ACCESS EDUCATION

Victorian Certificate of Education
2024 Unit 1 Trial Paper

Letter

STUDENT NUMBER | | | | | | | | | |

STUDENT NAME _____

BIOLOGY
Written examination

Reading time: 7 minutes
Writing time: 1 hour 15 minutes

QUESTION AND ANSWER BOOK

Structure of book

Section	*Number of questions*	*Number of questions to be answered*	*Number of marks*
A	20	20	20
B	5	5	40
			Total 60

SECTION A – Multiple-choice questions

Instructions for Section A

Answer **all** questions in pencil on the answer sheet provided for multiple-choice questions.

Choose the response that is **correct** for the question.

A correct answer scores 1, an incorrect answer scores 0.

Marks will **not** be deducted for incorrect answers.

No marks will be given if more than one answer is completed for any question.

Use the following information to answer Questions 1 and 2

Yoghurt is a popular fermented dairy product made by heating milk in the presence of two species of bacteria: *Lactobacillus delbrueckii* and *Streptococcus thermophilus*.

Question 1

Lactobacillus delbrueckii and *Streptococcus thermophilus* are prokaryotes. This means that

A. they lack membranes.

B. they lack mitochondria.

C. they lack ribosomes.

D. they lack DNA.

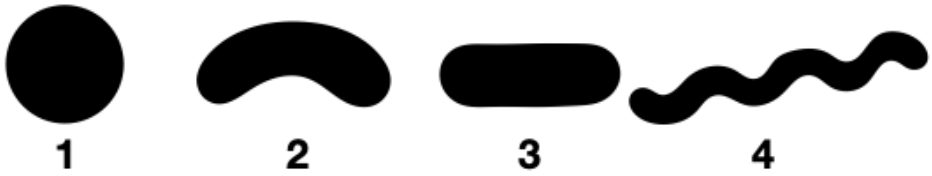
Question 2

Which of the following accurately represents the shapes of *Lactobacillus delbrueckii* and *Streptococcus thermophilus* respectively?

A	
B	
C	
D	

Question 3

Compare the following four bacteria.



Assuming they each have the same volume, which of the following statements is true of their surface area.

A. Their surface area is the same.

B. Bacteria 1 has the largest surface area.

C. Bacteria 4 has the largest surface area.

D. Bacteria 3 has the largest surface area.

Question 4

A biologist compared the amount of rough endoplasmic reticulum in two kinds of human cells: follicular cells and plasma cells. She found that plasma cells had more than twice as much rough endoplasmic reticulum as follicular cells, and that follicular cells had significantly more smooth endoplasmic reticulum than the plasma cells. From this information, it is reasonable to predict that

A. follicular cells play an important role in the storage of sugars.

B. plasma cells produce more proteins than follicular cells.

C. follicular cells require much more ATP energy than plasma cells.

D. plasma cells contain more genes than follicular cells.

Question 5

The image below is a transmission electron micrograph of a single mammalian cell, which has been isolated from its background. Four of the structures in the cell have been labelled.

