

Trial Examination 2009

VCE Biology Unit 3

Written Examination

Question and Answer Booklet

Reading time: 15 minutes
Writing time: 1 hour 30 minutes

Student's Name: _____

Teacher's Name: _____

Structure of Booklet

Section	Number of questions	Number of questions to be answered	Number of marks
A	25	25	25
B	7	7	50
			Total 75

Students are permitted to bring into the examination room: pens, pencils, highlighters, erasers, sharpeners and rulers. Students are NOT permitted to bring into the examination room: blank sheets of paper and/or white out liquid/tape. No calculator is allowed in this examination.

Materials supplied

Question and answer booklet of 21 pages.
Answer sheet for multiple-choice questions.

Instructions

Write your **name** and **teacher's name** on this booklet and in the space provided on the answer sheet for multiple-choice questions. All written responses should be in English.

At the end of the examination

Place the answer sheet for multiple-choice questions inside the front cover of this booklet.

Students are NOT permitted to bring mobile phones and/or any other unauthorised electronic devices into the examination room.

Students are advised that this is a trial examination only and cannot in any way guarantee the content or the format of the 2009 VCE Biology Unit 3 Written Examination.

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SECTION A: MULTIPLE-CHOICE QUESTIONS**Instructions for Section A**

Answer **all** questions in pencil on the answer sheet provided for multiple-choice questions.

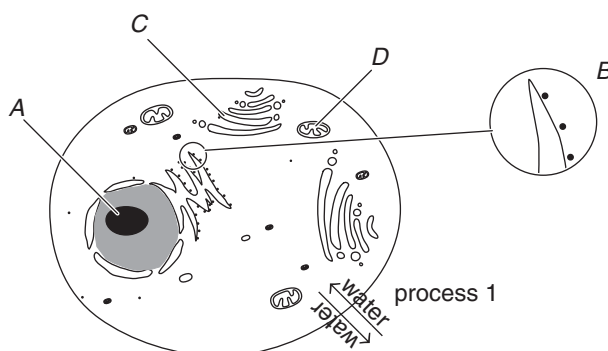
Choose the response that is **correct** for the question.

A correct answer scores 1, an incorrect answer scores 0.

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

No marks will be given if more than one answer is completed for any question.

Questions 1, 2 and 3 refer to the following information.

**Question 1**

Process 1 refers to

- A. facilitated diffusion
- B. active transport
- C. endocytosis
- D. osmosis

Question 2

The site of the electron transport chain would be

- A. structure A
- B. structure B
- C. structure C
- D. structure D

Question 3

The formation of peptide bonds would occur on

- A. structure A
- B. structure B
- C. structure C
- D. structure D

Question 4

Deoxyribonucleic acid (DNA) is a double-stranded polynucleotide found in all living organisms. It can be correctly stated that

- A. DNA contains an equal number of adenine and guanine bases.
- B. if 27% of the bases in the molecule are cytosine, then 23% should be guanine.
- C. DNA contains a number of adenine and thymine bases that equals the number of cytosine and guanine bases.
- D. if 23% of the bases in the molecule are guanine, then 27% should be thymine.

Question 5

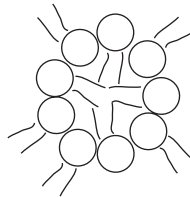
An example of a condensation reaction is

- A. the formation of sucrose from glucose.
- B. the formation of glucose from sucrose.
- C. the production of fatty acids and glycerol from saturated fats.
- D. the liberation of amino acids from muscle fibres when mixed with pepsin.

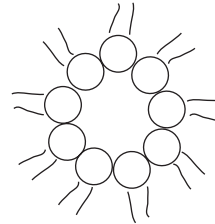
Question 6

The diagram that represents the way in which pure phospholipids extracted from cells would arrange themselves when mixed with pure water is

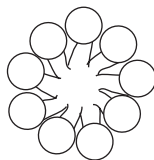
A.



