Unit 1 Biology Exam 2024 – Assessment Guide

Section A

VCAA Key Knowledge	Question	Answer Guide
cells as the basic structural feature of life on Earth, including the distinction between prokaryotic and eukaryotic cells *surface area to volume ratio as an important factor in the limitations of cell size and the need for internal compartments (organelles) with specific cellular functions*	**Question 1** *E coli* is a type of bacteria that can cause some types of food poisoning. Which of the following correctly compares an *E coli* cell to a human cell? **A.** an *E coli* cell would not contain ribosomes **B.** the surface-to-volume ratio of a human cell would be greater **C.** a human cell is larger than an *E coli* cell **D.** both cells contain membrane-bound organelles	***C*** *Eukaryotic cells, such as human cells, are larger and more complex than prokaryotic bacterial cells.* *As the size of a cell increases, its surface-to-volume ratio reduces; hence, human cells would have a lower surface-to-volume ratio.* *Only eukaryotic cells contain membrane-bound organelles.* *Both cell types contain ribosomes; however, prokaryotic cell ribosomes are free in the cytosol.*
the structure and function of the plasma membrane in the passage of water, hydrophilic and hydrophobic substances via osmosis, facilitated diffusion and active transport	**Question 2** The cell membrane has a range of roles in cell function; different substances may pass through the membranes through different means. A sodium ion moving down its concentration gradient would pass through the membrane via **A.** osmosis. **B.** facilitated diffusion. **C.** active transport. **D.** simple diffusion.	***B*** *Ions are charged particles, which makes them hydrophilic and, therefore, repelled by the hydrophobic fatty-acid tails of the plasma membrane. Hence, a protein channel/carrier is required for it to pass through the plasma membrane via facilitated diffusion. As the ion is moving down its concentration gradient, the process is passive rather than active transport.*

apoptosis as a regulated process of programmed cell death	**Question 3** A sequence of events initiated from within the cell has resulted in caspase enzymes being activated within a particular cell, digesting proteins. This process would have been preceded by **A.** the release of cytochrome c from mitochondria. **B.** blebs forming in the cell. **C.** the formation of apoptotic bodies. **D.** the binding of death receptors to the mitochondria.	*A*	*Both the intrinsic and extrinsic apoptotic pathways involve the release of cytochrome c, which triggers caspase enzymes to digest cell proteins, eventually causing the cell to break apart and form apoptotic bodies. The intrinsic pathway is initiated from within the cell via mitochondria.*

regulation of body temperature, blood glucose and water balance in animals by homeostatic mechanisms, including stimulus-response models, feedback loops and associated organ structures	**Question 4** Our body systems are constantly working to maintain our bodies at a constant temperature. In humans, a common mechanism to cool down is sweating, cooling the body through the evaporation of sweat on the skin. This example of homeostasis **A.** requires a receptor and a response. **B.** can be described as a positive feedback loop. **C.** requires a stimulus, which is the activation of sweat glands. **D.** does not involve the hypothalamus.	*A*	*The process described is a negative feedback loop. As an example of the stimulus-response model, it involves a receptor and a response. The stimulus is the increase in body temperature, whereas the activation of sweat glands is the response.*

specialisation and organisation of animal cells into tissues, organs and systems with specific functions: digestive, endocrine and excretory	**Question 5** A key structure in the human kidney is the nephron. In which part of the nephron does most reabsorption of water occur? **A.** the proximal convoluted tubule **B.** the bladder **C.** the distal convoluted tubule **D.** the loop of Henle	*D*	*Most water absorption occurs in the loop of Henle.*

Use the following information to answer Questions 6 and 7.

Figure 1 shows two cells in different stages of cell division.

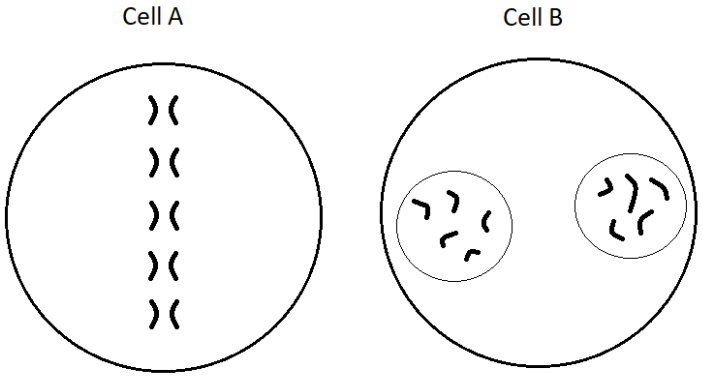


Figure 1

the eukaryotic cell cycle, including the characteristics of each of the sub-phases of mitosis and cytokinesis in plant and animal cells

Question 6

Which of the following is correct regarding these two cells?

