

Trial Examination 2009

VCE Biology Unit 3

Written Examination

Suggested Solutions

SECTION A: MULTIPLE-CHOICE QUESTIONS

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

SECTION A: MULTIPLE-CHOICE QUESTIONS**Question 1 D**

The diagram clearly shows that water is moving across the membrane in both directions. The process that this illustrates is osmosis.

Question 2 D

The electron transport chain is embedded in the inner mitochondrial membrane and its role is to move electrons through a series of proteins that leads to the accumulation of hydrogen ions in the space between the two mitochondrial membranes. The other areas are pointing to a nucleus, endoplasmic reticulum and golgi.

Question 3 B

Peptide bonds are the covalent bonds between amino acids in proteins. These bonds are formed during the process of translation that occurs in ribosomes. The endoplasmic reticulum is clearly 'rough' which means out of the four organelles to choose from, this one has ribosomes along it

Question 4 D

Guanine pairs with cytosine to make up $23\% \times 2 = 46\%$ of bases. Of the remaining 54%, half must be thymine because this pairs with adenine, the fourth type of base in DNA.

Question 5 A

A condensation reaction occurs when many of the biological polymers form. Sucrose is a disaccharide and when two monosaccharides combine to make it, water is a by-product. All other responses are examples of breaking larger molecules into smaller ones. These types of reactions are hydrolysis reactions, where water is a reactant.

Question 6 C

Phospholipids have a polar end (circle) which is able to mix with water and non polar tails which face away from water. The most stable arrangement of the phospholipids would be for all the polar heads to face outwards leaving the non polar tails facing inwards away from the water.

Question 7 D

The genome is all the DNA (coding and non coding) found within the cell. Only some of this DNA is expressed as cells are specialized according to which genes are active. However, all the translated proteins within the cell refers to the cell's proteome.

Question 8 D

D correctly shows the enzyme (*E*) emerging unchanged from a reaction in which a substrate (*S*) is converted into products (P_1 and P_2). **C** is written the wrong way round, while **A** and **B** suggest that the enzyme is produced or used up by the reaction.

Question 9 A

In the stimulus-response model, the stimulus is the ultimate cause of the response. In this case, the tack ultimately causes the withdrawal response.

Question 10 C

The control is a version of the experiment where all the experimental variables are present except the variable under investigation. In this case, the variable under investigation is classical music during milking, so this must be absent from the control.

Question 11 C

If control was solely nervous, cutting the nerve to the stomach would stop all steps in gastric digestion, so **A** is incorrect. If control was solely hormonal, all steps would take place despite cutting the nerve, so **B** is also incorrect. The dependence of the first step on nervous coordination, and the independence of the third step, show that both nerves and hormones are involved.

Question 12 D

Although different neurotransmitter substances may operate, synapses in both the CNS and the PNS work in similar ways, and synapses and neuromuscular junctions work in similar ways. Therefore, **B** and **C** are not reasonable explanations, because they do not explain feeling in some patients but not in others. **A** could be a correct explanation of why pain is felt, but it might apply equally to everyone and again does not explain feeling in some patients but not in others. **D** is therefore the best explanation.

Question 13 D

Lymph nodes occur at the junctions between lymph vessels and contain large populations of phagocytes and lymphocytes that destroy bacteria and cell debris present in the lymph. Lymph nodes are not involved in the transport, absorption or excretion of substances, so **A**, **B** and **C** are incorrect.

Question 14 B

T-lymphocytes (T cells) are so called because they mature in the thymus gland. Thymosin is one of several polypeptide hormones secreted by the thymus that control the maturation of T cells (*note: students are not expected to know this*). In mammals, phagocytes and B-lymphocytes are produced in the bone marrow and mature in various locations in the circulatory and lymphatic systems.

Question 15 C

Basophils secrete histamines that cause inflammation. The other three cell types are all phagocytes that engulf and digest pathogens.

Question 16 C

Bacteria do not cause inflammation directly, so **A** is incorrect. The histamines secreted by basophils make capillaries 'leaky', so that the antibodies contained in plasma reach the infected tissue in large amounts. Phagocytes can also leave the capillaries to destroy bacteria at the site of infection. This produces pus, a mixture of living and dead bacteria, body cells and phagocytes. However, **B** and **D** are incorrect because increased phagocytosis and pus formation are the consequences, not the causes, of inflammation.