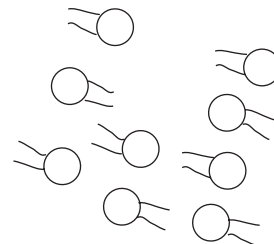
B.



C.



D.

**Question 7**

The difference between a cell's genome and a cell's proteome is that

- A. the genome refers to the entire DNA complement of a cell and the proteome refers only to the genes used by the cell.
- B. the genome refers only to the genes expressed by the cell and the proteome refers to the proteins translated by the cell.
- C. the genome refers to the proteins expressed within the cell and the proteome refers to the way the proteins interact with each other.
- D. the genome refers to the entire DNA complement of a cell and the proteome refers to all the proteins translated by the cell.

Question 8

The equation that correctly describes the result of a reaction involving an enzyme is

(Note: P_1 = product 1, P_2 = product 2, S = substrate, E = enzyme)

- A. $P_1 + S \rightarrow P_2 + E$
- B. $S + E \rightarrow P_1 + P_2$
- C. $P_1 + P_2 + E \rightarrow S + E$
- D. $S + E \rightarrow P_1 + P_2 + E$

Question 9

A student accidentally places her hand on a tack and quickly pulls her hand away.

The tack represents

- A. a stimulus.
- B. an impulse.
- C. a response.
- D. an effector.

Question 10

You are conducting an experiment to test the hypothesis that dairy cows will yield more milk due to raised levels of the milk-producing hormone oxytocin, if they listen to classical music while being milked. Your 20 experimental cows listen to classical music during milking; you collect all their milk and measure the quantity.

Your 20 control cows should be subjected to identical experimental conditions, except

- A. they should listen to classical music all the time, not just during milking.
- B. they should listen to a different type of music, like heavy metal.
- C. they should not listen to any music.
- D. they should not be milked.

Question 11

The secretion of digestive juices in the stomach occurs in three steps.

First, secretion of digestive juices begins when we see, smell or taste food.

Secondly, when food gets to the stomach it stimulates secretion of digestive juice.

Thirdly, when food in the stomach is partly digested there is a decrease in the secretion of digestive juice.

If the nerve to the stomach from the brain is cut, the first step no longer occurs but the second and third steps continue.

This shows that secretion of digestive juice in the stomach is controlled by

- A. nerves.
- B. hormones.
- C. both nerves and hormones.
- D. neither nerves or hormones.

Question 12

Neurotransmitters work at the neuromuscular junctions and synapses. Anaesthetics work either to block the effect or the production and release of neurotransmitters. Most surgical operations involving anaesthetics proceed normally. However, some people claim that they remained 'awake' during surgery despite the use of anaesthetics and felt pain throughout. Unfortunately, anaesthetists and surgeons are not normally able to detect this from their monitors.

The different reactions to anaesthetics could be due to

- A. anaesthetics blocking neurotransmitters in motor neurons, but not sensory neurons.
- B. anaesthetics affecting synapses but not neuromuscular junctions.
- C. the peripheral nervous system and the central nervous system reacting differently to the same anaesthetics.
- D. neurotransmitters or their cell membrane receptors not responding as expected to anaesthetics in every individual.

Question 13

A malfunction of the lymph nodes would most likely interfere with

- A. the release of carbon dioxide into the lymph.
- B. the filtering of glucose from the lymph.
- C. the release of oxygen into the lymph.
- D. the removal of bacteria from the lymph.

Question 14

The main feature of the thymus gland that helps to protect the body against disease is that

- A. it houses decaying lymphocytes and recycles the nutrients within them.
- B. it is the site of maturation of T lymphocytes and the production of thymosin.
- C. it is the site of production and maturation of B lymphocytes.
- D. macrophages and monocytes are produced here and migrate to other tissues of the body.

Question 15

The cell type that is primarily responsible for the inflammatory response is

- A. macrophage.
- B. neutrophil.
- C. basophil.
- D. monocyte.

