

Cell Structure, Reproduction and Development - Questions by Topic

Q1.

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)

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(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.

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(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.

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

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(Total for question = 13 marks)

Q2.

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.

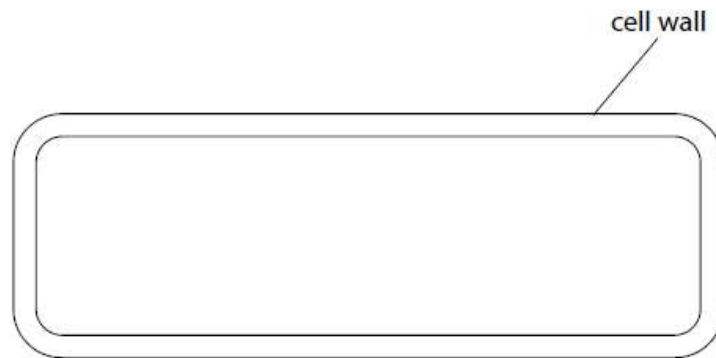
(1)

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

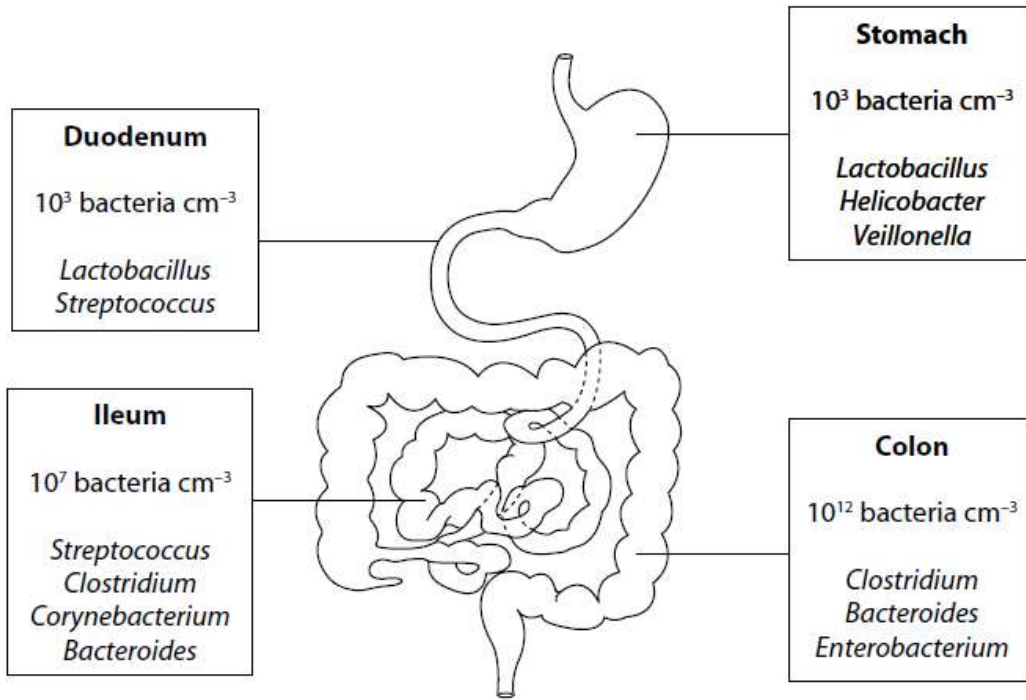
Draw **three** labelled features on this diagram that may be found in a prokaryotic cell.

(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.

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(Total for question = 10 marks)

Q3.

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

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

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(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
<input type="checkbox"/> A	1	1
<input type="checkbox"/> B	1	4
<input type="checkbox"/> C	4	1
<input type="checkbox"/> 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
<input type="checkbox"/> A	bar chart	bar chart
<input type="checkbox"/> B	bar chart	histogram
<input type="checkbox"/> C	histogram	bar chart
<input type="checkbox"/> D	histogram	histogram

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

(2)

Answer

(Total for question = 6 marks)

Q4.

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

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

(1)

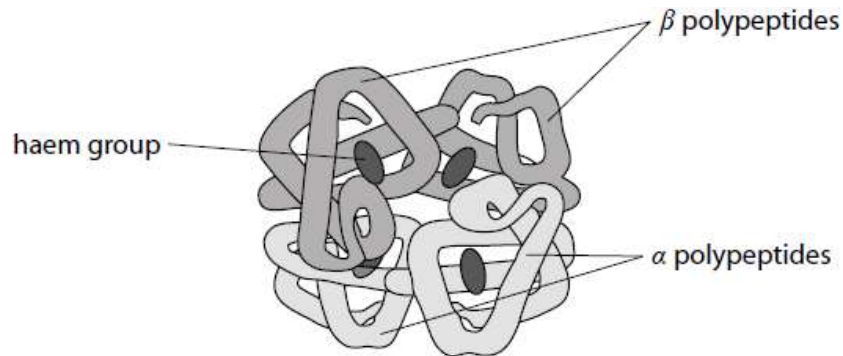
- A** they can produce all types of cell
- B** they can produce all types of cell except extraembryonic cells
- C** they can produce some types of cell
- D** they can produce red blood cells only

(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.