Question 17 B

Vaccination is a form of 'artificial infection' where the body's specific immune response and 'immunological memory' is activated by the deliberate injection or ingestion of antigens. This differs from natural infection by a pathogen, so **A** is incorrect. Passive immunity is acquired when antibodies are injected or ingested. These antibodies destroy pathogens but do not activate an immune response, so **C** and **D** are incorrect.

Question 18 **A**

D is incorrect because prions are proteinaceous infectious particles that do not contain nucleic acids. They cause proteins in brain cells to become mis-folded and non-functional, leading to spongiform encephalopathies, such as Creutzfeldt–Jakob disease (CJD). **B** and **C** are incorrect because prions are not blood toxins or viruses.

Question 19 **C**

Mammals generally respond to a reduction in temperature by increased shivering and (if the reduction is prolonged) an increase in respiratory and basal metabolic rates, so **A**, **B** and **D** are incorrect. Increased blood flow close to the skin surface is a means of losing heat as a homeostatic response to higher temperature. The opposite response could be expected in this case.

Question 20 **A**

In the context of this question, competitive inhibition is when a chemical with a shape similar to the ligand ‘competes’ with the receptor binding site. As a result, the effect of the ligand is reduced. This is often the functional mechanism of many drugs.

Question 21 **C**

The process of signal transduction in the context of this diagram is for a gene to be expressed. **A** is incorrect because the proteins activated as a result of signal transduction would usually lead to transcription (rather than translation). **B** is incorrect as a reflex response would need to be very fast and the process illustrated would be far too slow. **D** is incorrect because if the response was to increase ligand secretion, this would lead to negative feedback.

Question 22 **D**

Steroid hormones are classified as lipids, and are therefore lipid soluble, this eliminates **A** and **C**. As oestrogen would be lipid soluble it would probably dissolve through the phospholipid membrane and bind to a receptor in the cytosol, so **D** is correct.

Question 23 **B**

This is a graph interpretation question where the student needs to choose the correct line, which shows the LH peaking at about day 14.

Question 24 **C**

If menstruation is towards the end of the cycle, the only logical stimulus would be the changing progesterone levels. The corpus luteum starts to degenerate without conception and this is the structure that secretes progesterone after ovulation. As the corpus luteum degenerates the amount of progesterone decreases and the uterine lining begins to degrade and menstruation begins.

Question 25 **B**

A polyvalent antivenin must contain a variety of antibodies so it could be used to treat a bite from an unknown snake. This excludes **A** and **D** as the answer. Even though **A** has the correctly shaped antibody, the mixture is not polyvalent. Only mixture **B** includes an antibody that could bind to the toxin.

SECTION B: SHORT-ANSWER QUESTIONS**Question 1**

- a. i. ATP and NADPH⁺ (or NADPH) 1 mark
 ii. carbon dioxide 1 mark
- b. i. light intensity 1 mark
 ii. The enzymes controlling photosynthesis are at or near their optimum temperature. 1 mark
 iii. carbon dioxide concentration in the atmosphere 1 mark
- c. The rate of photosynthesis is high at wavelengths when the absorption by the pigment is low.
 OR
 The rate of photosynthesis is high at wavelengths such as 450 nm and 650 nm where the absorption is low. 1 mark

Total 6 marks

Question 2

- a. It is catabolic because a complex molecule (the amino acid) has been broken down into simpler molecules (including ammonia). 1 mark
- b. Ammonia produced by the breakdown of urea has changed the pH/produced a alkaline solution. 1 mark
- c. i. the optimum temperature is around 35 °C because ammonia/the blue colour/an alkaline solution was produced
 OR
 the urea was broken down in only 5 seconds. 1 mark
 ii. it takes 28 seconds longer at 55 °C
 OR
 it takes 33 seconds at 55 °C compared with 5 seconds at 35 °C 1 mark
 AND
 because at temperatures above the optimum, urease molecules become denatured and lose their enzymic function. 1 mark
- d. These are experimental controls 1 mark
 included to show that the blue colour is due solely to the breakdown of urea by urease. 1 mark

