

VCE Biology Unit 1

Written Examination

Suggested Solutions

SECTION A – MULTIPLE-CHOICE QUESTIONS

1	<input type="checkbox"/> A	<input type="checkbox"/> B	<input type="checkbox"/> C	<input checked="" type="checkbox"/> D
2	<input type="checkbox"/> A	<input type="checkbox"/> B	<input checked="" type="checkbox"/> C	<input type="checkbox"/> D
3	<input type="checkbox"/> A	<input checked="" type="checkbox"/> B	<input type="checkbox"/> C	<input type="checkbox"/> D
4	<input checked="" type="checkbox"/> A	<input type="checkbox"/> B	<input type="checkbox"/> C	<input type="checkbox"/> D
5	<input type="checkbox"/> A	<input type="checkbox"/> B	<input checked="" type="checkbox"/> C	<input type="checkbox"/> D
6	<input type="checkbox"/> A	<input type="checkbox"/> B	<input type="checkbox"/> C	<input checked="" type="checkbox"/> D
7	<input checked="" type="checkbox"/> A	<input type="checkbox"/> B	<input type="checkbox"/> C	<input type="checkbox"/> D
8	<input type="checkbox"/> A	<input checked="" type="checkbox"/> B	<input type="checkbox"/> C	<input type="checkbox"/> D
9	<input type="checkbox"/> A	<input checked="" type="checkbox"/> B	<input type="checkbox"/> C	<input type="checkbox"/> D
10	<input checked="" type="checkbox"/> A	<input type="checkbox"/> B	<input type="checkbox"/> C	<input type="checkbox"/> D
11	<input type="checkbox"/> A	<input type="checkbox"/> B	<input type="checkbox"/> C	<input checked="" type="checkbox"/> D
12	<input type="checkbox"/> A	<input checked="" type="checkbox"/> B	<input type="checkbox"/> C	<input type="checkbox"/> D
13	<input type="checkbox"/> A	<input type="checkbox"/> B	<input checked="" type="checkbox"/> C	<input type="checkbox"/> D
14	<input type="checkbox"/> A	<input type="checkbox"/> B	<input type="checkbox"/> C	<input checked="" type="checkbox"/> D
15	<input type="checkbox"/> A	<input type="checkbox"/> B	<input checked="" type="checkbox"/> C	<input type="checkbox"/> D
16	<input type="checkbox"/> A	<input type="checkbox"/> B	<input checked="" type="checkbox"/> C	<input type="checkbox"/> D
17	<input checked="" type="checkbox"/> A	<input type="checkbox"/> B	<input type="checkbox"/> C	<input type="checkbox"/> D
18	<input checked="" type="checkbox"/> A	<input type="checkbox"/> B	<input type="checkbox"/> C	<input type="checkbox"/> D
19	<input type="checkbox"/> A	<input type="checkbox"/> B	<input checked="" type="checkbox"/> C	<input type="checkbox"/> D
20	<input type="checkbox"/> A	<input checked="" type="checkbox"/> B	<input type="checkbox"/> C	<input type="checkbox"/> D
21	<input type="checkbox"/> A	<input type="checkbox"/> B	<input type="checkbox"/> C	<input checked="" type="checkbox"/> D
22	<input type="checkbox"/> A	<input type="checkbox"/> B	<input checked="" type="checkbox"/> C	<input type="checkbox"/> D
23	<input type="checkbox"/> A	<input checked="" type="checkbox"/> B	<input type="checkbox"/> C	<input type="checkbox"/> D
24	<input type="checkbox"/> A	<input type="checkbox"/> B	<input type="checkbox"/> C	<input checked="" type="checkbox"/> D
25	<input type="checkbox"/> A	<input checked="" type="checkbox"/> B	<input type="checkbox"/> C	<input type="checkbox"/> D

Question 1 D

D is correct. Mitochondria are membrane-bound organelles that are only present in eukaryotic cells.

A is incorrect. Both prokaryotic and eukaryotic cells are surrounded by a plasma membrane.