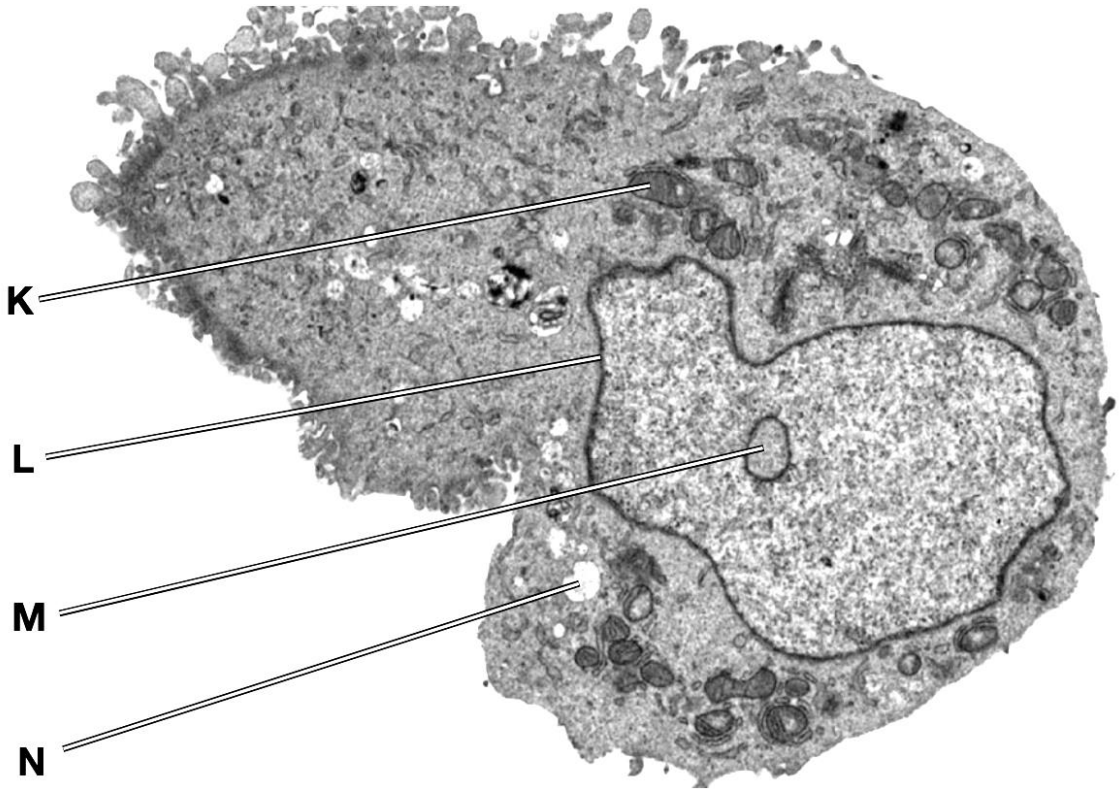


Figure 1. Mammalian cell. Image courtesy of Maryna, Journal of Cell Biology January 7, 2013

Which of the following statements is true?

A. K is a mitochondrion.

B. L is the plasma membrane.

C. M is the nucleus.

D. N is a ribosome.

Question 6

The diagram below shows a section of the plasma membrane of a human liver cell.

