

QCE Biology Units 1&2

Paper 1

SECTION 1 – MULTIPLE-CHOICE QUESTIONS

	A	B	C	D
1.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>
2.	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>
3.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>
4.	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>
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8.	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>
9.	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>
10.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>
11.	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
12.	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>
13.	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>
14.	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>
15.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>

	A	B	C	D
16.	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>
17.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>
18.	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>
19.	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>
20.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>
21.	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>
22.	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
23.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>
24.	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
25.	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>

QUESTION 1 D

D is correct. The deoxyribonucleic acid (DNA) in the cytosol of prokaryotes is one circular molecule/chromosome; in eukaryotic cells, the DNA is in a membrane-bound nucleus and consists of several linear DNA molecules/chromosomes. **A** is incorrect. Prokaryotes do have cellular membranes. **B** is incorrect. Yeast cells are not prokaryotes. **C** is incorrect. Prokaryotes do not contain any membrane-bound organelles; mitochondria have membranes, although ribosomes do not.

QUESTION 2 C

C is correct. To make proteins, cells need the coded information in the DNA and the site of protein synthesis, the ribosomes. **A** is incorrect. Both prokaryotes and eukaryotes have DNA and ribosomes where proteins are made. **B** is incorrect. Cells make proteins for structure and cell functioning throughout the lifetime of the cell, not just when the genetic material is dividing. **D** is incorrect. Mitochondria are needed in eukaryotes to provide energy for protein synthesis; however, prokaryotes gain enough energy from anaerobic respiration in the cytosol.

QUESTION 3 D

D is correct. Each division on the calibrated scale is 25 microns and the length of the animal cell is 5 divisions, so $25 \times 5 = 125$ microns long. **A** is incorrect. The organism is 5 scale units long, which must be multiplied by 25 microns. **B** is incorrect. The organism is 5 scale units long, which must be multiplied by 25 microns, not 5 microns. **C** is incorrect. The organism is 5 scale units long, which must be multiplied by 25 microns, not 20 microns.

QUESTION 4 B

B is correct. Various types of vesicles transport proteins from the rough endoplasmic reticulum and the Golgi body for the secretion of the protein from the cell. **A** is incorrect. Only the later two stages of aerobic cellular respiration occur in mitochondria. **C** is incorrect. The nuclear instructions are also important for protein synthesis, not just for secretion. **D** is incorrect. The smooth endoplasmic reticulum synthesizes lipids that will be used within the cell, not secreted out of the cell.

QUESTION 5 A

A is correct. Even though more substrate molecules are available at higher substrate concentrations, all the active sites of the enzyme molecules are occupied, so the reaction remains at a constant rate. **B** is incorrect. The substrate concentration is increasing from 0.5% to 0.8%, so it has not all been used up. **C** is incorrect. Substrate is not produced. **D** is incorrect. All or most of the enzymes continue to be recycled and available.

QUESTION 6 C

C is correct. The highest production of adenosine triphosphate (ATP) in aerobic cellular respiration occurs in the third stage, the electron transport chain, on the cristae and produces 32 or 34 ATP per glucose molecule. **A** is incorrect. No further ATP is produced in the second stage of anaerobic respiration. **B** is incorrect. The Calvin cycle is for photosynthesis; the alternative name for the Krebs cycle is the citric acid cycle. **D** is incorrect. All living cells carry out glycolysis.

QUESTION 7 B

B is correct. The gall bladder stores bile, which is a metabolic product from the breakdown of red blood cells in the liver, and releases it for mechanical breakdown of fats in the duodenum. **A**, **C** and **D** are incorrect. Bile plays no role in blood glucose regulation, protein digestion or glycogen storage.

QUESTION 8 C

C is correct. Amylases, also called carbohydrases, are the group of enzymes that speed up the chemical breakdown of complex carbohydrates into simpler carbohydrates. They are produced by the salivary glands, pancreas and duodenal wall. **A** is incorrect. The first proteolytic enzyme is produced in the stomach. **B** is incorrect. The liver produces bile, not a lipase enzyme. **D** is incorrect. The pH in the duodenum is around 8.2, which is alkaline.

QUESTION 9 B

B is correct. The difference in concentration gradient for oxygen is $\frac{105}{40}$ mmHg, which is a steeper concentration gradient than that for carbon dioxide at $\frac{45}{40}$ mmHg, so the rate of oxygen diffusion will be faster than the rate of carbon dioxide diffusion. **A** is incorrect. Much of the inhaled oxygen is exhaled. **C** is incorrect. Although nitrogen passes in and out of the lungs during breathing, none of the nitrogen diffuses into the blood. **D** is incorrect. Carbon dioxide passes out of the blood into the air in the alveoli by diffusion, not active transport.

QUESTION 10 D

D is correct. Bone cells are multipotent, which means they are unspecialised and can multiply continuously but can differentiate into only a few cell types, not many types as if they were pluripotent. **A**, **B** and **C** are incorrect. Bone marrow cells are not mature, specialised or totipotent.