B is incorrect. Ribosomes are not surrounded by a membrane and are found in both prokaryotic and eukaryotic cells.

C is incorrect. The fluid component of the cytosol is found in all living cells.

Question 2 C

C is correct. Cell 3 contains more mitochondria than the other cell types; therefore, as mitochondria undergo aerobic cellular respiration, cell 3 would provide more energy for muscle cell contraction.

A is incorrect. A spherical cell would not be able to readily elongate and contract as required by muscle cells.

B is incorrect. A spherical cell would have a smaller surface area to volume ratio than a flattened circular cell, so it would have a comparatively lower rate of exchange.

D is incorrect. All the cells have a nucleus, which is essential to control the contraction process.

Question 3 B

B is correct. Hydrophilic molecules are water-soluble and lipophobic, so they would not be able to pass through the phospholipid bilayer of the plasma membrane.

A is incorrect. Hydrophilic substances are not always large (for example, mineral ions) and they are not lipid-soluble.

C is incorrect. Hydrophilic substances can move both along and against the concentration gradient, but this is not the factor that limits their movement through the membrane.

D is incorrect. The only method of transport that needs energy to be provided by the cell is active uptake. The method used in this instance is facilitated diffusion, which does not require energy.

Question 4 A

A is correct. The diagram shows glucose molecules moving from a higher concentration to a lower concentration via protein channels using protein carriers. This would occur by facilitated diffusion, which does not require the energy provided by ATP.

B is incorrect. The diagram correctly shows the heads of the phospholipid molecules facing outwards and the tails towards each other.

C is incorrect. The diagram correctly shows the glucose molecules passing through the protein channel using protein carriers.

D is incorrect. The diagram correctly shows the glucose molecules moving down the concentration gradient from a higher concentration to a lower concentration.

Question 5 C

C is correct. Villi are present in the duodenum and ileum of the small intestine to increase the surface area for absorption of digested food.

A is incorrect. There are no microvilli in the stomach; the stomach is mainly involved in mechanical and chemical digestion.

B is incorrect. The oesophagus is used in the transport of food from the mouth to the stomach, not in absorption as shown in the diagram.

D is incorrect. The microvilli in the colon are used in the absorption of water and mineral ions, not glucose molecules.

Question 6 D

D is correct. A single chromosome undergoes DNA replication and then separation to either end of the bacterial cell, so each offspring cell contains the same DNA.

A is incorrect. Bacteria do not undergo the stages of mitosis (G1 and G2), so they do not carry out the cell cycle.

B is incorrect. Bacteria have no nucleus-containing chromosomes to undergo the stages of mitosis.

C is incorrect. There is no spindle formation involved in binary fission.

Question 7 A

A is correct. Metaphase would occur between the stages shown in cells X and Y. Therefore, in metaphase, there would be six chromosomes, each made up of two chromatids, as shown in cell X.

B is incorrect. Cell Y shows only two centrioles, one at each pole of the spindle fibre network.

C is incorrect. In metaphase, there would be 12 chromatids as shown in cells X and Y.

D is incorrect. In metaphase, the chromosomes align along the equator of the spindle network. Each chromosome consists of two chromatids joined by a centromere, so there would only be six centromeres.

Question 8 B

B is correct. Cell X is undergoing prophase, as shown by the chromosomes appearing as double-stranded structures. Metaphase would then occur, followed by anaphase. Anaphase is shown in cell Y by the daughter chromosomes separating to the poles.

A is incorrect. The chromosomes have already replicated before mitosis begins, so each chromosome in cell X already consists of two chromatids, as shown.

C is incorrect. Neither cell X nor Y is undergoing cytokinesis, which would occur after anaphase (shown in cell Y).

D is incorrect. The nuclear membrane breaks down during prophase (shown in cell X), so it has already disappeared before the stage shown in cell Y.

Question 9 B

B is not a correct statement and is, therefore, the required response. Apoptosis is innate and genetically determined. Although environmental factors such as toxins and stressors can initiate apoptosis, apoptosis is usually triggered by normal, healthy processes in the body, not factors external to the cell or tissue.

