Neap:

Trial Examination 2016

VCE Biology Unit 3

Written Examination

Question and Answer Booklet

Reading time: 15 minutes
Writing: 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	Suggested time (minutes)
A	25	25	25	30
B	7	7	50	60
			Total 75	Total 90

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 correction fluid/tape.

No calculator is allowed in this examination.

Materials supplied

Question and answer booklet of 19 pages.

Answer sheet for multiple-choice questions.

Instructions

Please ensure that you write **your name** and your **teacher's name** in the space provided on this booklet and in the space provided on the answer sheet for multiple-choice questions.

All written responses must be in English.

At the end of the examination

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

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 2016 VCE Biology Units 3 & 4 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.

Question 1

Which of the following is a biomolecular relationship?

A. Nucleotides are only found in DNA.

B. All hormones are protein.

C. Amino acids make up polypeptides.

D. All lipids are fats.

Question 2

Water has a range of important properties.

One such property is that it is

A. a non-polar molecule.

B. transparent.

C. a good solute.

D. viscous.

Question 3

Haemoglobin is an important oxygen transport protein. It is comprised of two α-polypeptides and two β-polypeptides that are held together by non-covalent bonds.

Haemoglobin is functional at the

A. primary level.

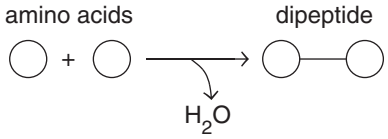
B. secondary level.

C. tertiary level.

D. quaternary level.

Question 4

A chemical reaction is depicted below.



It would be reasonable to say this reaction is

A. a hydrolysis reaction that occurs at the ribosome.

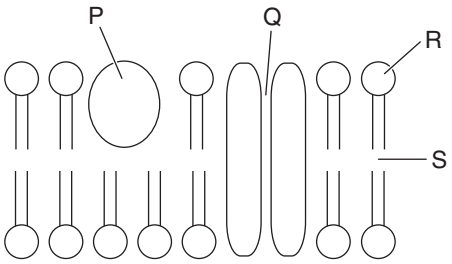
B. a condensation reaction that occurs in the nucleus.

C. an anabolic reaction that could occur in the mitochondria.

D. a condensation reaction that occurs in a vesicle.

Question 5

The diagram below shows a plasma membrane. P to S are areas within the membrane that have various properties.



Which of the following is correct?

A. Q and S are hydrophobic.

B. P, Q and R are hydrophilic.

C. S is lipophobic.

D. R and S are hydrophilic.

Question 6

Which of the following molecules is a protein?

A. sucrose

B. RNA

C. sucrase

D. guanine

Question 7

When comparing the genome with the proteome of an organism, it is appropriate to say

A. the genome and the proteome in a particular cell are the same.

B. the proteome controls the genome within the organism.

C. all of the instructions from the genome are transferred to the proteome at some stage within the organism.

D. the genome in each cell in a particular organism is the same but the proteome is different.

Question 8

Some viruses are called retroviruses and contain RNA as their blueprint. Once inside the host cell, an enzyme called reverse transcriptase converts the RNA into DNA. An RNA retrovirus sequence is shown below.

3′ GAUCAGUCCA 5′

What would the DNA code be for this sequence?

A. 3′ CTAGTCAGGT 5′
5′ GATCAGTCCA 3′

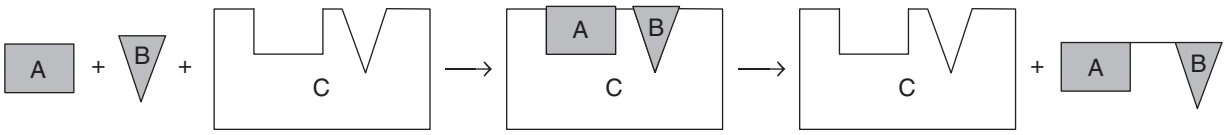
B. 5′ CTAGTCAGGT 3′
3′ GATCAGTCCA 5′

C. 3′ CATGACTGGA 5′
5′ GTACTGACCT 3′

D. 3′ CUAGUCAGGU 5′
5′ GAUCAGUCCA 3′

Question 9

A chemical reaction is shown below.