A. the stage shown in *Cell A* occurs directly after interphase
B. the stage shown in *Cell B* is preceded by cytokinesis
C. the stage shown in *Cell A* occurs before the stage shown in *Cell B*
D. in *Cell B*, the chromosomes are attached to the mitotic spindle

C Cell A *is in metaphase and* Cell B *is in telophase. Metaphase occurs before telophase and is preceded by prophase.*

Cytokinesis occurs following telophase. In telophase, the chromosomes are no longer attached to the mitotic spindle.

the eukaryotic cell cycle, including the characteristics of each of the sub-phases of mitosis and cytokinesis in plant and animal cells

Question 7

The process in *Figure 1* occurs in many types of cells. Which type of cell could *not* be depicted as undergoing this process?

A. skin cells
B. liver cells
C. hair cells
D. bacterial cells

D *The cells are both eukaryotic cells as they undergo mitosis rather than binary fission; hence, they cannot be bacterial cells.*

Use the following information to answer Questions 8 – 10.

Figure 2 depicts the structure of a type of cell.

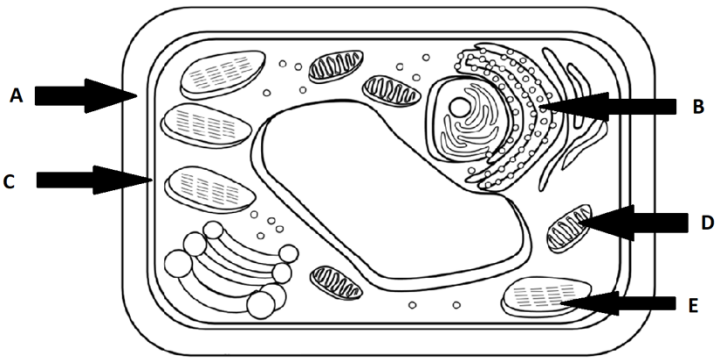


Figure 2

Adapted From: https://www.biologycorner.com/worksheets/cell_color_plant.html

the structure and specialisation of plant and animal cell organelles for distinct functions, including chloroplasts and mitochondria

Question 8

Which of the following correctly matches the labelled organelles to their respective functions?

	C	E
A.	allows oxygen to diffuse into and out of the cell	site of cellular respiration
B.	allows oxygen to diffuse into and out of the cell	site of glucose production
C.	maintains cell stability	site of cellular respiration
D.	allows oxygen to diffuse into and out of the cell	site of protein synthesis

B *C is the cell membrane, which allows substances into and out of the cell. E is a chloroplast, wherein photosynthesis occurs, producing glucose.*

the structure and specialisation of plant and animal cell organelles for distinct functions, including chloroplasts and mitochondria	**Question 9** Which organelles would *not* be found in a human cell? **A.** A and E **B.** E only **C.** A only **D.** A and D	*A*	*Animal cells do not contain cell walls or chloroplasts.*

the structure and function of the plasma membrane in the passage of water, hydrophilic and hydrophobic substances via osmosis, facilitated diffusion and active transport	**Question 10** The cell in *Figure 2* is placed in a slightly hypotonic environment. Which of these is most likely to occur as a result? **A.** there will be no change to the cell **B.** the cell will swell and burst **C.** the cell will shrivel **D.** the cell will become turgid	*D*	*When placed in a hypotonic environment, water will enter the cell through osmosis; due to its cell wall, a plant cell will become turgid rather than burst.*

properties of stem cells that allow for differentiation, specialisation and renewal of cells and tissues, including the concepts of pluripotency and totipotency	**Question 11** Consider two stem cells; *Cell A* is a multipotent stem cell whereas *Cell B* is a pluripotent stem cell. In terms of potency, which of the following is correct? **A.** *Cell A* has greater potency **B.** *Cell B* is largely limited as to the number of cell types it can differentiate into **C.** *Cell B* can differentiate into a greater variety of cell types compared to Cell A **D.** *Cell A* can only be found in the very early stages of embryonic development	*C*	*Pluripotent stem cells, which are present in the early stages of embryonic development, have a greater potency than multipotent stem cells, which are found in adults. This means that they have the capacity to differentiate into a greater variety of mature cells.*

specialisation and organisation of plant cells into tissues for specific functions in vascular plants, including intake, movement and loss of water	**Question 12** Select the option that correctly completes the blank spaces in the following passage: *In vascular plants, _____ tissue only allows water to flow _____, whereas _____ tissue allows substances to flow in both directions. Vascular plants are generally _____ than non-vascular plants.* **A.** xylem, upwards, phloem, larger **B.** xylem, downwards, phloem, larger **C.** phloem, upwards, xylem, larger **D.** xylem, laterally, phloem, smaller	*A*	*Xylem tissue transports water upwards through the plant. Phloem tissue allows for the transport of other substances in both directions. Vascular plants are typically larger than non-vascular plants.*

cells as the basic structural feature of life on Earth, including the distinction between prokaryotic and eukaryotic cells

binary fission in prokaryotic cells

Question 13

Bacterial cells and animal cells differ exclusively in several ways. Some of these differences are best outlined by which option?