Total 7 marks

Question 3

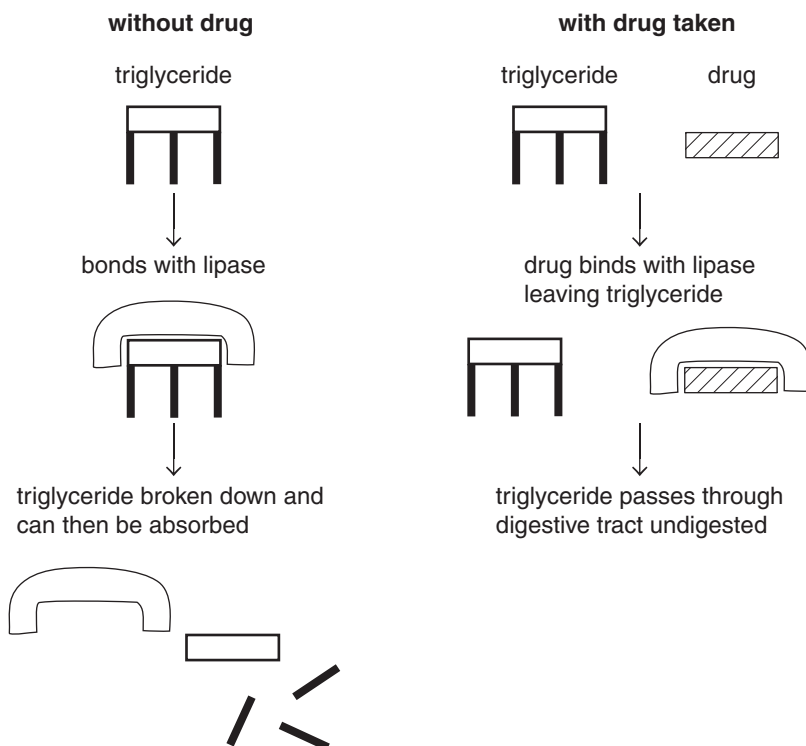
- a. i. Ribose is a pentose sugar that is one of the components of RNA nucleotides. 1 mark
- ii. As G6PD is an enzyme (protein), it is synthesized at the ribosomes. 1 mark
- iii. When more than one polypeptide combines to make the functional protein it is referred to as the quaternary level of arrangement. 1 mark
- b. i. An individual with favism would have a negative spot test (no fluorescence) 1 mark
- ii. An individual without favism would have G6PD and so would produce 6-phosphogluconate 1 mark
this in turn would enable NADPH to couple with resazurin to form the fluorescent resorufin. 1 mark
- c. 2 ATP used and 4 ATP produced leaving a net production of 2 ATP
2 NADH produced
2 Pyruvate produced 2 mark

*Note: Any error in either the number or type of product would lose a mark.
Two errors would gain zero marks.
Total 8 marks*

Question 4

- a. i. saturated fat
OR
triglycerides 1 mark
- ii. one glycerol and three fatty acids (*numbers not essential*) 1 mark

b.



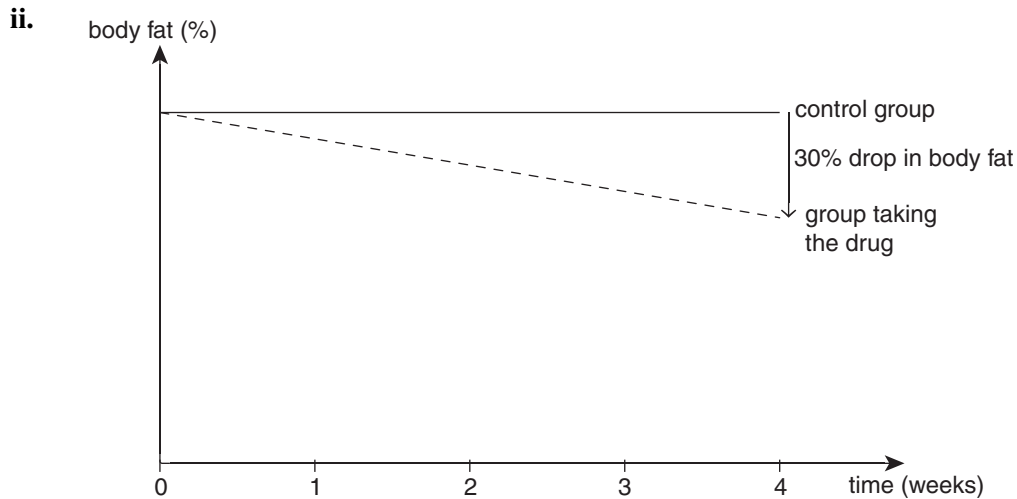
2 marks

*1 mark for diagram illustrating how the drug competes with the enzyme.
1 mark for use of labels to describe the effect.*

- c. i. two groups of people (one group given the drug, the other group a placebo) 1 mark
Mentions any two of the following:

- large numbers (like 100)
- same weight range
- same health status
- repeating the experiment

2 marks



2 marks

1 mark for correct labelling of the axis and inclusion of the control and variable lines.