QUESTION 11 A

A is correct. Guard cells and mesophyll (both palisade and spongy mesophyll) contain chloroplasts and can carry out photosynthesis. **B** is incorrect. Water vapour always exits through the stomata, never entering through the stomata, even on a humid day. **C** is incorrect. Movement in the xylem is always towards the leaf cells, never away from the leaf cells. **D** is incorrect. The waxy cuticle is important to reduce water loss but too delicate to act as a protective barrier.

QUESTION 12 C

C is correct. From the graph, the action potential of the axon in diluted sea water (**D**) lasts almost twice the time as in sea water (**W**). **A** and **B** are incorrect. The magnitude of depolarisation and the peak of the action potential are both greater in sea water. **D** is incorrect. The axon in dilute seawater returned to resting potential slower than the axon in normal seawater.

QUESTION 13 B

B is correct. About 60% of the body's heat energy is produced from the aerobic cellular respiration in most cells from the breakdown of glucose. **A** and **D** are incorrect. Brain regulation and gaseous exchange do not contribute heat. **C** is incorrect. It is not the contraction of the muscles that generates significant heat; rather, it is the cellular respiration that provides the energy needed for contraction of the muscle cells.

QUESTION 14 B

B is correct. Aestivation is a behaviour displayed by animals during summertime when they go into a state of dormancy to avoid the hot and dry environmental conditions; their body rhythms slow down so that they do not gain as much heat due to the lower metabolic rate. **A** is incorrect. Insulation is a structural mechanism, but it reduces heat loss and does not increase heat gain. **C** is incorrect. Countercurrent heat exchange results in reduced heat loss. **D** is incorrect. Kleptothermy (huddling to reduce surface area to volume ratio and thereby heat loss) is a behavioural thermoregulatory mechanism, not a structural mechanism.

QUESTION 15 D

D is correct. The stomata of the mesophyte plant are fully open at 12 pm in the 24-hour period, so the guard cells must be swollen/turgid. **A** is incorrect. The stomata of plant Z, the xerophyte, are closed during the day, so little evaporation will occur to cool the plant. **B** and **C** are incorrect. Plant Z is the xerophyte, as it displays an inverted stomatal pattern, and its stomata are smaller at night than during the day.

QUESTION 16 C

C is correct. For sharks to be osmoconformers, they must maintain an internal environment equal in osmotic concentration to their external environment. **A**, **B** and **D** are incorrect. They describe possible mechanisms of water/ion balance in a shark, but do not indicate that the result must be an isotonic internal environment.

QUESTION 17 D

D is correct. Cytosol is the fluid inside living cells, and cells are not considered part of the internal environment of the mammalian body. **A**, **B** and **C** are incorrect. The interstitial fluid, blood and lymph are part of the internal environment of the mammalian body.

QUESTION 18 C

C is correct. Once the indoleacetic acid (IAA) hormone binds to specific IAA receptors located on regions of the roots and shoots, this signalling molecule will activate transfer of the message through the cell in signal transduction, which will result in a cellular response. **A** is incorrect. Specific receptors for IAA are only found on some cells. **B** is incorrect. The hormone travels from a receptor to an effector. **D** is incorrect. The hormone does not cause a negative feedback response.

QUESTION 19 C

C is correct. The breakdown of the neurotransmitter occurs between two neurons, so it must occur during transmission in the tissue fluid of the synapse. **A**, **B** and **D** are incorrect. The breakdown does not occur in the pre- or post-synaptic neuron, nor during release of the neurotransmitter from the vesicles.

QUESTION 20 D

D is correct. Prions are only made of abnormal and infectious protein; unlike a virus, they contain neither DNA nor RNA. **A** is incorrect. Prions do not contain DNA or RNA. **B** and **C** are incorrect. Both prions and viruses are non-cellular in structure and transmissible between hosts.

QUESTION 21 B

B is correct. On the two upper parts of the molecule, there are two antigen-binding sites that are specific in shape to bind antigens. These binding sites are different on specific antibodies. **A** is incorrect. There are only four polypeptide chains, not four pairs. **C** is incorrect. There are only two antigen-binding sites, not four. **D** is incorrect. There are only two light and two heavy chains.

QUESTION 22 A

A is correct. Prostaglandins are lipids made at sites of tissue damage or infection that are involved in dealing with injury by controlling processes such as inflammation and blood flow. **B** is incorrect. Complement proteins stimulate phagocytes and are involved in bacterial cell lysis. **C** is incorrect. Histamines are involved in inflammation and allergic responses. **D** is incorrect. Cytokines are signalling molecules that carry messages between immune cells.

QUESTION 23 D

D is correct. Bacteria are pathogens that cause infectious disease that can be transferred from one host to another, so the production of the antibacterial chemical by the mint plant would be a method of reducing infection. **A** and **C** are incorrect. These mechanisms will only deter animals that are herbivores, which does not specifically prevent infectious disease. **B** is incorrect. The toxin scares aphids away and has no effect on infectious disease.