	Prokaryotic Cells	Eukaryotic Cells
A.	reproduce through binary fission	contain circular DNA
B.	contain circular DNA	reproduce through binary fission
C.	reproduce through binary fission	reproduce through mitosis
D.	have cell walls	reproduce through mitosis

C *Prokaryotic cells reproduce through binary fission, while eukaryotic cells through mitosis.*

Although eukaryotic cells do contain some circular DNA, this is not exclusive to eukaryotic cells as prokaryotes have circular chromosomes. Also, while prokaryotes do have a cell wall, this is not exclusive to prokaryotes as plant cells contain a cell wall.

specialisation and organisation of animal cells into tissues, organs and systems with specific functions: digestive, endocrine and excretory

Question 14

The human digestive system contains several organs working together to absorb nutrients from food. The passage of food through the human digestive system travels, in order, through the

A. mouth, oesophagus, stomach, large intestine, small intestine and, finally, through the anus.
B. mouth, oesophagus, stomach, small intestine, large intestine and, finally, through the anus.
C. mouth, oesophagus, small intestine, large intestine and, finally, through the anus.
D. mouth, stomach, oesophagus, small intestine, large intestine and, finally, through the anus.

B *Although there are additional organs involved in the digestive system, of the organs listed, only option B lists them in the correct order.*

specialisation and organisation of animal cells into tissues, organs and systems with specific functions: digestive, endocrine and excretory

Question 15

Part of the lining of the alimentary canal of the digestive system consists of villi and microvilli. What is the location and purpose of these?

A. to increase the surface area of the stomach, allowing for greater nutrient absorption
B. to increase the surface area of the small intestine, allowing for greater nutrient absorption
C. to secrete bile, which assists in the breakdown of lipids
D. to secrete mucus into the lining of the stomach, protecting the stomach lining from the acidic environment of the stomach

B *The small intestine is where most nutrient absorption takes place. To maximise the absorption of nutrients, the intestine is lined with tiny structures called villi and microvilli, which increase the surface area that is available for absorption.*

disruption to the regulation of the cell cycle and malfunctions in apoptosis that may result in deviant cell behaviour: cancer and the characteristics of cancer cells	**Question 16** Cancerous tumours occur as a result of **A.** too much apoptosis. **B.** too little cell division. **C.** too little apoptosis. **D.** too little mitosis.	*C*	*In a cancerous cell, the cell cycle is compromised, leading to uncontrolled cell division and growth. If the cancerous cells are not destroyed by apoptosis, they will continue to divide and form a tumour.*

Use the following information to answer Questions 17 and 18.

Figure 3 shows a cellular structure.

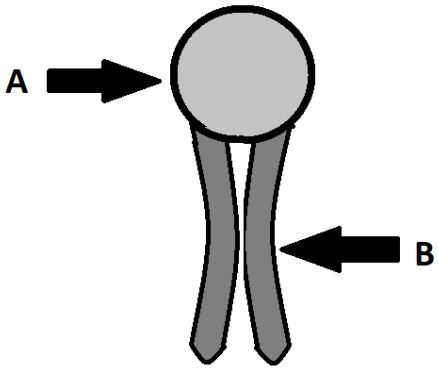


Figure 3

the structure and function of the plasma membrane in the passage of water, hydrophilic and hydrophobic substances via osmosis, facilitated diffusion and active transport	**Question 17** The part labelled 'B' is **A.** hydrophilic. **B.** hydrophobic. **C.** polar. **D.** lipophobic.	*B*	*The image depicts a phospholipid; B represents the fatty-acid tails, which are hydrophobic, non-polar, and lipophilic.*

the structure and function of the plasma membrane in the passage of water, hydrophilic and hydrophobic substances via osmosis, facilitated diffusion and active transport	**Question 18** In an animal cell, the part labelled 'A' would be exposed to **A.** the internal cell environment only. **B.** the external cell environment only. **C.** both the internal and external cell environments. **D.** neither the internal nor the external cell environments.	*C*	*In the plasma membrane, the phospholipids are arranged in a bilayer, with the phosphate heads facing the internal and external cell environments and the fatty-acid tails facing inwards.*

malfunctions in homeostatic mechanisms: type 1 diabetes, hypoglycaemia, hyperthyroidism	**Question 19** Disruptions in homeostasis can result in conditions like diabetes. A person with type I diabetes cannot regulate the **A.** production of thyroxin. **B.** absorption of glucose. **C.** absorption of insulin. **D.** production of glucose.	*B*	*In people with type I diabetes, the pancreas produces little or no insulin. Since insulin regulates the uptake of glucose by cells, they are unable to regulate glucose absorption.*

regulation of water balance in vascular plants

specialisation and organisation of plant cells into tissues for specific functions in vascular plants, including intake, movement and loss of water

Question 20

Girdling is a process in which the bark, phloem and xylem tissue are removed around the outside of a woody trunk. Which of the following best describes the consequences of girdling on the plant?

A. cells above the girdling would be deprived of glucose, while cells below the girdling would be deprived of water
B. cells below the girdling would be deprived of both glucose and water, while cells above the girdling would be unaffected
C. cells below the girdling would be deprived of glucose, while cells above the girdling would be deprived of water
D. cells above the girdling would be deprived of both glucose and water, while cells below the girdling would be unaffected

C *The removal of xylem tissue prevents the transport of water from roots to tips and, so, cells above the girdling would be deprived of water. Removal of phloem tissue prevents the transport of glucose, produced in the leaves, down to the other parts of the plant; hence, cells below the girdling would be deprived of glucose.*

regulation of body temperature, blood glucose and water balance in animals by homeostatic mechanisms, including stimulus-response models, feedback loops and associated organ structures

Question 21

The regulation of water balance can be modelled using a stimulus-response model. Which of the following are effectors in this process?