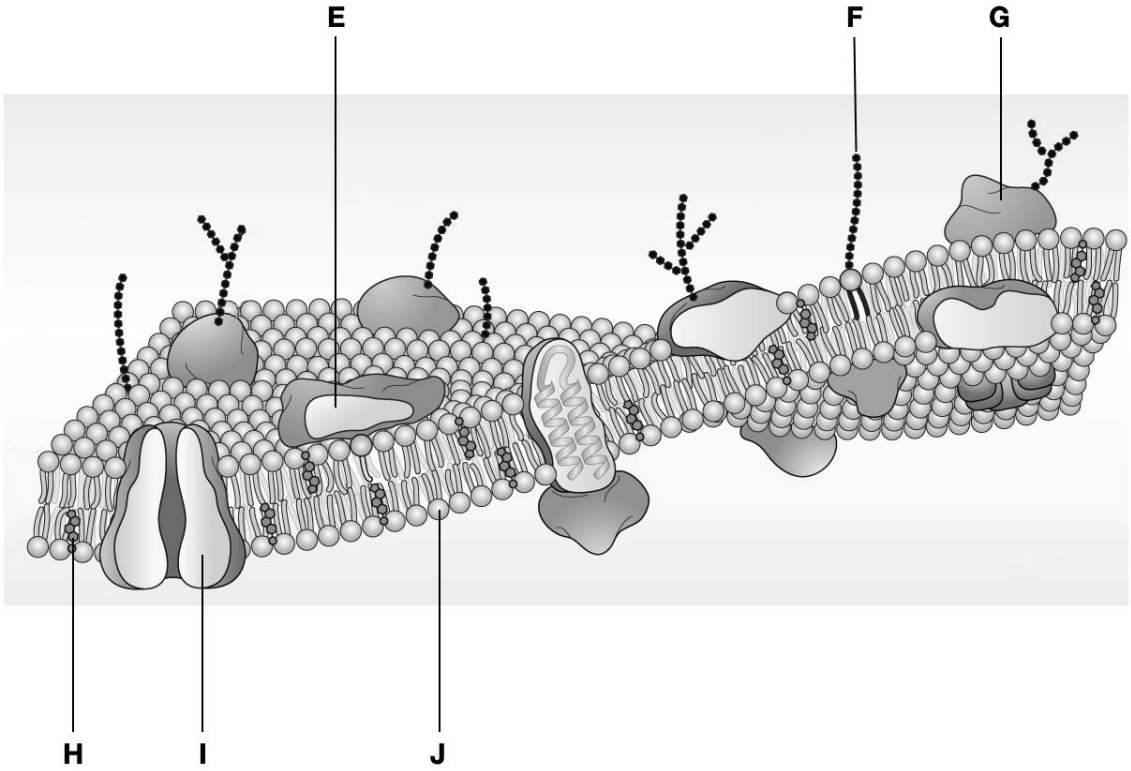


Figure 2. CNX OpenStax, CC BY 4.0 <https://creativecommons.org/licenses/by/4.0>, via Wikimedia Commons

Which of the following statements is accurate?

A. E is a transmembrane protein.

B. F is a fatty acid tail.

C. J is a phospholipid.

D. H is a glycoprotein.

Question 7

The cells of plant root hairs, contain a high concentration of mineral salts, compared to the concentration of mineral salts in the surrounding soil, from which they are absorbed. The reason plants concentrate mineral ions in the root hairs in this way, is to increase the efficiency of water uptake from the soil. Which of the following is a reasonable conclusion to make about root hair cells under natural conditions?

A. Mineral salts move into the root hair cells by facilitated diffusion.

B. The plant must spend energy to transport water into a root hair cell.

C. Root hair cells are surrounded by a hypertonic solution.

D. Water enters the root hair cells by osmosis.

Question 8

Chloroplasts are surrounded by a membrane called the chloroplast envelope which separates the stroma from the cell cytosol. The chloroplast envelope has a similar structure and composition to the plasma membrane. Based on your knowledge of the structure and function of chloroplasts, and the structure and function of membranes, which of the following is likely while a plant is photosynthesizing?

A. Glucose moves from the stroma of the chloroplast to the cytosol by facilitated diffusion.

B. Glucose enters the chloroplast from the cytosol by active transport.

C. Oxygen enters the chloroplast from the cytosol by simple diffusion.

D. Carbon dioxide enters the chloroplast from the cytosol by osmosis.

Question 9

Binary fission in bacteria usually

A. results in four daughter cells with different genetic traits.

B. results in two non-identical daughter cells.

C. results in four genetically identical daughter cells.

D. results in two genetically identical daughter cells.

Question 10

The image below is a photograph taken through a light microscope and shows mitosis taking place in some onion root cells. Three of the cells in the photograph have labels.