A, **C** and **D** are all correct statements. Apoptosis is defined as a natural, regulatory process of programmed cell death.

Question 10 A

A is correct. If the tumour suppressor genes (TSGs) are non-functional, inhibition of cell division, repair and apoptosis will not occur, resulting in millions of cells forming cancer tissue.

B is incorrect. If the function of proto-oncogenes (POs) was enhanced, the result would be uncontrolled promotion of cell division, not controlled reduction.

C is incorrect. In cancer cells, there is an imbalance in the activities of the two gene types, resulting in too much cell division and too little cell death and inhibition of cell division.

D is incorrect. It is the TSGs that trigger apoptosis, so apoptosis would still occur even if the POs were no longer functioning.

Question 11 D

D is not a correct statement and is, therefore, the required response. Cancer cells are poorly differentiated; they divide so rapidly that they do not become specialised.

A, B and **C** are all correct statements. Cancer cells grow and divide at an abnormally rapid rate, carry out tissue invasion and avoid programmed cell death.

Question 12 B

B is correct. All stem cells are unspecialised, so they are 'neutral' in that they do not have a specific structure or function. They do have the potential to specialise.

A, C and **D** are incorrect. Stem cells can divide over and over many times, can be induced to specialise and can replace cells damaged by illness or injury. However, these facts do not explain why they would be called 'neutral cells'.

Question 13 C

C is correct. Pluripotent stem cells can divide and develop into all cells of the human body (three germ layers), but not into extra-embryonic tissues such as the placenta. Totipotent cells can form all cell types, including both the embryonic and extra-embryonic tissues required for development of the entire organism.

A is incorrect. Pluripotent cells form many cell types, not a limited number of types.

B is incorrect. Pluripotent cells form most cell types, not just blood and bone.

D is incorrect. The names pluripotent and totipotent are not interchangeable. They describe different types of cells with different potentials in terms of the types of cells they can differentiate into.

Question 14 D

D is correct. Although stem cells are found in most adult tissues, they are most abundant in bone marrow and can be collected later in life.

A is incorrect. Although the brain contains stem cells, they are less abundant than in bone marrow.

B is incorrect. Although the pulp inside teeth contains stem cells, they are less abundant than in bone marrow.

C is incorrect. Although the tissue at the base of finger and toe nails contain stem cells, they are less abundant than in bone marrow.

Question 15 C

C is correct. For exchange by filtration in the glomeruli/Bowman's capsules and reabsorption and secretion in the kidney tubules, it is essential that the walls consist of a single layer of flattened cells to provide a large surface area to volume ratio for exchange.

A is incorrect. The spherical shape of the Bowman's capsule would not be the best shape to fit many of them into the small kidneys. The shape provides a greater surface area to volume ratio to aid filtration efficiency.

B is incorrect. The kidney tubules are not cylindrical. They are long, convoluted and looped, providing a huge surface area for exchange.

D is incorrect. The shapes described would not play a role in protection from fluid movement.

Question 16 C

C is incorrect and is, therefore, the required response. Positive feedback results in the response produced increasing the original stimulus. This would result in body temperature being uncontrolled, rather than being thermoregulated by negative feedback and resulting in homeostasis.

A, B and **D** are all correct. These processes could be used to regulate body temperature.

Question 17 A

A is correct. Nerve messages from the hypothalamus in the brain have stimulated the skin arteriole to dilate (become larger) in diameter, which would bring more blood closer to the skin surface for increased heat loss by radiation.

B is incorrect. The pituitary gland sends hormonal messages, not nerve messages, around the body.

C is incorrect. In this case, heat is lost from the skin surface, not gained.

D is incorrect. The skin arteriole has dilated, not constricted (become smaller), in diameter.

Question 18 A

A is correct. When running along the beach, Jim's body would have been carrying out a higher rate of cellular respiration, generating considerable heat. This would increase his body temperature. In response, his body would undergo vasodilation of the skin arterioles to increase heat loss as shown in the diagram.