A. aquaporins and osmoreceptors
B. osmoreceptors and the hypothalamus
C. osmoreceptors and cells in the thirst centre
D. aquaporins and cells in the thirst centre

D *In the stimulus-response model, effectors initiate a response. In the regulation of water balance, this can include aquaporins, which assist in the transport of water across the cell membrane, and cells in the thirst centre.*

Osmoreceptors act as receptors, while the hypothalamus acts as the control centre.

cells as the basic structural feature of life on Earth, including the distinction between prokaryotic and eukaryotic cells

Question 22

Prokaryotic and eukaryotic cells differ in terms of the structures they contain. Which of the options below correctly lists the structures that are *only* found in each cell type?

	Prokaryotic Cells	Eukaryotic Cells
A.	cell wall	nucleus
B.	capsule	mitochondria
C.	ribosomes	nucleus
D.	capsule	ribosomes

B *Prokaryotic cells do not contain membrane-bound organelles, including nuclei and mitochondria. Only prokaryotic cells possess a capsule, but both prokaryotic cells and some eukaryotic cells have a cell wall. Both types of cells contain ribosomes.*

properties of stem cells that allow for differentiation, specialisation and renewal of cells and tissues, including the concepts of pluripotency and totipotency

analyse and evaluate bioethical issues using relevant approaches to bioethics and ethical concepts, including the influence of social, economic, legal and political factors relevant to the selected issue

Question 23

Stem cells offer the potential to treat several degenerative diseases. As with all medical treatments, stem cell therapies must undergo numerous trials and testing and be clinically proven before being widely available to the public. If a trial on a particular therapy was to only publish the positive outcomes, how would this violate the ethical principle of integrity? Choose the most correct answer.

A. this would violate integrity as there is an unequal distribution of the benefits of the results to the public
B. this would violate integrity because benefits are not maximised and risks are not minimised
C. this would violate integrity because there is direct harm as a result
D. this would violate integrity because not all of the results, whether favourable or unfavourable, are reported

D

Integrity requires the honest communication of all sources of information and results, whether favourable or unfavourable, in ways that permit scrutiny and contribute to public knowledge and understanding.

If unfavourable results are withheld, integrity would be violated. Option A relates to the principle of justice, B to beneficence, and C to non-maleficence.

Use the following information to answer Questions 24 and 25.

A student conducts a small experiment to investigate the effect of water salinity on osmosis through egg membranes.

Three groups of eggs are de-shelled and submersed in water baths of 0%, 20%, and 40% saline solutions respectively for 12 hours. The initial and final masses of each egg group are measured and the % change in mass is calculated.

identify independent, dependent and controlled variables in controlled experiments

Question 24

The independent and dependent variables in this experiment are, respectively,

A. salinity and % change in mass.
B. % change in mass and osmosis.
C. salinity and temperature.
D. osmosis and % change in mass.

A

The independent variable is the one that is deliberately varied by the experimenter, which is the salinity of the solution in which the egg groups are submerged. The dependent variable is the one that is measured, which, in this case, is the % change in mass.

the structure and function of the plasma membrane in the passage of water, hydrophilic and hydrophobic substances via osmosis, facilitated diffusion and active transport

Question 25

Consider the eggs that were submerged in the 40% solution; how would you expect the mass of these eggs to change over the 12-hour submersion and why?

A. the mass would decrease as the eggs are in a hypotonic solution and, thus, would lose water
B. the mass would increase as the eggs are in a hypotonic solution and, thus, would gain water
C. the mass would decrease as the eggs are in a hypertonic solution and, thus, would lose water
D. the mass would increase as the eggs are in a hypertonic solution and, thus, would gain water

C

The eggs in the 40% solution are in a hypertonic solution, which means that the salt concentration of the solution is higher than the salt concentration of the eggs; this will cause the eggs to lose water through osmosis.

Section B

VCAA Key Knowledge	Question	Answer Guide

A student took some stalks of celery and placed them in a large beaker of water coloured with blue food dye, as shown in *Figure 4*. She then left the celery to sit in the beaker for 24 hours. After 24 hours, she observed that more than two-thirds of the celery stalk was now stained blue.

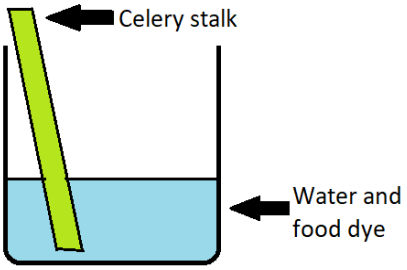


Figure 4

specialisation and organisation of plant cells into tissues for specific functions in vascular plants, including intake, movement and loss of water	**Question 1a** (2 marks) Identify the type of water transport that was occurring in the celery in this experiment and name the type of plant tissue responsible for this.	**Answer:** • *This is passive transport (or osmosis is also an acceptable answer).* • *Xylem tissue.* **Marking Protocol:** One mark for each of the above points.

specialisation and organisation of plant cells into tissues for specific functions in vascular plants, including intake, movement and loss of water	**Question 1b** (1 mark) Explain what occurred to result in the student's observation.	**Answer:** • *The coloured water entered the celery via osmosis as there is a concentration gradient between the bottom of the stalks, which are submerged in the water, and the tips.* • *Water moved from an area of high concentration in the beaker to an area of lower concentration in the celery cells, causing the celery to stain blue.* **Marking Protocol:** One mark for either of the above points.