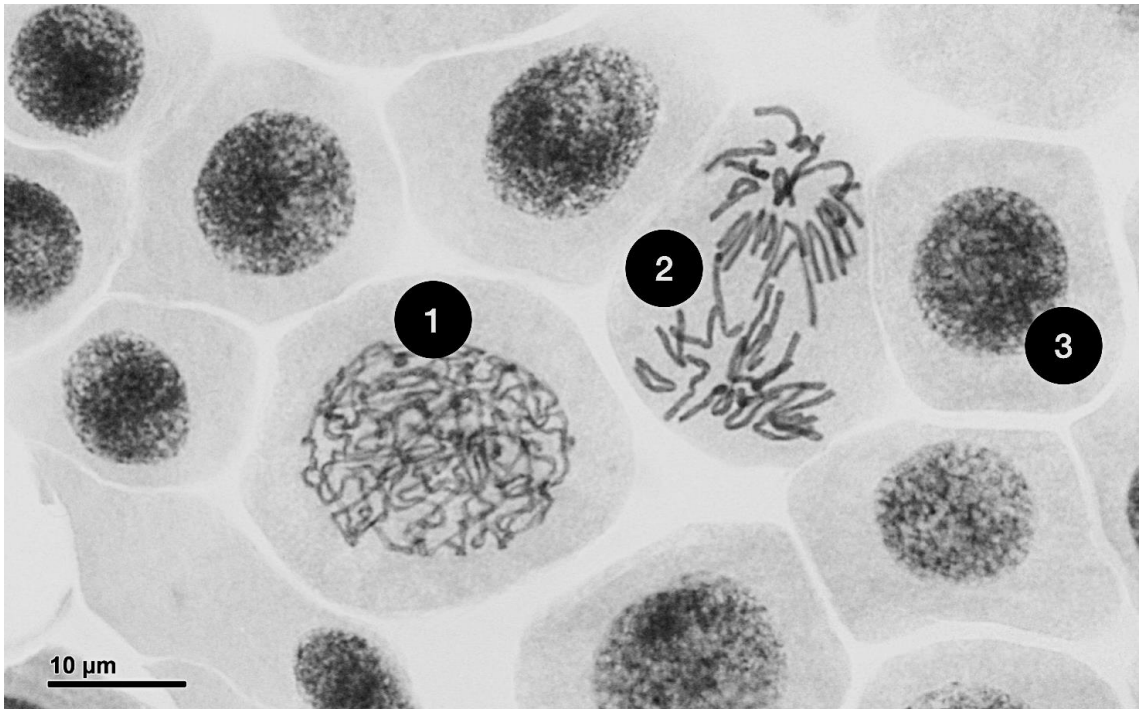


Figure 3. Mitosis in onion meristem. Source: Wikimedia commons

Which of the following is true?

A. Cell 1 is at late prophase.

B. Cell 2 is at anaphase.

C. Cell 2 is at an earlier stage of mitosis than cell 1.

D. Cell 3 is at telophase.

Question 11

When a cell is infected by a virus, the viral genetic information in the infected cell, causes the cell to produce viral proteins, some of which are subsequently presented on the outside of the cell. Circulating white blood cells named natural killer (NK) cells, detect these unusual proteins, and release a several cytotoxic chemicals, including FasL, perforin and granzyme, which cause the cell to die gently, without the cytoplasm spilling into the internal environment. This process is called

A. necrosis.

B. cytokinesis.

C. autophagy.

D. apoptosis.

Question 12

What type of stem cells are used by scientists for stem cell research?

A. Oligopotent stem cells

B. Totipotent stem cells

C. Pluripotent stem cells

D. Multipotent stem cells

Question 13

The image below was taken through a light microscope. It shows part of the stem of a vascular plant. One of the cells is indicated with an arrow.

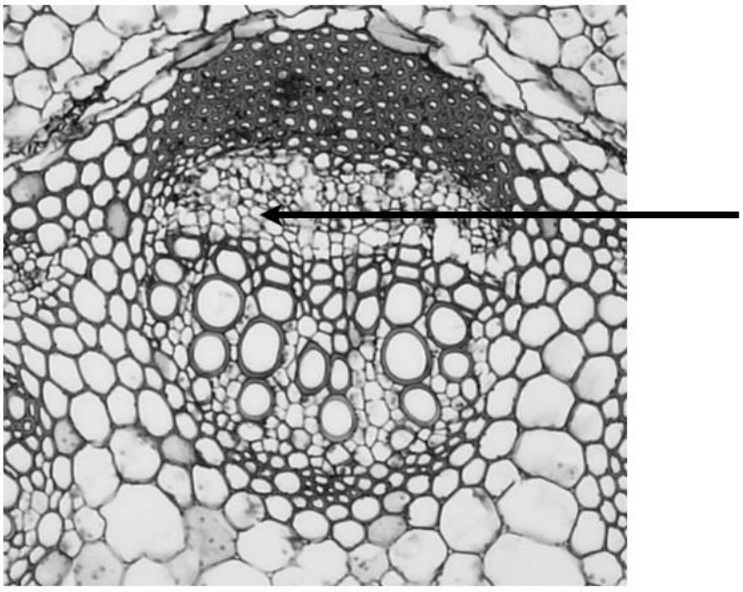


Figure 4. Helianthus stem. Image courtesy of Berkshire Community College Bioscience Image Library