Question 16

Tissues swell during inflammation because of

- A. the volume of bacteria present in the wound.
- B. the number of blood cells attacking the bacteria.
- C. the increased permeability of capillaries, which causes fluids to accumulate in the area.
- D. the accumulation of pus.

Question 17

Vaccines confer

- A. artificially acquired passive immunity.
- B. artificially acquired active immunity.
- C. naturally acquired passive immunity.
- D. naturally acquired active immunity.

Question 18

People who lived in the United Kingdom between 1980 and 2000 are not accepted as blood donors in Australia.

This precaution is being taken because

- A. their donated blood may contain prions capable of altering protein structures in brain cells.
- B. their donated blood may contain prion toxins that cause blood poisoning.
- C. their donated blood may contain prions capable of causing viral infections.
- D. their donated blood may contain prion DNA that may cause prion replication in brain cells.

Question 19

If an endotherm is exposed to a sudden and prolonged decrease in ambient temperature it is expected that it will experience

- A. a decrease in the rate of oxygen uptake.
- B. a decrease in muscular activity.
- C. a decrease in blood flow to the skin surface.
- D. a decrease in basal metabolic rate (BMR).

The following information refers to Questions 20 and 21.

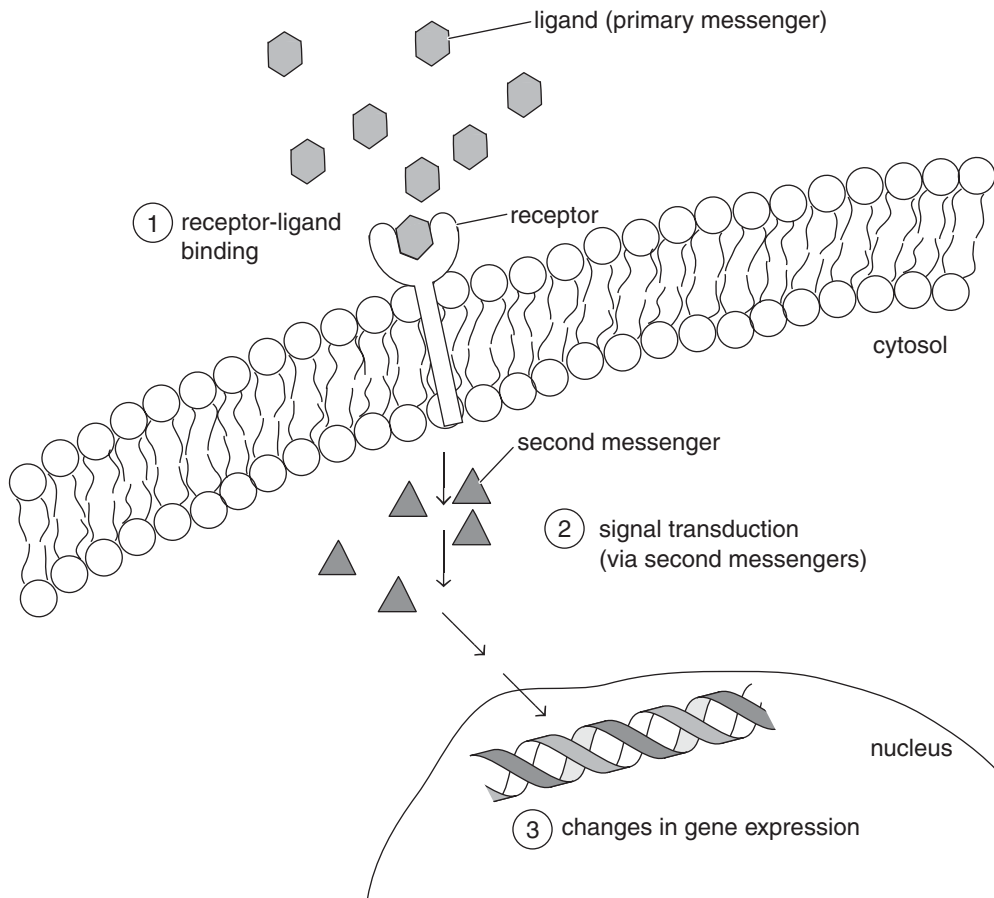


Figure 1 Cellular control

Question 20

The site where competitive inhibition with the ligand could most likely occur would be

- A. at the receptor.
- B. in the nucleus.
- C. on the ligand.
- D. in the cytosol.