In this reaction,

A. A and B are initially substrates, and A and B connected together is the product.

B. the enzyme C is no longer functional after the completion of the chemical reaction.

C. the enzyme C looks for the substrates so a chemical reaction can occur.

D. the enzyme C can bind to substrates other than A and B.

Question 10

It is appropriate to say

A. DNA replication occurs in the mitochondria.

B. RNA replication occurs in a chloroplast.

C. lipid biosynthesis occurs in the vacuoles.

D. glycoproteins are manufactured in the nucleus.

Use the following information to answer Questions 11–13.

Five tomato plants were placed into five enclosed Perspex containers and a carbon dioxide probe was inserted into each container. Each plant was exposed to a different temperature and the carbon dioxide levels were measured over a three-hour period. All other environmental conditions were kept constant (including the size of the plant, the light intensity the plants were exposed to, the size of the Perspex container and the initial air quality). The results of the experiment are shown in the table below.

Temperature (°C)	**Change in carbon dioxide levels from the initial amount (ppt)**
10	31 (decrease)
20	102 (decrease)
30	155 (decrease)
40	142 (decrease)
50	25 (decrease)

Question 11

The independent variable in the above experiment is the

A. temperature.

B. light intensity.

C. change in carbon dioxide levels.

D. initial carbon dioxide levels.

Question 12

The reason for the similar change in carbon dioxide levels at 10°C and 50°C is due to the

A. enzymes colliding less frequently with their substrates at both temperatures.

B. photosynthetic rate being higher than the respiration rate at these temperatures.

C. enzymes driving metabolism at these temperatures not functioning at their optimum.

D. enzymes being denatured at these temperature extremes.

Question 13

If the light source was switched off and the changes in carbon dioxide levels were measured, which of the following would be an appropriate measurement after another three hours at 30°C?

A. The results would stay at 155 ppt below the initial amount because the plant is no longer photosynthesising.

B. The results would show more than 155 ppt below the initial amount because the plant is now respiring.

C. The results would move back to the initial level of carbon dioxide because the plant is respiring more than it is photosynthesising.

D. The results would show less than 155 ppt below the initial amount because the plant is only respiring.

Question 14

Testosterone is a lipid hormone that has a range of roles, including stimulating sperm production and increasing muscle protein mass.

It would be reasonable to assume testosterone

A. would be in a higher concentration in the bloodstream than protein hormones.

B. would bind to extracellular receptors at the target cells.

C. moves directly to muscle and reproductive tissues to elicit a response.

D. would bind to intracellular receptors at the target cells.

Question 15

Reaction times in humans are very fast. When a starting pistol fires to begin a running race, it takes less than 0.3 seconds for the stimulus to be detected, processed and an appropriate response (pushing off the starting blocks) to be elicited.

There is no significant difference in reaction times when tall people are compared to shorter people as there

A. are more neurons along the pathway between the CNS and the effector in tall people, making the message faster over a longer distance.

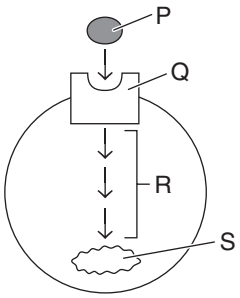
B. are less neurons along the pathway between the CNS and the effector in tall people, making the message travel faster over a shorter distance.

C. are approximately the same number of neurons between the CNS and the effector in tall and short people; however, the motor axons are longer in tall people.

D. is a greater proportion of myelin in tall people, making the nerve message travel faster between the CNS and effector.

Question 16

The diagram below is a model of signal transduction. P, Q, R and S are parts of the process



P, Q, R and S are, respectively,

A. protein hormone; receptor; signal transduction; response.

B. lipid hormone; receptor; signal transduction; response.

C. receptor; protein hormone; signal transduction; response.

D. receptor; lipid hormone; signal transduction; response.

Question 17

Some non-toxic pesticides are proving to be successful at keeping moth (*Euzophera pyriella*) populations in check. A chemical called tetradecadien, which is a natural extract from the moth, has been placed in small amounts into one-way traps. These attract the female moth, which is a pest of many exotic plants.