This cell

A. transports sugar from the leaves to the roots.

B. transports water from roots to leaves.

C. provides structural support for the stem.

D. carries out photosynthesis to make glucose for the plant.

Question 14

Echinoderms such as sea stars (starfish) are able to move about using tube feet; small projections on the undersurface of the sea star which can move back and forward. The tube feet are attached to a series of fluid-filled canals and reservoirs. Near the centre of the sea star is a fluid-filled ring vessel connected by rigid tubes called stone canals to a madreporite that allows water into the ring vessel from the sea. Fluid moves from the central ring vessel through five radial water canals which extend out to the arms of the sea star and branch to fill the tube feet. The walls of the radial canals contain muscles which can contract and relax, increasing and decreasing the fluid pressure in the tube feet, which causes them to move.

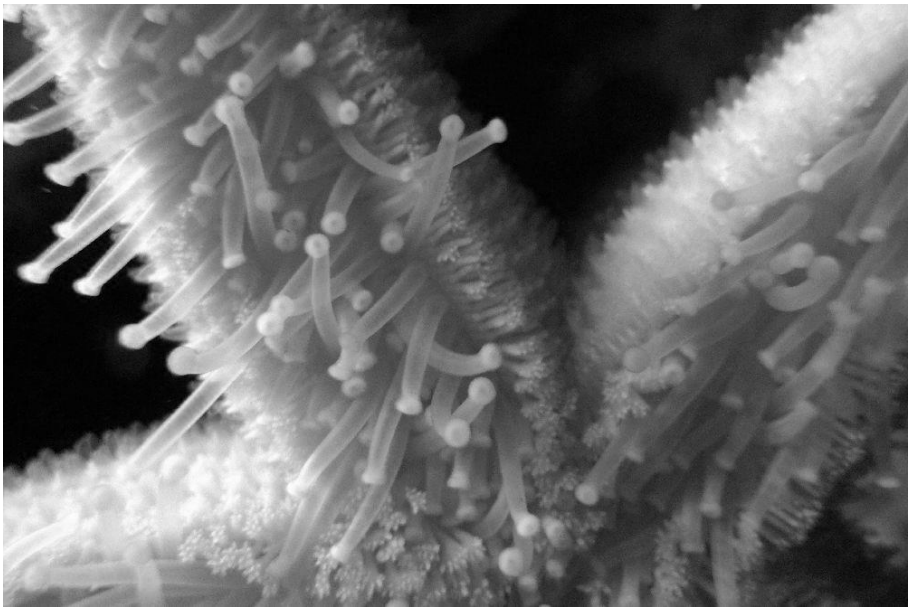


Figure 5. Tube feet on the under-surface of a sea star. Image credit CC Internets_dairy on Flickr

The most appropriate term to describe the arrangement of madreporite, ring vessel, stone canals, radial water canals and tube feet, described in the paragraph above is

A. the water vascular tissue.

B. the water vascular organ.

C. the water vascular system.

D. the water vascular organism.

Question 15

The enzyme that is secreted by the mammalian salivary glands into the mouth to digest starch to glucose is a

A. lipase.

B. amylase.

C. protease.

D. starchase.

Question 16

Which of the following is true of the hormone glucagon?

A. It is secreted by liver when blood glucose levels are low.

B. It is secreted by the pancreas when blood sugar concentration is high.

C. It stimulates skeletal muscle to absorb glucose from circulating blood.

D. It stimulates the liver to convert glycogen into glucose.

Question 17

Type 2 diabetes is primarily caused by

A. a lack of insulin secreted by beta cells in the pancreas.

B. an overproduction of glucagon by alpha cells.

C. a loss of cell sensitivity to insulin.

D. an autoimmune response in which the person's own immune system targets the cells that secrete insulin.

Question 18

The steroid hormone testosterone

A. is an exocrine hormone.

B. is a peptide hormone.

C. stimulates the uptake of glucose by liver cells.

D. is secreted by an endocrine gland.

Question 19

Water lilies are flowering vascular plants which grow on lake beds in warm climates. Their leaf stems are long and extend to the surface of the lake, and the leaves float flat on the water surface. It would be reasonable to expect that the stomata on water lily leaves

