

Biology Unit 1 2024 Trial Examination**Suggested Answers****Section A – Multiple-choice**

Question	Answer	Explanations and Notes
1	B	Prokaryotes do not contain membrane-bound organelles such as mitochondria. But prokaryotes do contain DNA, membranes (such as the plasma membrane), and ribosomes (which are not membrane-bound).
2	A	Bacillus refers to bacteria which are rod-shaped and Coccus refers to bacteria which are 'spherical.
3	C	A sphere has the smallest surface area to volume ratio. The less spherical a shape is, the greater its surface area will be.
4	B	Rough endoplasmic reticulum (decorated with ribosomes) is involved in the synthesis and transport of proteins. Smooth endoplasmic reticulum is involved in the transport of lipids. Therefore, since plasma cells have a lot more RER, it is reasonable to conclude that they produce and transport many proteins.
5	A	L is the nuclear membrane (or nuclear envelope). M is a nucleolus. N is a food vacuole.
6	C	E is a peripheral protein. F is a carbohydrate chain (or glycolipid if you include the entire molecule). H is cholesterol.
7	D	Because the concentration of mineral salts in the root hairs is high, water will move from outside the root hair, (where there is a relatively low solute concentration), to inside the root hair (where there is a relatively high solute concentration).
8	A	The outputs of photosynthesis in the chloroplast are glucose and oxygen. Glucose moves out of the chloroplast for use by the mitochondria, but it is too large and polar, to leave the chloroplast by simple diffusion, so it passes through a carrier protein, but because it is moving down a concentration gradient, this is called facilitated diffusion. Glucose is not expected to enter the chloroplast during photosynthesis, nor does oxygen as both are outputs. Carbon dioxide does enter the chloroplast, but by simple diffusion, not osmosis.

9	D	Binary fission is a relatively simple cell division in which a single cell gives rise to two identical daughter cells (unless there is a genetic mutation in one).
10	B	Cell 1 is at early prophase. Cell 2 is at anaphase (one can see the chromosomes have been/are being pulled to either pole of the cell, but it is still a single cell and is not being divided into two yet). Cell 3 is at interphase.
11	D	Autophagy is a conserved natural degradation of a cell that allows the orderly degradation and recycling of cellular components—but not in response to a viral infection. Necrosis is another form of cell death, but in it, the cell dies a traumatic and inflammatory death in which the cytoplasm is spilled into the internal environment. Cytokinesis is not a form of cell death.
12	C	Scientists use pluripotent stem cells for stem cell research.
13	A	The cell indicated is a phloem sieve tube cell. Sugars move from leaves to roots through these. Answer D was talking about Xylem vessel cells which are the large cells with heavily lignified cell walls (the cells that look like big white dots, below the arrow). Structural support for the stem is provided by fibres around at the top of the vascular bundle (the very dark-coloured ones) and by the Xylem vessels. None of these cells shown are photosynthetic.
14	C	This is an example of a system, because several different organs are described, and a system is composed of different organs that cooperate to perform a common function.
15	B	Amylase describes enzymes that digest carbohydrates. “amylum” is Greek for starch.
16	D	Glucagon is secreted by alpha cells in the islets of Langerhans in the pancreas when the level of blood sugar/glucose is low. It stimulates liver cells to convert glycogen to glucose and to release glucose to the bloodstream.
17	C	Type 2 diabetes is not an autoimmune disease as Type 1 diabetes is. Rather it is caused by a lack of sensitivity of insulin receptors to insulin. Even though the beta cells in the pancreas secrete insulin, cells do not respond to it. Eventually, the beta cells may wear out and fail to produce insulin, but this is not the primary cause.
18	D	Testosterone is a steroid hormone which means it is a lipid-based (not peptide-based) hormone. Hormones are secreted by endocrine glands, not exocrine glands. It is insulin that stimulates uptake of glucose by liver cells, not testosterone.