Tetradecadien would best be described as a

A. pheromone.

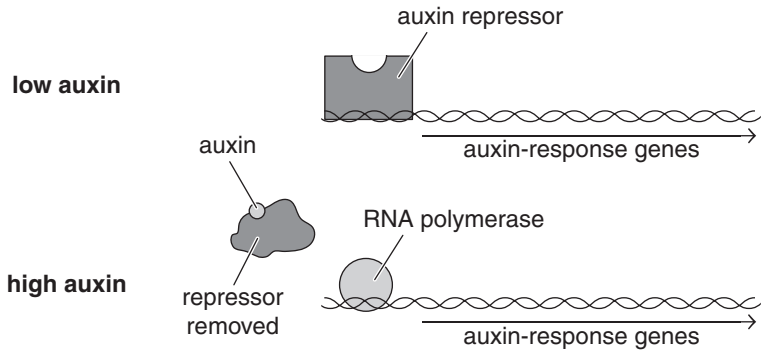
B. hormone.

C. neurotransmitter.

D. plant growth regulator.

Question 18

The diagram below shows the action of auxin on the activation of a group of genes collectively called the auxin-response genes. When the auxin binds to the auxin repressor, a change in shape of the auxin repressor occurs.



Based on the information in the diagram it is reasonable to conclude that

A. auxin is impermeable to plant cell membranes.

B. auxin is a competitive inhibitor of RNA polymerase.

C. one of the auxin-response genes would code for RNA polymerase.

D. auxin and a receptor on the auxin repressor are complimentary to each other.

Question 19

Which of the following is the best way to describe the structure of a virus?

A. a membrane capsule around a nucleic acid core

B. naked DNA inside a protein capsid

C. both DNA and RNA inside a protein shell

D. about the same size as a bacteria

Question 20

Sebum is a secretion from the sweat glands that helps to waterproof the skin as well as providing some defence against skin bacteria and fungal spores.

For the body's capacity to defend itself against pathogens, sebum could be regarded as

A. a physical barrier that reduces the entry of pathogens through the skin.

B. a chemical barrier that reduces the opportunity for potential pathogens to grow on the skin.

C. a second line of defence.

D. an active form of immunity.

Question 21

The levels of a particular antibody were measured in a human regularly for a two-year time period. The results are shown in the table below.

Time measured	Level of antibody
April 2014	0
November 2014	75
April 2015	23
November 2015	155
April 2016	102

From this data it is reasonable to assume

A. the November 2015 antibody levels were due to a second exposure to the antigen.

B. the November 2014 antibody levels were due to a second exposure to the antigen.

C. the April 2015 antibody levels were due to the antigen being present in the body and reducing the antibody levels.

D. there were less memory cells available in April 2016 compared to April 2015.

Question 22

The interaction between a helper T cell and a naive B cell will lead to more coordinated

A. destruction of a viral-infected cell.

B. inflammation due to interleukin secretion from the helper T cell.

C. clonal expansion and differentiation of the naive B cell.

D. apoptosis of the antigen.

Question 23

An example of how artificial passive immunity could be gained would be by

A. receiving the chickenpox vaccine.

B. a baby gaining antibodies through breast milk.

C. getting ill as a result of contracting the swine flu.

D. receiving an injection of antibodies after being bitten by a funnel-web spider.

Use the following information to answer Questions 24 and 25

Multiple sclerosis (MS) is a degenerative neurological disorder that affects about two million people worldwide. There appears to be a combination of factors (genetic and environmental) that lead to its diagnosis. The symptoms of the disorder are a result of the gradual destruction of the myelin-producing cells by the body's own immune system. A cure is a long way off; however, there are a variety of measures that can be taken to slow down the onset of symptoms. In Australia there is a relationship between latitude and incidence of MS. The risk increases as you move south from Queensland through to Tasmania. A link between the incidence of MS and vitamin D deficiency, as well as the herpes virus, has been hypothesised. This may provide scope for preventative measures against MS.

Question 24

Multiple sclerosis is

A. a genetic disease.

B. an autoimmune disease.

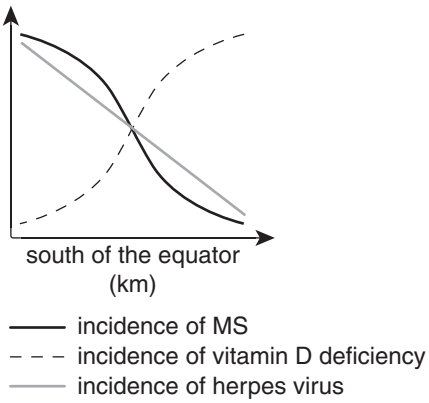
C. an allergic response.