Specialisation and organisation of plant cells into tissues for specific functions in vascular plants, including intake, movement and loss of water	**Question 1c** (3 marks) Provide two comparisons for the form of transport that was identified in Question 1a to the form of transport that moves glucose around a plant - name the tissue responsible for this type of transport.	**Answer:** • *Glucose is moved around a plant via active transport, which means that energy is required, whereas passive transport/osmosis requires no energy input.* • *In plants, active transport occurs in both directions, whereas passive transport only transports water upwards.* • *Phloem tissue is responsible for active transport.* **Marking Protocol:** One mark for each of the above points.

identify outliers, and contradictory or provisional data	**Question 1d** (2 marks) Plant cells contain a component that prevents cells from swelling and bursting when they absorb water. Identify this structure and identify one other cell type it could be found in.	**Answer:** • *The cell wall prevents plant swells from lysing.* AND any ONE of • *A cell wall can also be found in:* ○ *prokaryotes/bacteria.* ○ *fungi.* ○ *protists.* **Marking Protocol:** One mark for each of the above points.

The student decides to extend her investigation and explore the effects of water salinity on the process that she observed. She sets up four beakers filled with four different salt solutions, each with a celery stalk placed in them and, again, leaves them for 24 hours.

identify and analyse experimental data qualitatively, handing where appropriate concepts of: accuracy, precision, repeatability, reproducibility and validity of measurements; errors (random and systematic); and certainty in data, including effects of sample size in obtaining reliable data	**Question 1e** (1 mark) The student understands the importance of validity in her experiment. Explain what it means for a measurement to be valid.	**Answer:** • *For a measurement to be valid, it must measure what it intends to measure (i.e. the only variable that causes variation in the dependent variable is the independent variable).* **Marking Protocol:** One mark for the above point.

identify independent, dependent and controlled variables in controlled experiments	**Question 1f** (2 marks) Identify two ways in which the student could design her experiment to be valid.	**Answer:** *The student could:* • *keep the water temperature constant.* • *use same-sized celery sticks in each beaker.* • *keep the volume of water constant.* • *use same-sized and same-shaped beakers for each salinity.* • *include a beaker with 0% salt solution as a control group.* **Marking Protocol:** One mark for each of the above points, or any other suitable response, to a maximum of two.

Figure 5 shows a segment of the plasma membrane in an animal cell. Sodium ions (Na^+), potassium ions (K^+) and oxygen molecules are passing through the membrane *into* the cell. Within the plasma membrane are structures labelled A, B and C.