19	B	Since the leaves of a water lily float on the surface of the water, if the stomata must be located mostly on the upper leaf surface where they are able to absorb CO ₂ from the air above. The leaf may have a thick waxy cuticle, but this would not cover the stomata, as this would prevent CO ₂ from entering the stomata, defeating the purpose of having stomata.
20	B	This is a classic example of negative feedback in which there is a change in a variable of the internal environment (in this case, blood plasma osmolarity), and a stimulus-response mechanism is initiated that counteracts that change. The response is not a reflex arc as it is not especially fast and involves the brain.

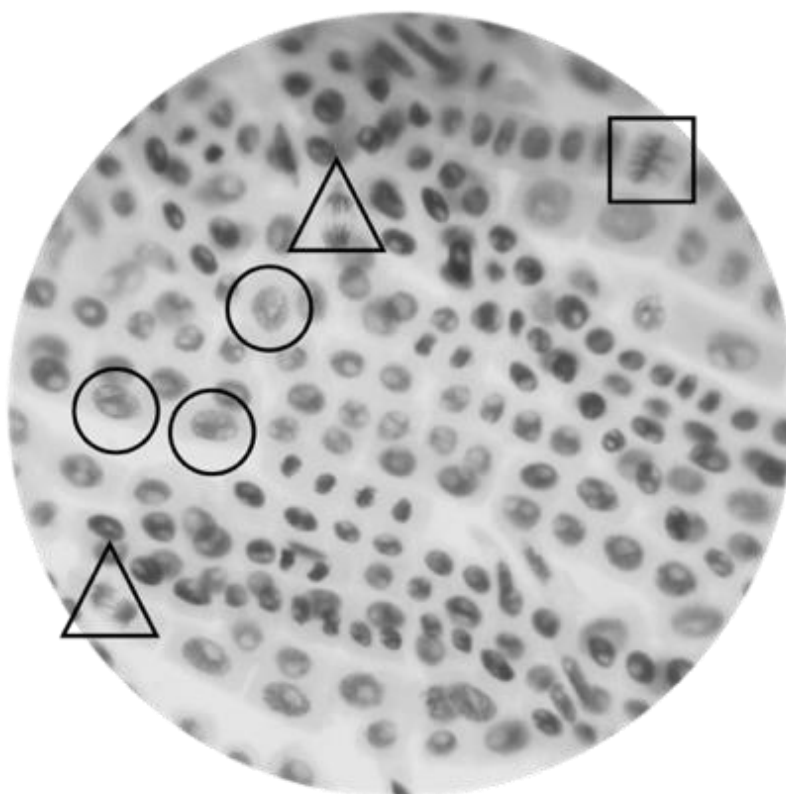
Section B – Short-answer

Question 1.

- a. Eukaryotic means that the cell contains membrane-bound organelles.
- b. There are a number of answers which students could have offered to this question. Suggested answers include Feature 1: the cells were much larger than prokaryotic cells. Feature 2: the cells contained a clearly defined nucleus. Feature 3: the cells contained visible organelles such as mitochondria.
- c. Feature 1: The cells contained thick cell walls, feature 2: The cells contained a large central vacuole. Feature 3: The cells may have contained chloroplasts. Other answers were possible, for example some students may have identified that plant cells tend to be box-shaped whereas animal cells are usually not.
- d. The small size of cells means that they have a very large surface area to volume ratio (1 mark), which makes it much more efficient for the cells to absorb nutrients and gases and to eliminate wastes (1 mark).

Question 2.

- a. The following are suggested answers, but other cells were possible – especially for a. i.



- b. Two of: Chromosomes begin to decondense. The cell begins to divide into two down the centre. The spindle fibre disappears. A nuclear membrane begins to form around the chromosomes.