A. open at night and close during the day.

B. are located mostly on the upper surface of the leaf.

C. are located mostly on the lower epidermis.

D. are covered in a thick waxy cuticle.

Question 20

If the level of water in the blood falls, osmoreceptor neurons in a small region of the brain known as the lamina terminus, detect the change in plasma osmolarity, and send a nervous message to a downstream region of the brain called the cingulate cortex. The cingulate cortex is responsible for creating the sensation of thirst, which motivates the animal to seek and drink water. Drinking water restores the water content of the blood plasma to its normal level. This is an example of

A. a reflex arc.

B. negative feedback.

C. an endocrine response.

D. positive feedback.

SECTION B – Short-answer questions

Instructions for Section B

Answer **all** questions in the spaces provided. Write using a black or blue pen.

Question 1 (9 marks)

Two students were examining some cells through a light microscope at a slide that was prepared by their teacher. They had not been told what kind of cells they were looking at.

The students quickly identified that the cells were eukaryotic.

a. Explain what eukaryotic means. 1 mark

b. Describe three features of the cells they might have noted, which enabled them to identify the cells as eukaryotic. 3 marks

Feature 1.

Feature 2.

Feature 3.

The students next identified that the cells were plant cells.

c. Describe three features of plant cells that the students might have seen through the microscope and used to determine that these were plant and not animal cells. 3 marks

Feature 1.

Feature 2.

Feature 3.

d. What advantage is there to a plant of having cells that are so small they cannot be seen without a microscope? 2 marks

Question 2 (8 marks)

The photograph below was taken through a light microscope. It shows onion tissue in which some cells are dividing by mitosis.