B is incorrect. Floating in the cold water would result in vasoconstriction as soon as Jim's body temperature dropped below optimum.

C is incorrect. Jim comes out of the cold water and stands on the beach drying himself on a cold, windy day. In these conditions, Jim would cool off quickly, so vasoconstriction is more likely.

D is incorrect. Walking will not generate a lot of heat as the day is cold and windy, which would increase heat loss.

Question 19 C

C is correct. The glands of the endocrine system are all ductless, emptying the hormones they secrete directly into the bloodstream.

A is incorrect. Hormones are mostly made of protein, with some made of lipid.

B is incorrect. Antidiuretic hormone (ADH) is produced by a receptor organ.

D is incorrect. ADH is carried in the blood, not the tissue fluid.

Question 20 B

B is correct. The plasma-ADH concentration begins to increase at 280 pmol/L, so this must be the set point for ADH secretion.

A, C and D are incorrect. These values are either before or after the set point for ADH secretion.

Question 21 D

D is correct. The measurement recorded is the ADH concentration in the blood plasma. The pituitary gland is the endocrine gland that secretes ADH into the blood.

A, B and C are incorrect. These organs are not involved in the secretion of ADH into the blood.

Question 22 C

C is correct. The increase in plasma-ADH concentration occurs before the increase in thirst intensity and will stimulate increased reabsorption of water by the kidney before Nina begins to feel thirsty.

A is incorrect. This option is the opposite of what is expected.

B is incorrect. The two processes share a direct relationship, as observed on the graph.

D is incorrect. Thirst is an important sensation in osmoregulation to stimulate the need to drink.

Question 23 B

B is correct. Water vapour passes from inside the leaf air spaces – where it is a higher concentration – to the outside environment by diffusion along the concentration gradient. For this to happen, the guard cells must be turgid so that the stomata are open.

A is incorrect. Evaporation is not the name of the process described. However, evaporation does occur inside the leaf; liquid water in the moist leaf cell walls changes into water vapour by evaporation, increasing the water vapour concentration in the leaf spaces.

C is incorrect. Osmosis is not the name of the process described. Osmosis is a term used for movement of liquid water. Movement out of the leaf involves gaseous water vapour, so it is referred to as diffusion.

D is incorrect. Radiation is not the name of the process described. Radiation is a term used for heat ray movement, not water vapour.

Question 24 D

D is correct. High light intensity will correlate with an increase in temperature, which would increase the rate of transpiration from the plant through the stomata.

A is incorrect. High humidity means that the water vapour concentration in the air surrounding the plant would increase, and the concentration gradient would decrease, reducing the rate of transpiration.

B is incorrect. If there is no wind, there will be no water vapour blown away from around the leaves. This would not increase transpiration.

C is incorrect. In low temperatures, there will be a low rate of evaporation of water inside the leaves. This would not increase transpiration, as the concentration gradient to the outside of the plant would not increase.

Question 25 B

B is correct. If the xylem is blocked, the water cannot move upwards to the leaves to replace water vapour being lost via transpiration, resulting in severe wilting and probable death.

A is incorrect. A reduction in light available would result in a decrease in transpiration, so wilting would be less likely.

C is incorrect. Plants have large numbers of roots. If just a few roots are broken, the plant should still be able to absorb enough water to prevent wilting.

D is incorrect. Water movement is in the xylem, not in the phloem, which is for transport of sugars and other organic substances.