Question 21

The impact of signal transduction in this cell could include

- A. the activation of an enzyme that promotes translation.
- B. a muscular contraction as a reflex response.
- C. the internal production of 'suicide' proteins that leads to apoptosis of the cell.
- D. more ligands eventually binding to the cell as a result of negative feedback.

Question 22

Oestrogen is a steroid hormone that initiates a variety of responses.

Oestrogen causes a cellular response by binding to

- A. membrane receptors, as it is not lipid soluble.
- B. membrane receptors, as it is lipid soluble.
- C. receptors in the cytosol, as it is not lipid soluble.
- D. receptors in the cytosol, as it is lipid soluble.

The following information refers to Questions 23 and 24.

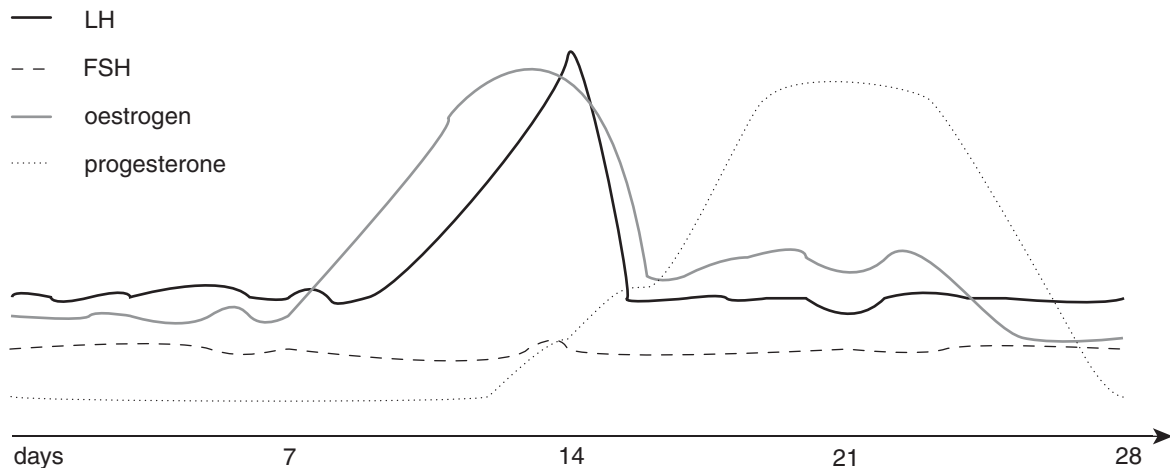


Figure 2 Hormones controlling the human menstrual cycle

Question 23

Ovulation is triggered by a surge in LH.

From the information provided in the graph this occurs on

- A. day 7
- B. day 14
- C. day 21
- D. day 28

Question 24

Menstruation (removal of the thickening of the uterus lining) starts towards the end of the menstrual cycle.

The likely stimulus for this event would be

- A. the raised levels of oestrogen from day 7 to 14.
- B. the increasing levels of progesterone from day 14 to 21.
- C. the decreasing levels of progesterone from day 24 to 28.
- D. the constant levels of FSH throughout the menstrual cycle.

Question 25

Polyvalent antivenin is administered to patients who get bitten by a snake but are unsure of the type of snake inflicting the bite. Each component of the antivenin contains an antibody against the toxin of each snake. A person was bitten by a tiger snake and the toxin is illustrated below in Figure 3.