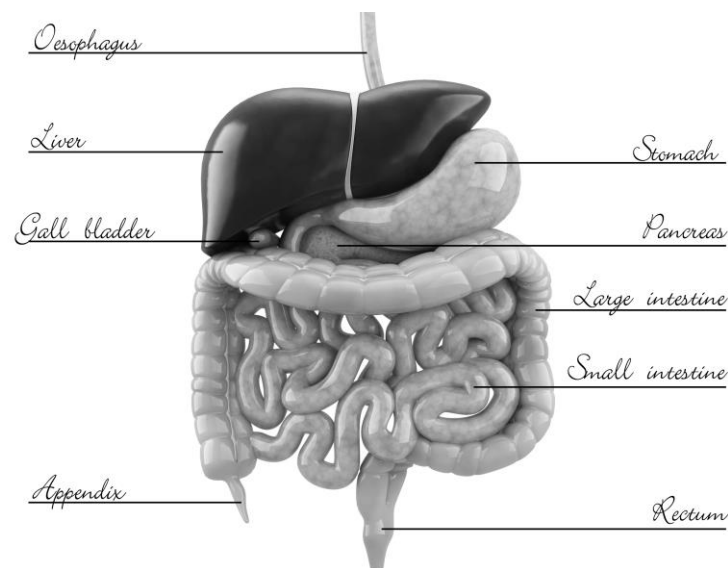
- c. In an onion cell at telophase, a cell plate forms to separate the two cells, whereas in a frog cell a cleavage furrow forms for this purpose OR in an onion cell there are no centrioles to organise the spindle, whereas in a frog cell there are centrioles.
- d. Abdul is correct (1 mark) Once the chromatids of a chromosome separate, they are properly called chromosomes, but in anaphase these are still contained within the one cell, therefore the cell temporarily contains twice as many chromosomes as it did during prophase, even though the amount of genetic material is the same (1 mark).

Question 3.

- a. Apoptosis is a controlled (or 'programmed') form of cell death, in which a cell dies by shrinkage and blebbing without spilling its contents into the extracellular environment (1 mark). During development, apoptosis is important in eliminating unwanted cells such as those between the digits, resulting in separate toes and fingers (1 mark). Therefore, if apoptosis fails, the toes and fingers may stay fused (1 mark).
- b. Apoptosis is also an important mechanism for getting rid of cells that have become cancerous during the life time of an individual (1 mark), therefore a failure in apoptosis is one cause of tumor development in a cancer patient (1 mark).
- c. Caspases are the enzymes responsible for digesting cell contents including the cytoskeleton, leading to cell shrinkage and blebbing.
- d. Intrinsic pathway: compounds escaping from damaged mitochondria (perhaps due to exposure to high energy radiation) can initiate the intrinsic pathway (1 mark).
Extrinsic pathway: signaling molecules (cytokines) released from some immune cells (such as natural killer cells) bind with a receptor on the surface of a target cell, and this signal results in the extrinsic pathway being initiated inside the target cell (1 mark).

Question 4.

- a. One mark awarded for each correct answer.



- b.** The most important function of the small intestine is to absorb the products of digestion from the lumen of the small intestine into the bloodstream.
- c.** For each structural feature, the student must describe a specific structural feature AND explain how it contributes to the function of the small intestine. There are numerous features which could be chosen and if these are accurate and explained, the student should be awarded a mark. The following are three examples.

Structural feature 1: The lining is covered in villi (1 mark). This increases the surface area of the lining, which increases the rate at which food can be absorbed (1 mark).

Structural feature 2: The lining of the intestine has many capillaries (1 mark). This makes it possible for absorbed nutrients to be delivered into the bloodstream (1 mark).

- d.** Water moves up the oesophagus by waves of strong peristaltic contractions of smooth muscle.

Question 5.

- a.** The hypothalamus
- b.** Vasoconstriction of arterioles leading to the skin surface (1 mark). Shivering of skeletal muscles (1 mark).
- c.** When the arterioles leading to the skin surface constrict, blood is diverted deeper in the skin. By increasing the distance between the blood and the air, this reduces the amount of heat being lost through the skin because the temperature gradient from the blood to the cold air outside is lessened. OR Shivering of skeletal muscles uses energy, which results in the muscle cells increasing their rate of cellular respiration. Because heat is a byproduct of cellular respiration this generates heat to warm the body.
- d.** Any two reasonable responses should be awarded 1 mark each. An explanation is not required. Examples of reasonable responses include:
 - Jumping up and down
 - Rubbing hands together
 - Huddling in a ball-like shape
 - Cuddling other skiers
 - Seeking shelter from the wind.

END OF SUGGESTED ANSWERS