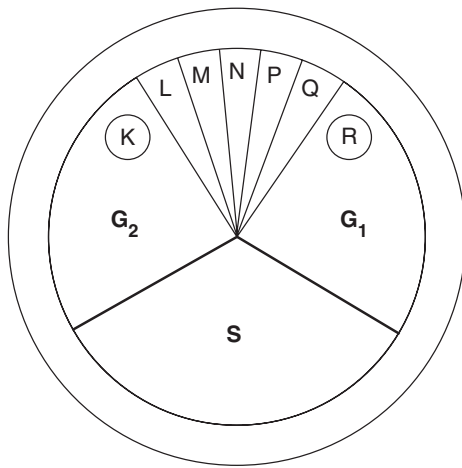
SECTION B

Question 1 (5 marks)

- a. i. cells 1 mark
- ii. The cells contain no membrane-bound nucleus or organelles. 1 mark
- b. i. chlorophyll (*or another pigment that can absorb light*) 1 mark
- ii. oxygen 1 mark
- iii. The process is diffusion. The gas will diffuse from a high concentration in the cells to a lower concentration in the water, then in the air. 1 mark

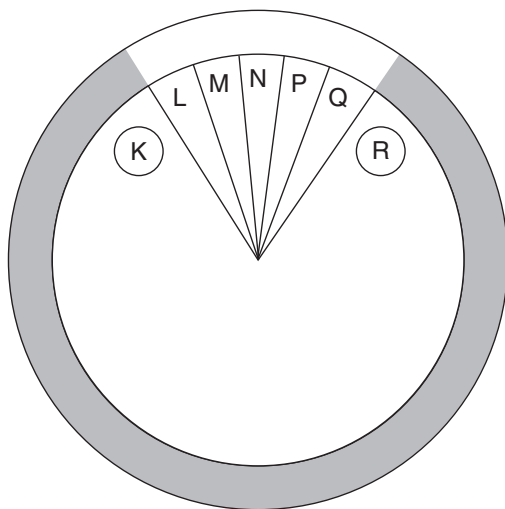
Question 2 (11 marks)

a.



2 marks
1 mark for correct divisions.
1 mark for correct labels.

b.

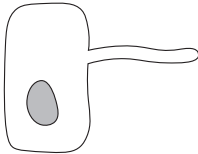




1 mark

- c. 1: A cell at point R will be smaller than a cell at point K. 1 mark
- 2: A cell at point R will contain half the amount of DNA material compared to a cell at point K. 1 mark

- d. i.** It is essential to produce genetically identical daughter cells for growth, repair and replacement. 1 mark
- ii.** In animal cells, the cell will divide by constriction of the plasma membrane, which squeezes in at the centre of the cell and divides the cell into two. 1 mark
- In plant cells, a cell plate will form and then a new cell wall will form across the centre of the cell, dividing the cell into two. 1 mark
- Note: The process occurring at point Q is cytokinesis. The name of the process is not required for full marks.*
- e.** At point K, a check occurs to determine if the chromosomes have replicated correctly and that there are no errors in the DNA structure. 1 mark
- f. 1:** The damaged DNA in the cell could be repaired and the cell cycle could resume. 1 mark
- 2:** If the damage is beyond repair, apoptosis could be induced, resulting in cell death. 1 mark

Question 3 (10 marks)**a.**

Cell type	Diagram of cell type showing key features for its function in water movement in plants	Explanation of how the cell type's key feature aids its functioning
Cell type I: Root hair cell		The extension of the root hair provides a larger surface area to volume ratio for water and mineral ion uptake.
Cell type II: Xylem vessel		Xylem vessels are hollow tubes to allow water to pass through. The ring-shaped thickening (lignin) helps to keep the dead, hollow tube rigid and supported against the force pulling the water up through the xylem vessel.
Cell type III: Guard cell		The thickened inner wall of the cell swells outwards, pulling the inner walls of the stoma apart to allow gaseous exchange.

5 marks

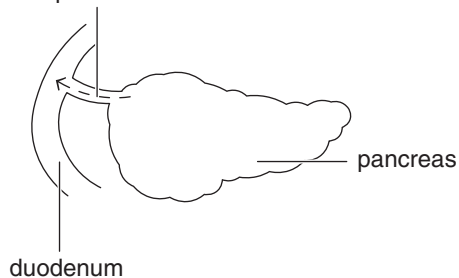
1 mark for each correct cell in the table.