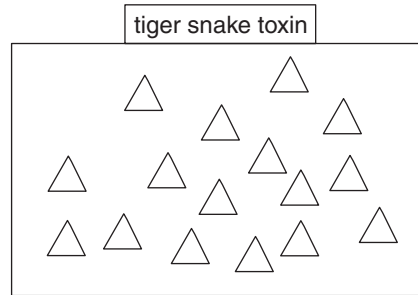
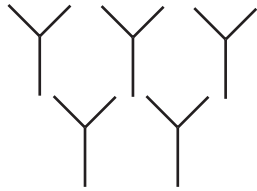


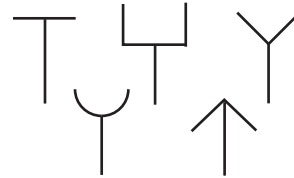
Figure 3

The antivenin mixture that would be successful is

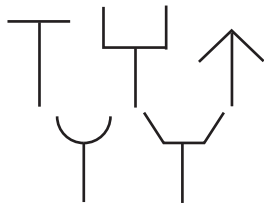
A.



B.



C.



D.



SECTION B: SHORT-ANSWER QUESTIONS**Instructions for Section B**

Answer this section in **pen**.

Answer all questions in the spaces provided.

Question 1

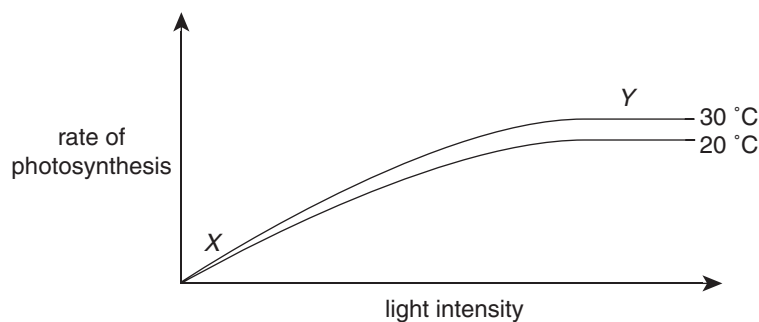
Photosynthesis is the principal biochemical process by which green plants manufacture carbohydrate using light energy. A number of environmental factors affect the rate of photosynthesis.

- a. i. Which two substances, generated by the light-dependent reactions of photosynthesis, are required for carbohydrate production by the plant?

- ii. Which third substance, obtained by the plant from its environment, is also directly required?

1 + 1 = 2 marks

Consider the following graph illustrating the relationship between photosynthesis and light intensity.



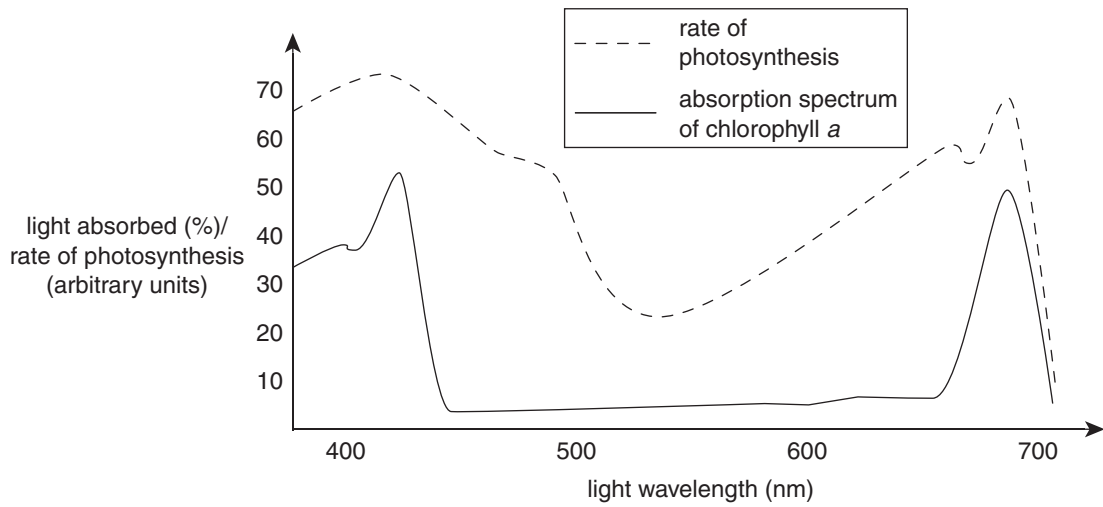
- b. i. What is the factor which is limiting the rate of photosynthesis at point X on the graph?