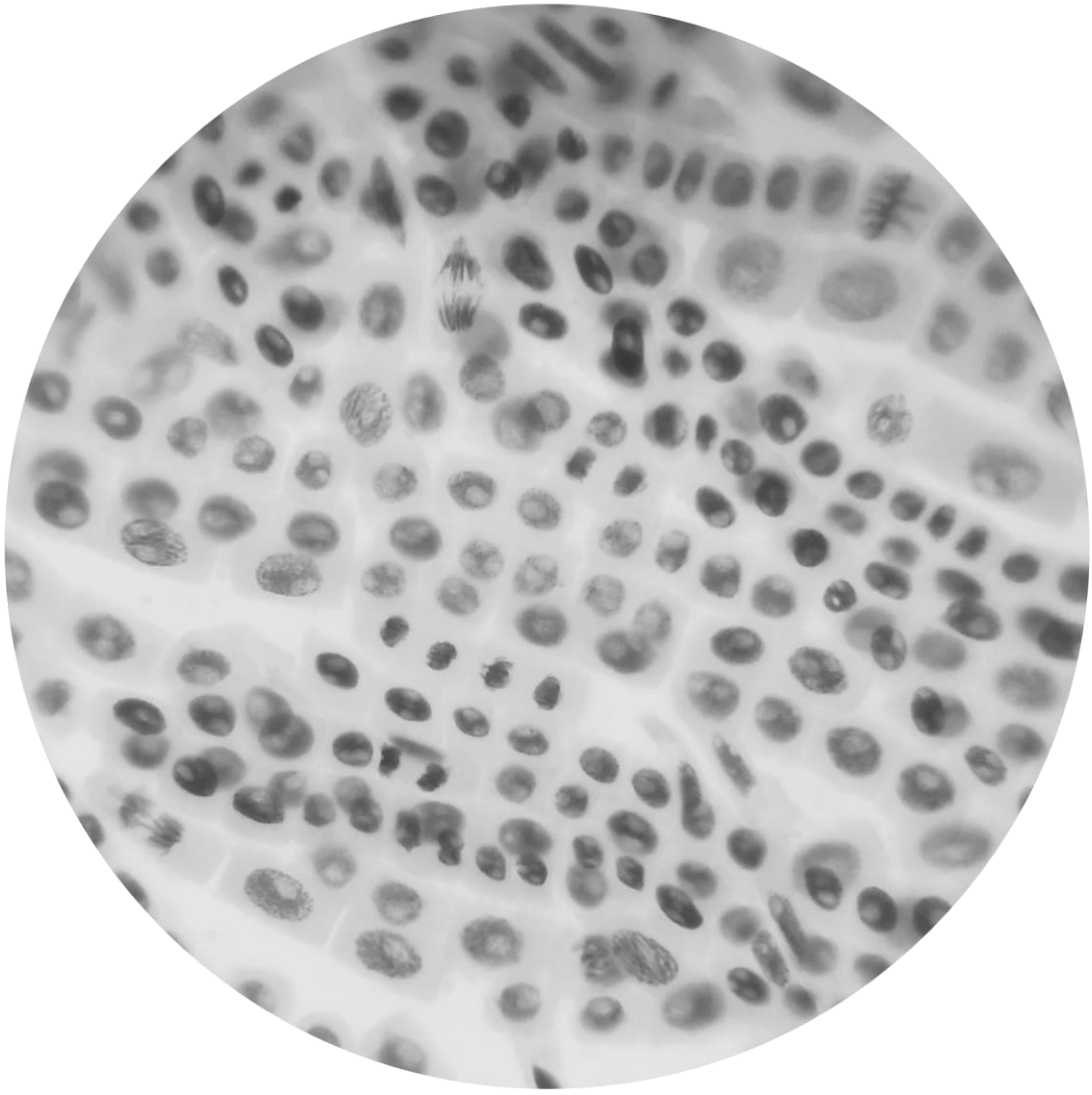


Figure 6. Mitosis de cebolla. Image credit: arturoUPM on Flickr. Image cropped, B&W adjustment.

a. **i.** Draw a circle around a cell in the photograph which is at prophase. 1 mark

ii. Draw a square around a cell which is at metaphase. 1 mark

iii. Draw a triangle around a cell which is at anaphase. 1 mark

b. Describe two events that take place in a cell during telophase. 2 marks

c. Identify one difference between mitosis in an onion cell and mitosis in a frog cell. 1 mark

d. Two students were discussing the number of chromosomes in onion cells. Abdul said that there are twice as many chromosomes in a cell at anaphase, as there are when the cell is at prophase. Kate disagreed, saying the number of chromosomes is the same, regardless of the phase of mitosis. Explain which student is correct.

2 marks

Question 3 (8 marks)

Some people are born with a condition called syndactyly, in which fingers and/or toes are fused together.

Figure 7. Syndactyly. Image credit CC https://www.wikidoc.org/index.php/File:Celldeath.jpg

Syndactyly is the result of a failure in the process of apoptosis during foetal development.

a. Explain what is meant by apoptosis, and how a failure in apoptosis may cause syndactyly. 3 marks

b. Describe another potential consequence of a failure in apoptosis. 2 marks

c. Briefly describe the role of caspases in the process of apoptosis. 1 mark

There are two pathways by which apoptosis can take place in a cell. These pathways are referred to as the intrinsic pathway and the extrinsic pathway. 2 marks

d. Give an example of how each of these pathways may be initiated.

Intrinsic Pathway:

Extrinsic Pathway:

Question 4 (9 marks)

The diagram below shows the human digestive system. Most organs are labelled.