- b. i.** Chloroplasts are present in a guard cell and absent in a root hair cell. 1 mark
A chloroplast's function is to absorb light and carry out photosynthesis, which would not happen in the dark of the soil where roots are located. 1 mark
- ii.** The nucleus is present in a guard cell and absent in a xylem vessel cell. 1 mark
A xylem cell is dead and does not require a nucleus for the function of water movement upwards in the xylem. 1 mark
- c.** The advantage is to provide separate internal compartments where the enzymes and other substrates used in the reactions can be localised to increase the efficiency of the specialised function(s) in the specific microenvironment within each organelle. 1 mark

Question 4 (9 marks)

- a. i.** Ribosomes are the site of synthesis of the enzyme amylase protein. 1 mark
- ii.** *Any one of:*
- The Golgi apparatus modifies and packages amylase protein for secretion.
 - Vesicles transport the amylase protein from the Golgi apparatus to the plasma membrane for secretion.
- 1 mark
- b.** The stomach secretes hydrochloric acid, which makes the region very acidic (pH 1–2). This denatures/destroys the amylase enzyme structure, so amylase action ceases. 1 mark
- c. 1:** Mucus protects the inner lining cells of the stomach from acid and enzyme action. 1 mark
2: Protease enzyme is activated in the acidic environment to begin digestion of proteins. 1 mark

- d.** enzymes enter the duodenum via the pancreatic duct



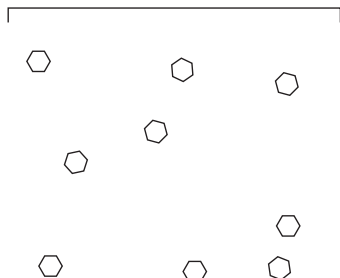
- 1 mark
- e. i.** the liver 1 mark
- ii.** Bile mechanically breaks down (emulsifies) fats/lipids from larger globules into tiny droplets. 1 mark
Enzymes chemically break down larger, more complex molecules into small, simple, soluble molecules. 1 mark

Question 5 (6 marks)

a. i. a phospholipid molecule 1 mark

ii. This represents the two membranes of the glomerulus and Bowman's capsule, each consisting of two layers of phospholipid molecules with their tails facing inwards. 1 mark

b. fluid inside Bowman's capsule



1 mark

1 mark for indicating the presence of amino acids only using the appropriate symbol from the key.

No large plasma proteins (globulin) are shown in filtrate/fluid in the Bowman's capsule as, even though they are hydrophilic, they are too big to pass through any part of the membranes. Amino acids are shown as they are small, water-soluble molecules that can pass through the protein channels in both membranes.

1 mark

c. Yes, Jacob was correct. Amino acids are hydrophilic and can pass through the protein channels of the membranes in a soluble state. 1 mark

d. All the glucose filtered into the glomerular filtrate is reabsorbed in the proximal convoluted tubule. 1 mark

Question 6 (9 marks)

a. insulin 1 mark

b. i. If alloxan destroys the beta cells (cells that produce the insulin hormone) in the pancreas, then the blood-glucose concentration in the rats treated with alloxan will increase and not be regulated. 1 mark

ii. Yes. All factors except the independent variable (treatment of the rats with alloxan or water) were kept the same/constant. (*The controlled variables include the species, age, size and health of the rats and the environmental conditions.*) 1 mark

iii. Rats are mammals and more closely related to humans than chickens. They better model the effects of pancreatic damage in humans. 1 mark

- c. i.** Group A. The blood glucose concentration was unregulated compared to the control group. After treatment, the blood glucose concentration of group A rose to 600mg/dL then dropped to approximately 50mg/dL before rising to over 600mg/dL again. 1 mark
- ii.** hypoglycaemia 1 mark
- iii.** No. The results are not deemed valid as the experiment was not reproduced and the sample size was small. (*However, there was only one independent variable and all factors, except the independent variable, were controlled.*) 1 mark
- iv.** No. There was no replication/repetition and the results were not presented in a format (table) to determine the variance of the data. 1 mark
- d.** The flour containing alloxan may cause damage to the pancreas of the consumer, resulting in diabetes or other related health issues. 1 mark