- ii. Account for the increase in the rate of photosynthesis when the temperature is raised from 20 °C to 30 °C.

- iii. Name an environmental factor which may be limiting the rate at point Y.

1 + 1 + 1 = 3 marks

The following graph shows the absorption spectrum of chlorophyll *a* and the rate of photosynthesis over the same range of wavelengths.



- c. What evidence on the graph indicates that chlorophyll *a* is not the only pigment involved in photosynthesis?

1 mark
Total 6 marks

Question 2

In mammals, excess amino acids absorbed from digested food are metabolised in the liver. Ammonia is removed from each amino acid molecule in a process called deamination. The ammonia is then converted into urea prior to excretion.

- a. State, with a reason, whether deamination is an anabolic or catabolic process.

1 mark

Ammonia can also be produced by the action of the enzyme urease on the substance urea. This reaction produces an alkaline solution, which can be detected using an indicator called bromothymol blue. This indicator is yellow in neutral solution and blue in alkaline solution.

In an investigation, urease was mixed with bromothymol blue. The mixture was divided equally between five test tubes, labelled *A* to *E*. Each test tube was placed in one of five water baths, each at a different temperature. The same quantity of urea was then added to each test tube. The time taken for the contents of each test tube to turn blue was recorded. The results of the investigation are shown in the table below.

Test tube	Temperature (°C)	Time taken for blue colour to appear (s)
<i>A</i>	5	89
<i>B</i>	15	21
<i>C</i>	35	5
<i>D</i>	45	17
<i>E</i>	55	33

- b. Why did the indicator change colour after urea was added to the enzyme?

1 mark

- c. With reference to information in the table

- i. state what you can conclude about the optimum temperature of the enzyme.

- ii. explain why the time taken for the blue colour to appear is different at 55 °C compared to 35 °C.

1 + 2 = 3 marks

- d.** The indicator was also added to a separate sample of urea and to a separate sample of urease. In neither test tube was a blue colour produced.

Explain why the indicator was added to separate samples of urea and urease.

2 marks
Total 7 marks

Question 3

Glucose-6-phosphate dehydrogenase (G6PD) deficiency (commonly called favism) is a disease that can cause anaemia and renal failure. It can be triggered by eating broad beans. G6PD catalyses the conversion of glucose-6-phosphate to 6-phosphogluconate, which is the first step in the pentose phosphate pathway. This pathway forms, amongst other products, the 5-carbon sugar ribose.

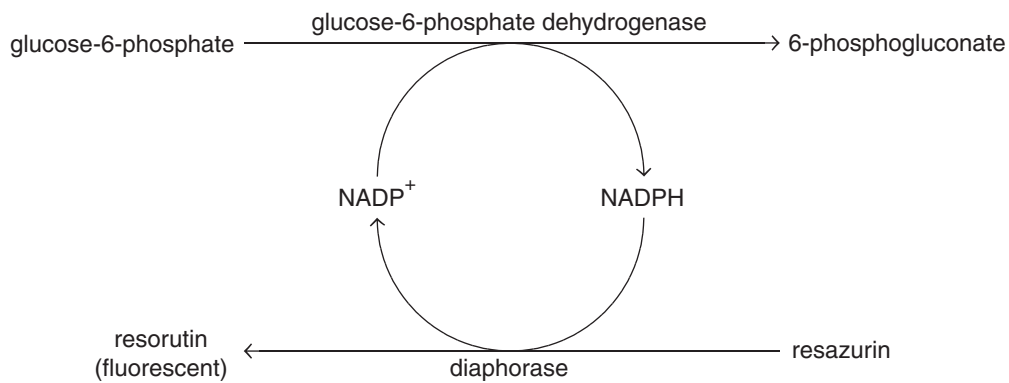
- a. i. What is the main biomolecular importance of ribose?