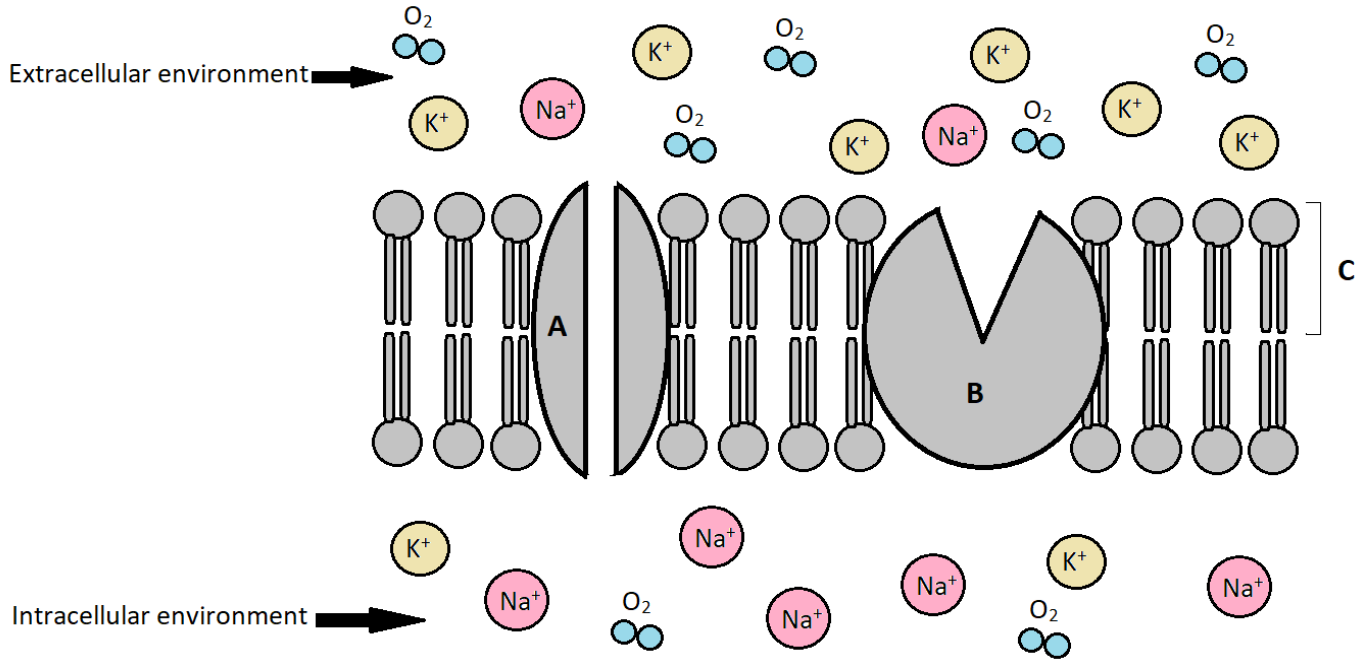


Figure 5

the structure and function of the plasma membrane in the passage of water, hydrophilic and hydrophobic substances via osmosis, facilitated diffusion and active transport	**Question 2a** (3 marks) Identify structures A, B and C.	**Answer:** • *A is a channel protein.* • *B is a carrier protein.* • *C is a phospholipid.* **Marking Protocol:** One mark for each of the above points.

the structure and function of the plasma membrane in the passage of water, hydrophilic and hydrophobic substances via osmosis, facilitated diffusion and active transport	**Question 2b** (3 marks) In entering the cell, will oxygen need to pass through either structures A or B? Give two reasons for your answer.	**Answer:** • *No (oxygen will diffuse directly through the cell / through the phospholipid bi-layer).* • *Oxygen moves down its concentration gradient; hence, transport into a cell does not require energy or a carrier protein.* • *Oxygen is a small, non-polar molecule and, so, is not repelled by the fatty-acid tails of the phospholipids, making it able to pass directly through the phospholipid bilayer.* **Marking Protocol:** One mark for each of the above points.

the structure and function of the plasma membrane in the passage of water, hydrophilic and hydrophobic substances via osmosis, facilitated diffusion and active transport	**Question 2c** (4 marks) Identify and explain the forms of membrane transport that will allow sodium ions and potassium ions to enter the cell.	**Answer:** • *Sodium ions enter cells via active transport.* • *This is because they move against the concentration gradient; hence, transport into the cell will require energy input and a carrier protein.* • *Potassium ions enter cells via facilitated diffusion.* • *This is because they move along the concentration gradient; hence, no energy input is required. However, as potassium is a charged ion, they are repelled by the phospholipid tails and, so, will require a channel protein.* **Marking Protocol:** One mark for each of the above points.

Figure 6 depicts the cell cycle in a human somatic body cell.

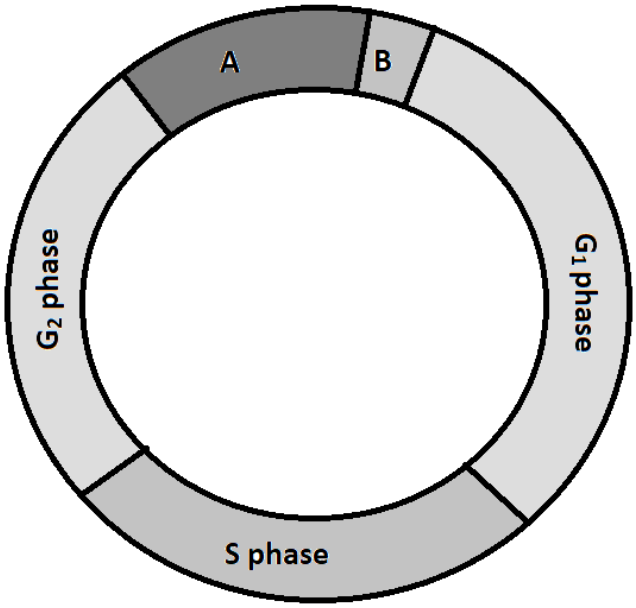


Figure 6

characteristics of each of the sub-phases of mitosis and cytokinesis in plant and animal cells	**Question 3a** (2 marks) Identify processes *A* and *B*.	**Answer:** • *A is mitosis.* • *B is cytokinesis.* **Marking Protocol:** One mark for each of the above points.

the eukaryotic cell cycle, including the characteristics of each of the sub-phases of mitosis and cytokinesis in plant and animal cells	**Question 3b** (4 marks) Process *A* is divided into four sub-stages. Identify and briefly describe these stages.	**Answer:** • *In prophase, the chromosomes condense.* • *In metaphase, the chromosomes line up in the middle/equator of the cell.* • *In anaphase, the chromatids move to opposite ends of the cell.* • *In telophase, two new nuclei form.* **Marking Protocol:** One mark for each of the above points.

the eukaryotic cell cycle, including the characteristics of each of the sub-phases of mitosis and cytokinesis in plant and animal cells	**Question 3c** (1 mark) What occurs during the S phase?	**Answer:** • *The cell synthesises/duplicates DNA.* • *Single stranded chromosomes become double stranded due to DNA replication.* **Marking Protocol:** One mark for either of the above points.