1 mark showing there is a 30% drop in body fat over four weeks.

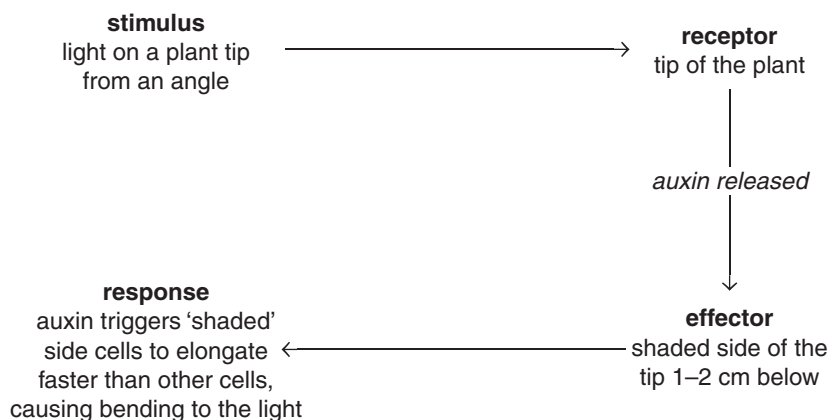
Total 9 marks

Question 5

- a. auxin 1 mark

Note: there are several plant hormones, students should choose one on which to elaborate.

- b. auxin study



2 marks

Note: there are many different stimulus response answers to this question because plant hormones often have a variety of functions.

- c. Auxin binds to receptors in these cells on the 'shade' side. 1 mark

Via signal transduction, 'growth' genes are activated to form proteins that will lead to the cell enlarging. 1 mark

Note: this answer should specifically relate to the answer to Question 5 b. Even auxin within the case study above could have different responses within the same cell.

Total 5 marks

Question 6

- a. i.** transmission due to biting when animals fight during feeding or mating behaviour
OR
transfer of tumour cells shed into carcasses and contacted during feeding 1 mark
because the low infectivity of DFTD suggests that transmission requires direct
or very close contact 1 mark
- ii.** reduction of rates of contact between infected and susceptible individuals, including
quarantine and movement controls 1 mark
- Note: other acceptable answers may include: culling infected individuals; culling all
individuals in a given area; vaccination or similar prophylactic treatment of uninfected
individuals, or; treating infected individuals and releasing them back into the wild.*
- b.** A virus that contains RNA, rather than DNA, as its genetic material 1 mark
- c. i.** The major histocompatibility complex (MHC) is a large group of genes found in most
vertebrates. The proteins encoded by the MHC are expressed on the surface of cells
as 'self' antigens (polypeptide fragments from the cell itself). 1 mark
Cells can also display 'non-self' antigens (e.g. fragments of invading microorganisms)
to phagocytes and lymphocytes that kill or co-ordinate the killing of pathogens, infected
or malfunctioning cells 1 mark
- ii.** Limited genetic diversity means that all devils have very similar genes controlling
formation of MHC proteins. 1 mark
Therefore tumour cells from one devil are recognised as 'self'/not recognised as
'non-self' by another devil and their specific immune response is not activated to
destroy/reject the allograft. 1 mark

Total 8 marks

Question 7

- a.** Pyrogens are released from macrophages once virus-affected cells are recognised as foreign; these raise body temperature to cause fever. 1 mark

Cytokines/interleukins (released by macrophages upon recognition of the viral antigens as foreign) promote vasodilation of blood vessels and increase capillary permeability, causing inflammation. 1 mark

- b. i.** inactivated ('killed') equine influenza virus 1 mark

Note: other accepted commercially available types of equine influenza vaccines include: live 'attenuated' virus, or; an unrelated but genetically modified virus with equine influenza antigens on the capsid surface.

- ii.** Recognition of non-self viral antigens leads to the clonal selection and proliferation of a specific type of B-lymphocyte. 1 mark

These B-lymphocytes produce specific antibodies that bind to viral antigens (on virus particles or presented on the cell membranes of virus-affected cells) and cause their destruction. 1 mark

- c.** Like all influenza A viruses, the equine influenza virus mutates and its antigens change in a process called antigenic drift. 1 mark

The lymphocytes, antibodies and memory cells produced following vaccination are specific to the H3N8 strain of the virus, and will have no effect against a new mutant equine influenza virus. 1 mark

Note: This is why mammals can catch influenza more than once, even in consecutive years, and why human influenza vaccines are changed annually in accordance with predicted antigenic requirements.

Total 7 marks