- ii. Where in the cell is G6PD synthesized?

- iii. The active form of the G6PD protein is made up of either two or four identical subunits. What level of arrangement is this referring to?

1 + 1 + 1 = 3 marks

When there are sufficient grounds to suspect favism, a direct test called the ‘Beutler fluorescent spot test’ can be used to confirm the diagnosis. The diagram below shows the sequence of steps involved in the fluorescent spot test.

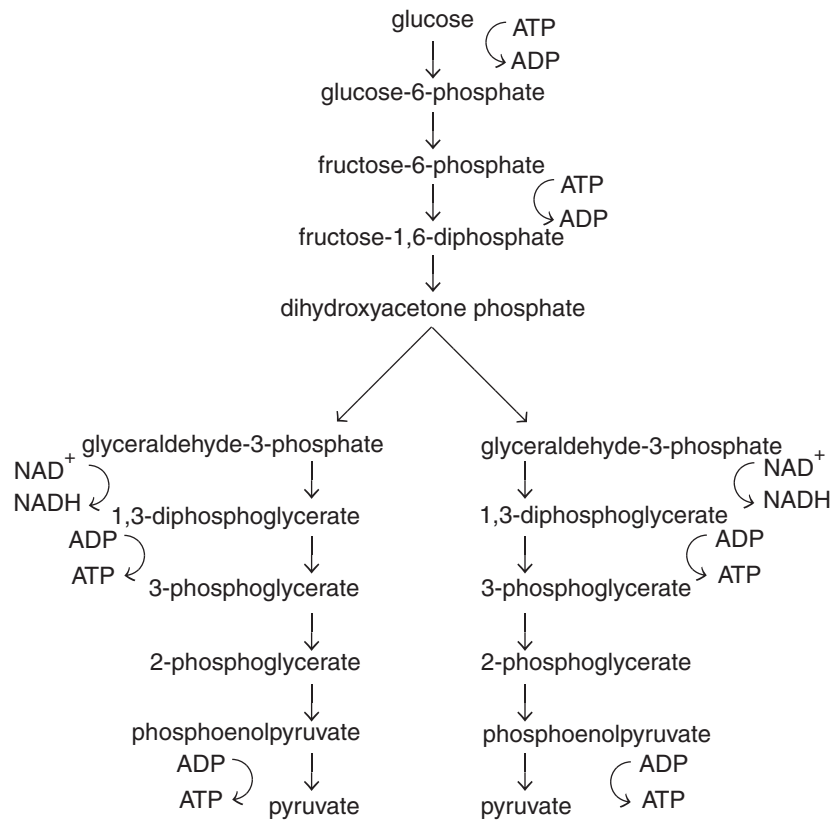


- b. i. Describe the type of test result seen in an individual with favism.

- ii. Explain why a person without favism would produce a different result.

1 + 2 = 3 marks

Glucose 6-phosphate is also part of glycolysis as illustrated in the metabolic pathway below.



- c. State accurately the products generated as a result of the glycolytic breakdown of one molecule of glucose.

2 marks
Total 8 marks

Question 4

Obesity is a condition in which excess body fat has accumulated to such an extent that health may be negatively affected. Rising rates of obesity seem to be a consequence of modern life, with access to large amounts of high calorie food and limited need for physical activity due to technological advancements. Around seven million Australians are now overweight or obese, a figure that is rapidly increasing. It is estimated that, at the current rate of increase, about 75% of the Australian population will be overweight or obese by 2020.

a. i. Name the type of lipid that is the main contributor to obesity.

ii. Describe the biomolecular structure of this type of fat.