D. an environmental disease.

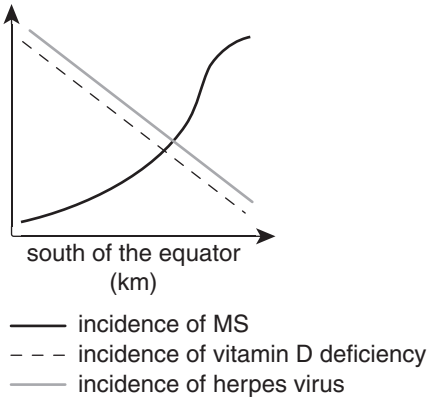
Question 25

Which of the following graphs most closely supports the hypothesis that links vitamin D deficiency and the herpes virus with the incidence of MS? (Note that the units of incidence are not to scale with respect to each other.)

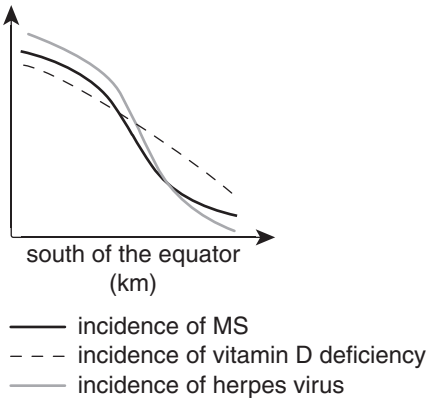
A.



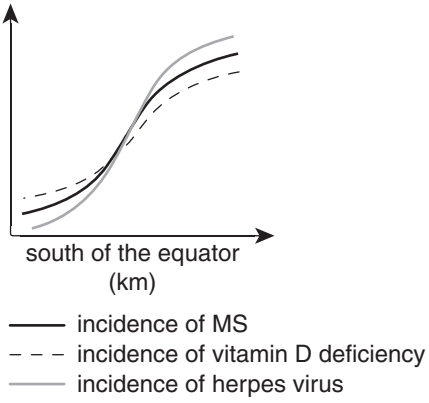
B.



C.



D.



END OF SECTION A

SECTION B: SHORT-ANSWER QUESTIONS

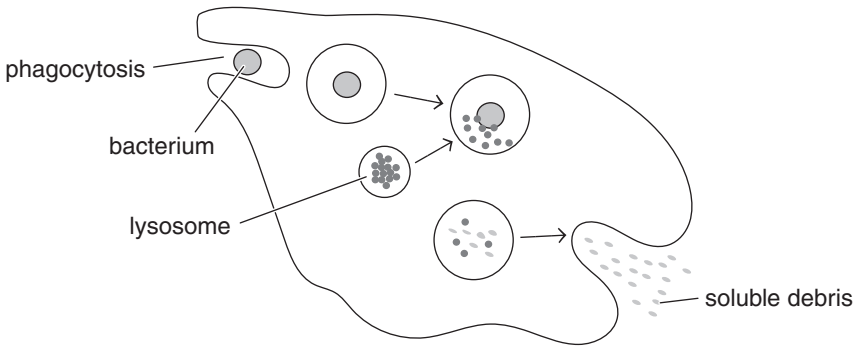
Instructions for Section B

Answer **all** questions in the spaces provided. Write using black or blue pen.

Question 1 (7 marks)

The lysosome is an important organelle in many cells. It is a vesicle filled with digestive enzymes that lyse a variety of biomolecules.

A bacterium is eaten by a macrophage and then the bacterium comes into contact with a lysosome. The diagram below illustrates this interaction.



a. **i.** Complete the table below. 2 marks

Type of enzyme	Substrate	Product(s)
protease		amino acids
glycosidase	polysaccharide	

ii. Name the process that releases the soluble debris from the cell. 1 mark

_____

b. A genetic disease called Pompe disease is characterised by a build-up of glycogen in some cells (muscle cells). This is due to lysosomes lacking the enzyme glucosidase, which is necessary to convert glycogen into glucose.

i. Draw a labelled diagram showing the action of glucosidase in a person without Pompe disease. 2 marks

ii. Describe the symptoms of someone suffering Pompe disease. 2 marks

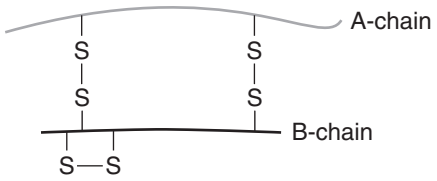
Question 2 (7 marks)