Apoptosis as a regulated process of programmed cell death	**Question 3d** (4 marks) A particular cell undergoing this cycle 'fails' a checkpoint in the G_1 stage, resulting in a signal from within the cell initiating self-destruction. Name this specific process and describe the steps that occur.	**Answer:** • *This is the internal (cell-mediated) pathway of apoptosis.* • *This causes mitochondria to release cytochrome C.* • *Cytochrome C activates caspase enzymes, which break down the cell's structure.* • *The cell then shrinks, blebs and lyses to form apoptotic bodies.* **Marking Protocol:** One mark for each of the above points.

Binary fission in prokaryotic cells	**Question 3e** (1 mark) Prokaryotic cells divide through a process called binary fission. Describe a difference between binary fission and the process depicted in *Figure 6.*	**Answer:** • *Binary fission is simpler.* • *Binary fission is faster.* • *Binary fission does not consist of four stages.* **Marking Protocol:** One mark for any of the above points, or any other suitable response.

Figure 7 shows a simplified negative feedback loop that occurs in the human body to maintain blood glucose levels.

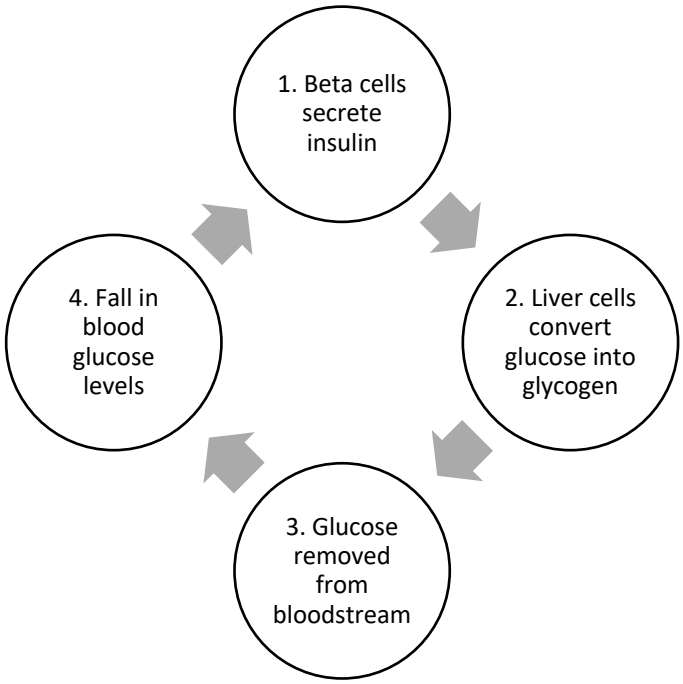


Figure 7

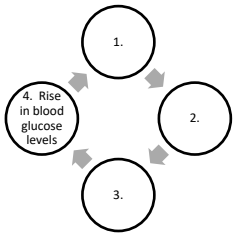
regulation of body temperature, blood glucose and water balance in animals by homeostatic mechanisms, including stimulus-response models, feedback loops and associated organ structures	**Question 4a** (2 marks) Would this feedback loop most likely occur just after a meal or after not eating for a few hours? Explain your answer.	**Answer:** • *This feedback loop would most likely occur after a meal.* • *This is as Figure 7 shows a response to high blood glucose levels, which occurs after the digestion of food containing carbohydrates.* **Marking Protocol:** One mark for each of the above points.

malfunctions in homeostatic mechanisms: type 1 diabetes, hypoglycaemia, hyperthyroidism	**Question 4b** (2 marks) How would this process be compromised in someone with type I diabetes? Describe how this would impact blood glucose levels.	**Answer:** • *In type I diabetes, pancreatic beta cells are destroyed and, so, they are unable to secrete insulin, meaning that the liver cells are not stimulated to convert glucose into glycogen.* • *This causes glucose to remain in the blood and prevents blood glucose levels from being brought back down to their set point.* **Marking Protocol:** One mark for each of the above points.

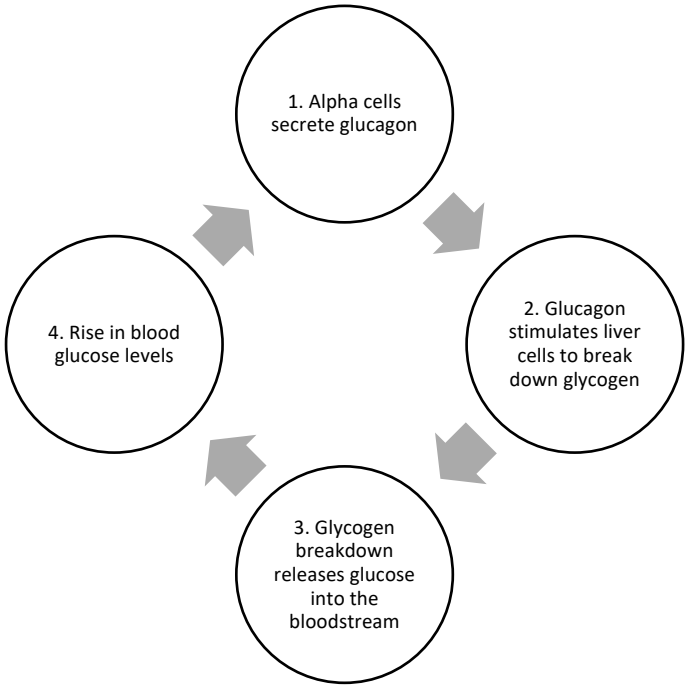
regulation of body temperature, blood glucose and water balance in animals by homeostatic mechanisms, including stimulus-response models, feedback loops and associated organ structures	**Question 4c** (1 mark) Another important hormone that is involved in blood glucose regulation is glucagon. What is the role of glucagon in the liver?	**Answer:** • *Glucagon stimulates liver cells to break down glycogen into glucose, releasing it into the bloodstream.* **Marking Protocol:** One mark for the above point.