1 + 1 = 2 marks

A drug is now available to help some obese patients lose weight. This drug is taken orally and acts by inhibiting gastric lipases. These are enzymes that are involved in the breakdown of dietary fat. When their actions are blocked by the drug, approximately 30% of dietary fat is prevented from being absorbed into the body. In a human trial, this led to a proportional loss in body fat over four weeks.

b. Draw a labelled diagram showing how this drug could have an effect on fat breakdown.

2 marks

c. i. Outline an experimental procedure that would need to be put in place when conducting human trials in order to prove the success of the drug.

3 marks

- ii. On the axes below, draw line graph(s) that support the data obtained as a result of human trials of the drug.



2 marks
Total 9 marks

Question 5

a. Name a plant hormone you have studied during Unit 3 Biology.

1 mark

b. Using a stimulus-response diagram, show how this hormone exerts a specific response in the plant.

2 marks

c. Explain at a cellular level how this particular hormone stimulates this specific type of response.

2 marks

Total 5 marks

Question 6

The Tasmanian devil (*Sarcophilus harrisii*) is a threatened marsupial carnivore that generally feeds on carrion or small prey animals. Conflicts often arise among groups of devils during feeding and mating behaviour. In 1996, Tasmanian devils were photographed in northeast Tasmania with what were apparently large tumours on their faces (Figure 4). This disorder has been named Devil Facial Tumour Disease (DFTD). The tumours prevent animals from feeding, resulting in death from starvation. By 2005, the tumours were occurring on more than half of the range of the species, and were associated with substantial population declines.



© McCallum and Jones 2006

Source: McCallum H, Jones M (2006) To lose both would look like carelessness: Tasmanian devil facial tumour disease. *PLoS Biol* 4(10)

Figure 4

In addition, DFTD does not appear to have spread to isolated captive populations, even in situations where there are adjacent affected wild individuals.

Tumours affect both male and female animals equally but the disease is rare in juveniles. Nearly all devils that succumb do so between two (modal age of first breeding in females) and three years of age.

- a. i.** Use evidence from the text above to suggest the most likely way in which the facial tumours are transmitted from one devil to another.

- ii.** Suggest how transmission of DFTD could be reduced or prevented in wild populations of Tasmanian devils.

2 + 1 = 3 marks

Although a possible cause of DFTD was once thought to be a retrovirus, research has provided evidence to the contrary.

- b.** What is a retrovirus?

1 mark

Devil facial tumours are caused by an allograft that divides in the recipient. An allograft is where tissue is transplanted from a donor of the same species, without the recipient's immune system rejecting the graft. This is exceptionally rare and has probably occurred because of depleted Major Histocompatibility Complex (MHC) diversity in this endangered species.

c. i. Briefly explain the role of MHC proteins in the immune response to infection in mammals.

ii. Use information from the text above to explain why an allograft of tumour cells transmitted to a Tasmanian devil might not be rejected.

2 + 2 = 4 marks
Total 8 marks

Question 7

In August 2007 the Australian horse industry was rocked by an outbreak of equine influenza. This disease is caused by an H3 influenza virus of the subtype H3N8. Attempts were made by the authorities during the epidemic to use vaccination to increase the number of disease-resistant horses.

- a.** Explain why a horse would experience the onset of a high fever and inflammation after contracting equine influenza.

2 marks

- b. i.** Describe one possible form of an effective equine influenza vaccine.

- ii.** Explain how the vaccine would lead to an immune response in a horse.

1 + 2 = 3 marks

- c.** Why is any equine influenza vaccine unlikely to provide a horse with life-long protection against the disease?

2 marks

Total 7 marks

END OF QUESTION AND ANSWER BOOKLET