Insulin is a protein hormone that is produced in β cells and secreted from the islets of Langerhans in the pancreas when blood glucose levels are too high.

a. Complete the table below relating to the production, transport and eventual secretion of insulin from a β cell. 2 marks

Organelle	Specific function of the organelle
	site of insulin production
	transport of insulin within the cell
Golgi apparatus	

The human insulin protein is composed of 51 amino acids. It is comprised of two polypeptide chains (an A-chain and a B-chain) which are linked together by disulfide bonds (S—S). The diagram below illustrates the functional protein.



b. **i.** Describe the meaning of the term 'primary level of organisation' with respect to the insulin molecule. 1 mark

ii. Explain the function of the disulphide bonds in the functional insulin protein. 2 marks

c. Describe the relationship between the nuclear DNA of the β cells and the insulin the cell is able to synthesise. 2 marks

Question 3 (8 marks)

Some VCE Biology students were discussing mitochondria with each other. One student, Holly, said that mitochondria were located in heterotrophic eukaryotes but not in autotrophic eukaryotes. However; another student, Morgan, said that mitochondria were found in both heterotrophic eukaryotes as well as autotrophic eukaryotes.

a. Discuss which student is correct and explain your choice. 2 marks

b. **i.** In the space below, draw and label a diagram of a single mitochondrion. 2 marks

ii. On the diagram in part **i.**, show the location of the Krebs cycle and the electron transport chain. 2 marks

iii. Apart from the location of the processes within the mitochondrion, discuss **two** differences between the Krebs cycle and the electron transport chain. 2 marks

Question 4 (9 marks)

The 'flight-or-fight response' is a well-used phrase that relates to how the body responds to emergency situations. Part of the flight-or-fight response involves a nerve response and an endocrine response.

A scenario could be as follows:

Noah is walking across the road without looking for traffic. Unfortunately, a truck was travelling at a speed where it could not stop in time. Noah saw the truck out of the corner of his eye and had enough time to rapidly move backwards out of harm's way. However, a few seconds after evading the truck, Noah's heart started beating very fast due to the action of adrenalin on his heart muscle.

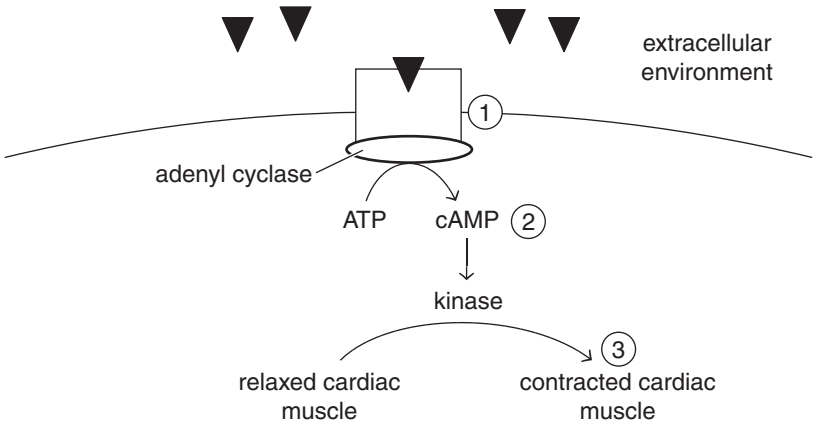
a. **i.** Discuss the type of response that led to Noah moving rapidly backwards. 2 marks

ii. Discuss why the action of adrenalin on Noah's heart muscle was slower than the time it took for him to move backwards. 2 marks

b. Neurotransmitters are important signalling molecules that play a role in the scenario depicted above.

Describe the role neurotransmitters play in the scenario and explain specifically how they carry out their function. 2 marks

c. The action of adrenalin on a heart muscle cell is illustrated in the diagram below.



Explain the steps involved in adrenalin eliciting a response. Make reference to parts 1, 2 and 3 from the diagram and explain the importance of each part with respect to the specificity of the response. 3 marks

Question 5 (5 marks)

Plant growth and differentiation is a very complex process initiated by a vast number of stimuli that cause the secretion of plant growth regulators. Gibberellic acid (GA) is a plant growth regulator that stimulates a wide variety of responses ranging from stem growth to seed germination.

a. Why do some tissues respond to GA but others do not? 1 mark

b. An experiment investigating the effect of changing the concentration of GA on a variety of specialised plant tissues was conducted and the results are shown in the table below.