regulation of body temperature, blood glucose and water balance in animals by homeostatic mechanisms, including stimulus-response models, feedback loops and associated organ structures

Question 4d (3 marks)
Complete the figure below to illustrate the body's response to low blood glucose levels. The final step has been completed for you.



Answer:



Marking Protocol:
One mark for each correct description of a step.

Stem cell research offers great potential for the treatment of certain diseases; however, due to the use of embryonic stem cells, it has also sparked controversy and ethical debates. Embryonic stem cells are sourced from a growing embryo, and as a result, the embryo is lost.

properties of stem cells that allow for differentiation, specialisation and renewal of cells and tissues, including the concepts of pluripotency and totipotency

Question 5a (2 marks)
Stem cells are categorised based on their potency.

What is the potency of embryonic stem cells and why does this make them particularly useful for research?

Answer:

- *Stem cells are pluripotent.*
- *This makes them useful for research as they have the capacity to differentiate into a wide variety of different types of cells and, therefore, they can be used to regenerate tissue.*

Marking Protocol:
One mark for each of the above points.

Properties of stem cells that allow for differentiation, specialisation and renewal of cells and tissues, including the concepts of pluripotency and totipotency

Question 5b (2 marks)
How does the potency of embryonic stem cells compare to the potency of stem cells that can be found in adult bone marrow?

Answer:

- *The stem cells that are found in bone marrow are multipotent whereas embryonic stem cells are pluripotent, which means the potency of bone marrow cells is lower.*
- *This means that they are limited in terms of the number of different cell types into which they can differentiate.*

Marking Protocol:
One mark for each of the above points.

properties of stem cells that allow for differentiation, specialisation and renewal of cells and tissues, including the concepts of pluripotency and totipotency	**Question 5c** (2 marks) Bone marrow transplants are an effective treatment for some blood cancers like leukemia. Explain why this is the case.	**Answer:** • *In people with blood cancers, the blood cells are affected.* • *All blood cells differentiate from stem cells in the bone marrow; bone marrow transplants provide patients with a supply of healthy stem cells that can mature/differentiate into non-cancerous blood cells.* **Marking Protocol:** One mark for each of the above points.

Analyse and evaluate bioethical issues using relevant approaches to bioethics and ethical concepts, including the influence of social, economic, legal and political factors relevant to the selected issue	**Question 5d** (3 marks) The decision of whether or not to harvest embryonic stem cells is influenced by the principles of bioethics. How might the principles of non-maleficence, respect and beneficence be used to argue against this form of stem cell research?	**Answer:** • *Non-maleficence is the avoidance of causation of harm, and it can be argued that harvesting embryonic stem cells harms the embryo as it causes it to perish.* • *Beneficence is the commitment to maximising benefits and minimising the risks and harms, and it could be argued that harming embryos, which could, if implanted, become a viable person, outweighs their potential benefit in using them for research purposes.* • *Respect considers the extent to which living things have an intrinsic value, and it could be argued that although embryos are essentially a cluster of cells and lack a recognisable human form, they are still alive and human to some extent and, so, destroying them for research is unethical.* **Marking Protocol:** One mark for each of the above points. N.B. Any other reasonable response should be accepted.

VCE UNIT 1 BIOLOGY

Written Examination

ANSWER SHEET – 2024

Student name:	

Use a **PENCIL** for **ALL** entries. For each question, shade the box which indicates your answer.

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

NO MARK will be given if more than **ONE** answer is completed for any question.

If you make a mistake, **ERASE** the incorrect answer – **DO NOT** cross it out.

1	A	B	**C**	D
2	A	**B**	C	D
3	**A**	B	C	D
4	**A**	B	C	D
5	A	B	C	**D**
6	A	B	**C**	D
7	A	B	C	**D**
8	A	**B**	C	D
9	**A**	B	C	D
10	A	B	C	**D**

11	A	B	**C**	D
12	**A**	B	C	D
13	A	B	**C**	D
14	A	**B**	C	D
15	A	**B**	C	D
16	A	B	**C**	D
17	A	**B**	C	D
18	A	B	**C**	D
19	A	**B**	C	D
20	A	B	**C**	D

21	A	B	C	**D**
22	A	**B**	C	D
23	A	B	C	**D**
24	**A**	B	C	D
25	A	B	**C**	D