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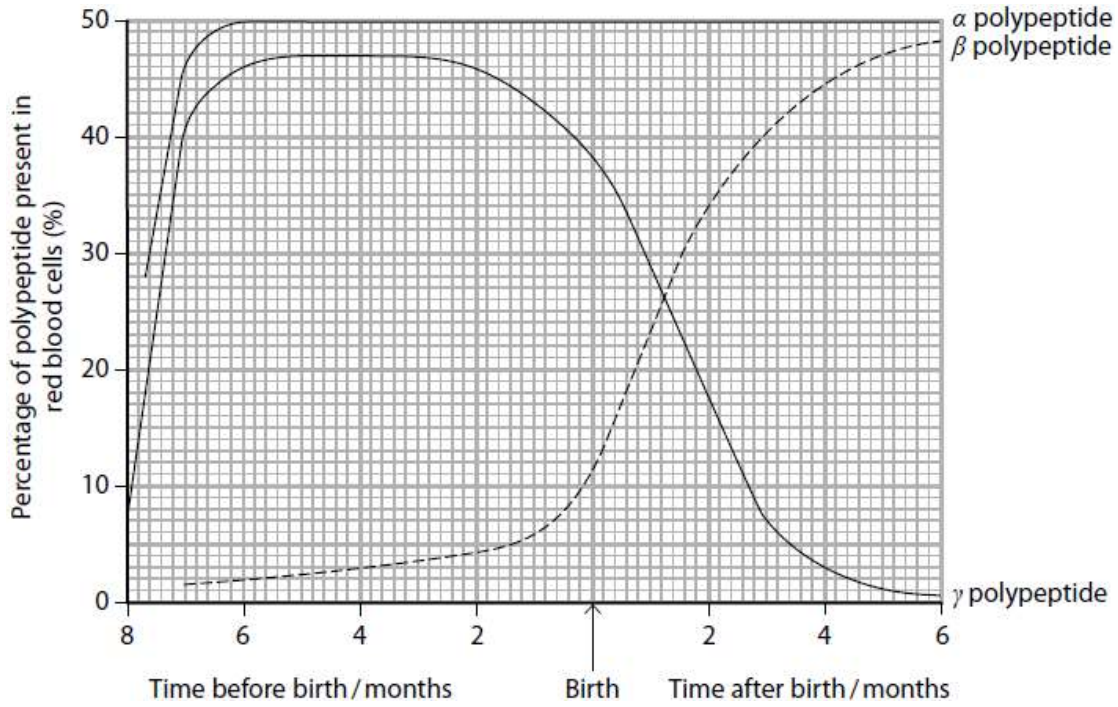
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(c) Fetal haemoglobin has a similar structure to adult haemoglobin. Fetal haemoglobin has two α polypeptides and two γ polypeptides.

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.

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

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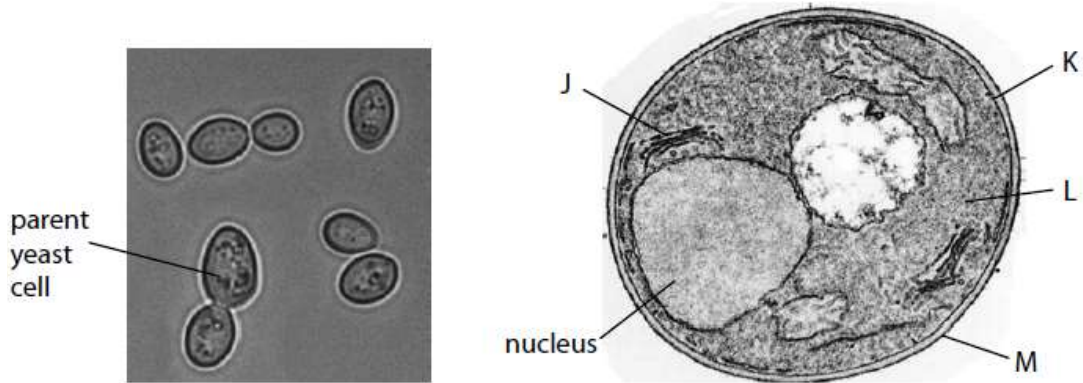
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(Total for question = 11 marks)

Q5.

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)

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

(2)

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(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.

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(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.

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(Total for question = 11 marks)