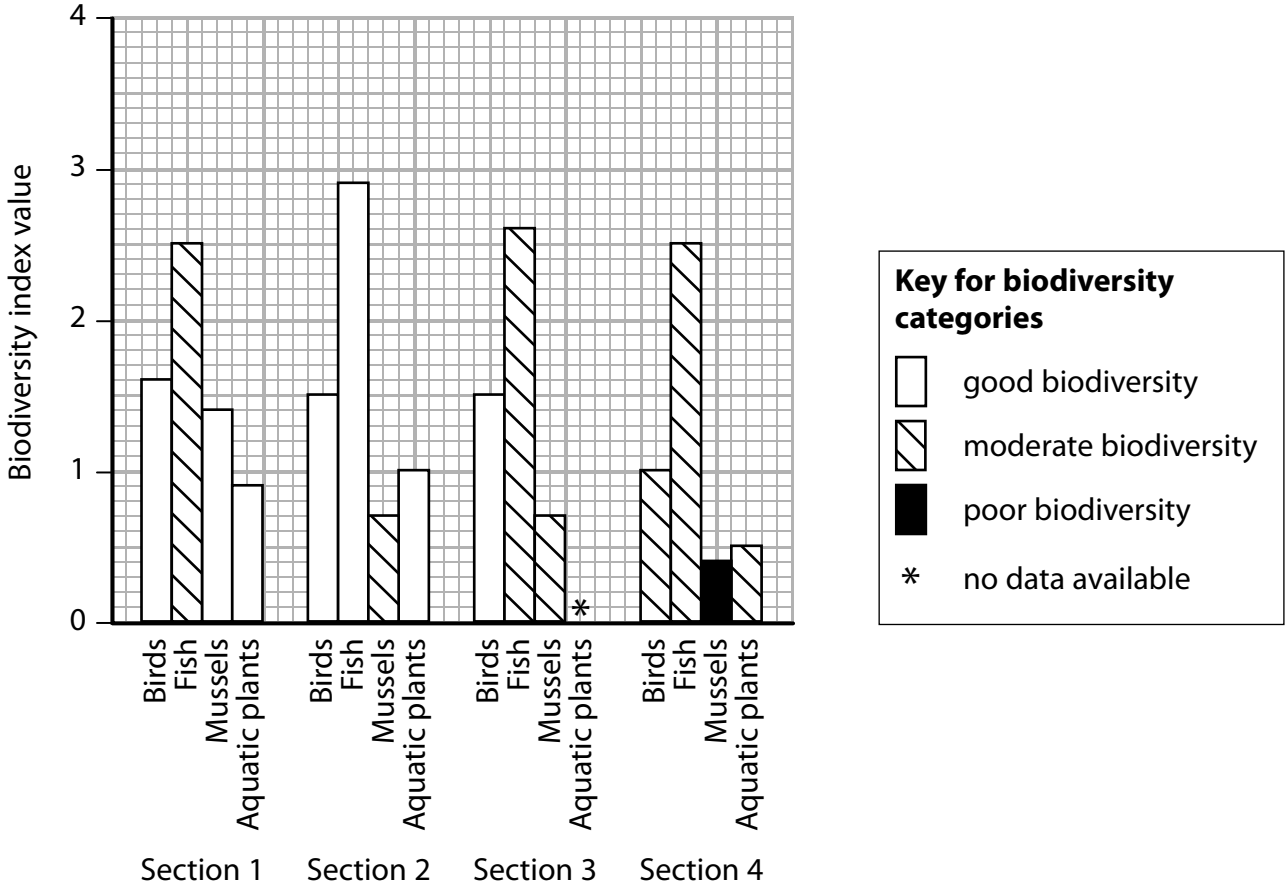
(4)

(Total for Question 7 = 11 marks)

8 The biodiversity of four groups of organisms – birds, fish, mussels and aquatic plants – was studied along four sections of the Rideau River in Canada.

A biodiversity index value was calculated for each group of organisms.

The graph shows the results of this study.



The biodiversity index value can be used to compare biodiversity within one group of organisms.

The biodiversity categories (good, moderate and poor) can be used to compare biodiversity between different groups of organisms.

(a) Which statement describes biodiversity?

(1)

☒ **A** species richness of only the endemic species within a habitat

☒ **B** species richness of all the species within a habitat

☒ **C** the role of only the endemic species within a habitat

☒ **D** the role of all the species within a habitat

*(b) Describe the changes in biodiversity along the Rideau River. Use the information in the graph to support your answer.

(6)

(c) In Section 1, birds have a biodiversity index value of 1.6 and fish have a biodiversity index value of 2.5.

Suggest why the fish are considered to have a moderate biodiversity and the birds have a good biodiversity, but the biodiversity index value of the fish is greater.

(2)

(d) No data were available for aquatic plants in Section 3.

A student collected some data in Section 3 to calculate a biodiversity index value.

The equation that the student used is:

$$D = \frac{N(N - 1)}{\Sigma n(n - 1)}$$

The data are shown in a table prepared by the student.

Species of aquatic plant	Number of aquatic plants counted	(n – 1)	n(n – 1)
Coontail	8		
Tape grass	6		
Common waterweed	3		
Northern water milfoil	2		
Star duckweed	9		
White water lily	2		
Water stargrass	2		
Eurasian water milfoil	6		
Curly pondweed	5		
European frogbit	2		
Flowering rush	3		

(i) Complete the table.

(1)

(ii) Calculate the biodiversity index value for the aquatic plants in Section 3 of this river.

(3)

Answer .....

(Total for Question 8 = 13 marks)

TOTAL FOR PAPER = 80 MARKS