QUESTION 24 A

A is correct. T lymphocytes are made when stem cells differentiate in the bone marrow; they then move to the thymus gland to mature. **B** is incorrect. T lymphocytes are specific in their defense. **C** is incorrect. T lymphocytes are only effective against cellular factors, such as cellular pathogens, cancer cells and transplant cells. **D** is incorrect. T lymphocytes destroy cells by releasing cytotoxins that destroy their cell membrane, not by engulfing and destroying them.

QUESTION 25 B

D is correct. It is important that memory cell levels in the body are kept high in case of exposure to the specific infectious pathogens and to maintain herd immunity within populations. **A** is incorrect. Genetic diseases are not infectious diseases. **B** is incorrect. Antibiotics are only effective for bacteria and some fungi, not all infectious pathogens. **C** is incorrect. Regional and interstate transmission can result in rapid spread as well as international travel, so restricting only international travel will not prevent the spread altogether.

SECTION 2**QUESTION 26 (4 marks)**

For example, any one of:

- **Digestive system:** The small and large intestines have long inner walls folded with villi and microvilli to provide a large surface area. The lining/epithelium is thin and moist for efficient exchange. The intestinal area is well supplied with blood and lymph capillaries for absorption and the transport of digested food, water, and mineral ions.
- **Respiratory system:** Millions of tiny spherical air sacs/alveoli provide a large surface area for the respiratory system. A wall of alveolus is one cell thick, with the inner surface moist for efficient exchange. Each alveolus is surrounded by a network of blood capillaries to carry oxygen and carbon dioxide in the blood efficiently to and from the exchange surface.
- **Vascular system:** Xylem vessels and phloem tubes in vascular bundles divide into smaller and smaller branches throughout the entire plant to provide a large surface area and ensure a branch is close to every plant cell. Holes in walls or moist cell membranes enable efficient exchange of organic substances, water and mineral ions.

[4 marks]

Note: The four characteristics that must be included are a large surface area; a moist, thin layer of liquid; a thin wall/epithelium; and an extensive surrounding network of vessels. Responses must relate these characteristics to one of the given systems to be awarded full marks.

QUESTION 27 (5 marks)

- a) Pyruvate is an essential input for aerobic cellular respiration in the mitochondria. [1 mark]

As there was no pyruvate in the fluid into which the cells were placed initially, they could not proceed with oxygen consumption until pyruvate was added. [1 mark]

- b) electron transport chain [1 mark]

Any one of:

- $H^+ + O_2 + ADP + P_i \rightarrow H_2O + ATP$
- hydrogen ions + oxygen + $ADP + P_i \rightarrow$ water + ATP

[1 mark]

- c) Any one of:

- There was no further reaction occurring to generate the energy to convert any more ADP and P_i into ATP.
- All the NADH and $FADH_2$ generated in glycolysis and the Krebs cycle had been used.

[1 mark]

QUESTION 28 (5 marks)

- a) **Y:** synapse. [1 mark]

Z: neuron / motor neuron / axon of a neuron. [1 mark]

- b) Transmission in area Z is via the method of an electrical impulse that causes an action potential to move along the neuron, [1 mark]
whereas in area Y, the chemical neurotransmitter released from neuron X diffuses through the tissue fluid. [1 mark]
- c) Glands have no tube or duct, secreting hormones directly into the blood. [1 mark]

QUESTION 29 (6 marks)

- a) In the three months before birth, the concentration of antibodies in the foetal blood is steadily increasing, as the foetus is receiving antibodies across the placenta from the mother's blood. [1 mark]
In the three months after birth, the antibody concentration in the baby's blood is decreasing rapidly as the maternal antibodies break down. There may be some maternal contribution in the mother's breast milk; however, the baby is not yet producing its own antibodies. [1 mark]
- b) From three-months old to twelve-months old, the baby will have vaccinations that will stimulate the production of their own antibodies. [1 mark]
Exposure to antigens in their surroundings and from other children will stimulate antibody production in the baby's body. [1 mark]
- c) Since the thymus gland is where T lymphocytes mature, there will be fewer T helper cells to stimulate the B cells. [1 mark]
Due to this, the older person's antibody concentration will decrease. [1 mark]

QUESTION 30 (5 marks)

- a) The redness of the rash is caused by inflammation. [1 mark]
Mast cells release histamines and prostaglandins, which causes blood vessels to dilate, bringing more blood and therefore more phagocytes to the area of infection. The area becomes raised as the blood vessel walls become more permeable for the phagocytes, causing swelling. [1 mark]
- b) **Humoral component:** Specific B plasma cells produce large quantities of antibodies that clump the antigens together (or coat the antigen for removal or precipitate the antigen), marking them to be engulfed and destroyed by phagocytes. [1 mark]
Cell-mediated component: Specific T lymphocytes produce chemicals called cytotoxins/perforin, which pierce the membrane of the bacterial cells destroying them. [1 mark]
- c) *For example:*
Prevent the entry of deer and field mice that may have the specific ticks that carry the Lyme bacteria into Australia or other countries. [1 mark]