Type of tissue	Low GA	High GA
stem	slow growth	fast growth
seed	no germination	germination
bud	no flowering	flowering

i. When would it be appropriate for a plant to have a low concentration of GA? Use **one** of the examples in the table above to illustrate your answer. 1 mark

ii. State **two** factors that would need to be kept constant when conducting an experiment such as the one above. 1 mark

iii. The results shown in the table for all tissue types is qualitative.
Describe how the effect of GA on seeds could be quantitatively measured. 2 marks

Question 6 (8 marks)

Human chorionic gonadotropin (hCG) is a hormone produced by the placenta when an embryo starts to implant or attach itself into the uterine lining. Implantation occurs on average 9 days, and between 6–12 days, after conception, fertilisation or ovulation. The purpose of this hormone is to keep progesterone levels in proper balance until the placenta is adequately developed to produce its own progesterone. In the early stages of pregnancy, hCG appears in the urine and forms the basis of a non-invasive pregnancy test kit that can easily be conducted at home.

a. Why is it advantageous to have a non-invasive pregnancy test kit available? 1 mark

The development of the pregnancy test kit combined immunology and reproductive biology. The end result was that antibodies against hCG were embedded onto a strip of plastic that can easily be dipped into a sample of urine.

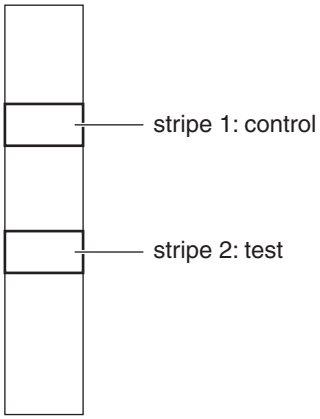
b. In the space below, draw an antibody that is bound to hCG. 2 marks

To develop the antibodies, hCG is injected into mice. The hCG is foreign to the mouse and so the immune response is directed against the hCG.

c. Describe the action of the mouse immune system that leads it to produce antibodies against hCG. 3 marks

The challenge for scientists was to find and isolate the specific cells of the mouse immune system that produce the antibodies against hCG. Once this was achieved, these cells were fused with cancer cells and the resultant cells were cultured. The outcome was a never-ending supply of pure antibody against hCG that could then be embedded into the pregnancy test strips. There are two stripes: stripe 1 is a control and will change colour (blue) regardless of a pregnancy or not, while stripe 2 will only change colour (blue) if hCG is present in the urine.

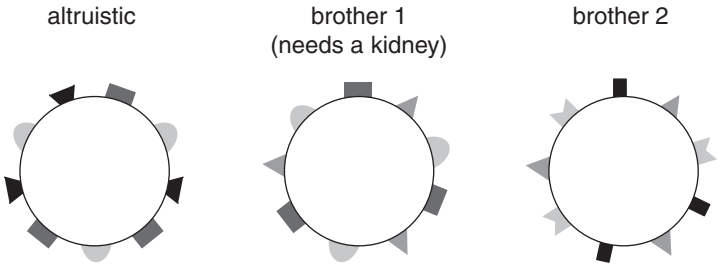
d. **i.** Label on the test strip below the colours expected if there is a pregnancy. 1 mark



ii. What is the purpose of the control stripe? 1 mark

Question 7 (6 marks)

Late in 2015 there was a series of kidney transplants that was initiated by an altruistic donor. There are large numbers of donor pairs, usually family groups, where one individual needs a kidney and the other is a willing donor. Sometimes there is a problem with compatibility, making the risk of rejection too high. The diagram below shows the self-antigens present on the altruistic donor, brother 1 (needing a transplant) and brother 2 (a willing donor for brother 1).



a. Why is the altruistic donor a better match for brother 1 than brother 2? 1 mark

b. Explain why the donated kidney will eventually be rejected by brother 1. 2 marks

c. What medical intervention can be put in place to minimise rejection of the kidney transplanted into brother 1? 1 mark

d. The whole procedure involved fourteen individuals spanning across two Australian states. All that was required to set the wheels in motion was an initial volunteer altruistic donor, illustrating the profound effect this life-changing decision has had on a large number of people.

What are **two** factors, other than compatibility, which should be taken into account when choosing recipients? 2 marks

_____

_____

_____

_____

END OF QUESTION AND ANSWER BOOKLET