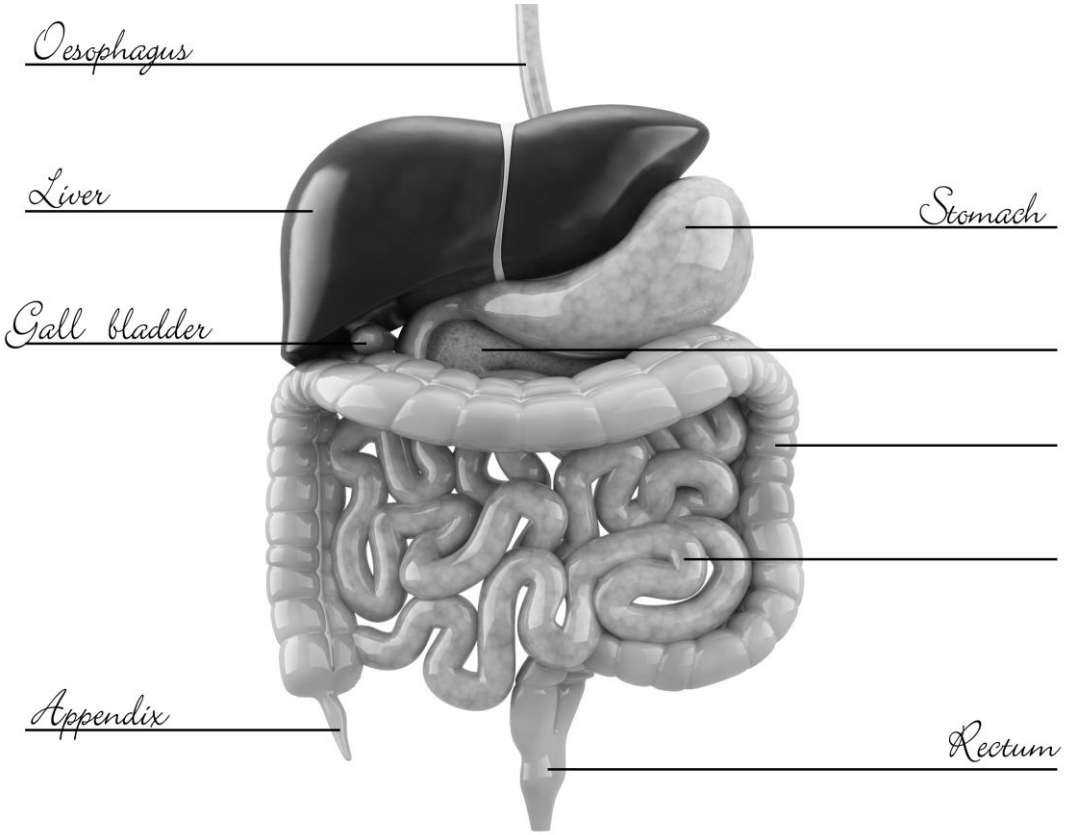


Figure 8. Digestive System. Image source: Shutterstock - https://www.shutterstock.com/image-illustration/human-anatomy-digestive-system-cutaway-including-230454745

a. Some of the organs in the diagram above are not labelled. Fill in the missing labels. 3 marks

b. What is the most important function of the small intestine? 1 mark

c. Describe three structural features of the small intestine, and for each, explain how the structural feature you have identified, helps it to perform its function efficiently.

Structural feature 1: 4 marks

Structural feature 2:

When a human drinks water, it flows down the oesophagus to the stomach. When a giraffe drinks water, however, it flows *up* the oesophagus, against gravity for almost 2 metres!

Figure 9. Giraffe drinking. Photo by Chris Stenger on Unsplash

d. Explain how water can move uphill, even though the oesophagus lacks valves. 1 mark

Question 5 (6 marks)

In March 2024, six cross-country skiers, were trapped in a snowstorm, near the Matterhorn Mountain in Switzerland. Rescuers were unable to reach them for several days because they were snowed in.

Anjan Truffer, the head of mountain rescue said that the skiers were ‘dressed quite lightly’ and ‘did not have much equipment’.

a. As a skiers’ core body temperature begins to fall below the normal temperature range (36.5ºC – 37.5ºC) the falling temperature is detected by a receptor. Where in the body is this receptor located? 1 mark

b. Describe two physiological responses that would expect to observe in the body of a skier whose body temperature has fallen below the normal body temperature range. 2 marks

c. Select **one** of the physiological responses you have described above and explain how that physiological response helps to prevent the core body temperature from falling even further. 1 mark

d. Describe two behavioural responses you might expect a cold skier to exhibit. 2 marks

END OF QUESTION AND ANSWER BOOK