

Student name

BIOLOGY

Unit 3

Trial Examination

QUESTION AND ANSWER BOOK

Total writing time: 1 hour 30 minutes

Structure of book

Section	Number of questions	Number of marks
A	25	25
B	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 book of 20 pages with a detachable answer sheet for multiple-choice questions inside the front cover.

Instructions

- Detach the answer sheet for multiple-choice questions during reading time.
- Write your **name** in the space provided above on this page and 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 book.

STAV Publishing

2008

BIOLOGY

Unit 3 Trial Examination

MULTIPLE CHOICE ANSWER SHEET

STUDENT NAME:	
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INSTRUCTIONS:**USE PENCIL ONLY**

- Write your name in the space provided above.
- Use a **PENCIL** for **ALL** entries.
- If you make a mistake, **ERASE** it – **DO NOT** cross it out.
- Marks will **NOT** be deducted for incorrect answers.
- **NO MARK** will be given if more than **ONE** answer is completed for any question.
- Mark your answer by placing a **CROSS** through the letter of your choice.

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

Specific instructions for Section A

This section consists of 25 questions. You should attempt **all** questions.

Each question has four possible correct answers. Only **one** answer for each question is correct. Select the answer that you believe is correct and indicate your choice on the Multiple Choice Answer Sheet by crossing the letter that corresponds with your choice of the correct answer.

If you wish to change an answer, erase it and cross your new choice of letter.

Each question is worth **one** mark. **No** mark will be given if more than one answer is completed for any question. Marks will **not** be deducted for incorrect answers.

Question 1

DNA consists of two strands forming a double helix. The two strands are held together by:

- A. hydrogen bonds.
- B. nucleotide bonds.
- C. phosphodiester bonds.
- D. carbon to carbon double bonds.

Question 2

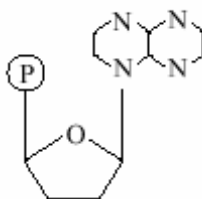
The anaerobic process resulting in a glucose molecule being split to form 2 pyruvic acid molecules is:

- A. photosynthesis.
- B. chemosynthesis.
- C. glycolysis.
- D. electron transport chain.

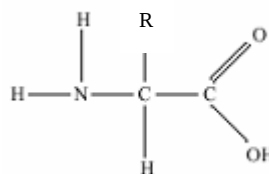
Question 3

Which of the following molecules is a monomer of protein?

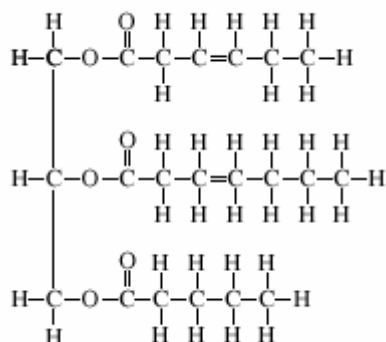
A.



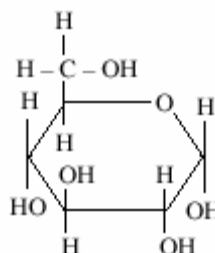
B.



C.

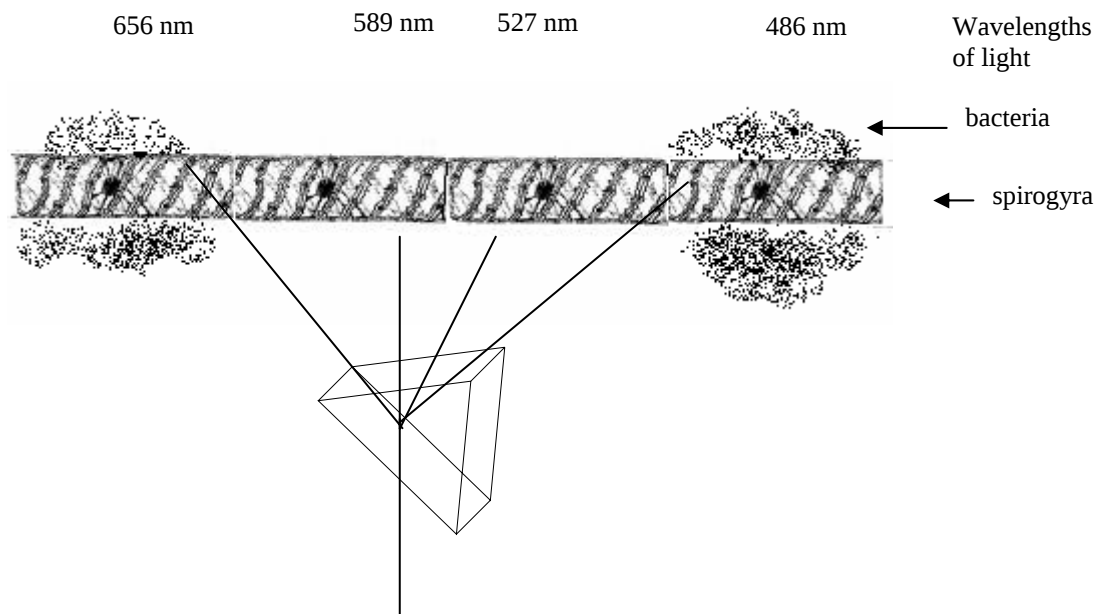


D.



Question 4

The filamentous algae, *spirogyra*, was placed on a slide to which a few drops of water containing the heterotrophic, aerobic bacteria, *Pseudomonas*, was added. The slide was covered with a cover-slip and then illuminated with light coming through a prism as shown in the diagram below.



The bacteria placed on the slide tended to accumulate at wavelengths 656 nm and 486 nm. In a controlled experiment, the bacteria were placed on a slide with no *spirogyra* and illuminated in the same way. The bacteria in this second experiment tended to accumulate around the edges of the cover-slip. The most likely explanation for the movement of the bacteria is:

- A. the bacteria move to the light of wavelengths 656 nm and 486 nm in order to photosynthesise.
- B. the bacteria move to the light of wavelengths 656 nm and 486 nm in order to absorb the starch produced by the algae as a result of photosynthesis.
- C. the bacteria move to the light of wavelengths 656 nm and 486 nm in order to absorb the oxygen given out by the algae as a result of photosynthesis.
- D. in the experimental set-up the wavelengths of 656 nm and 486 nm are closer to the edge of the cover-slip.

Question 5

A section of nucleic acid taken from a human cell has the following base sequence.

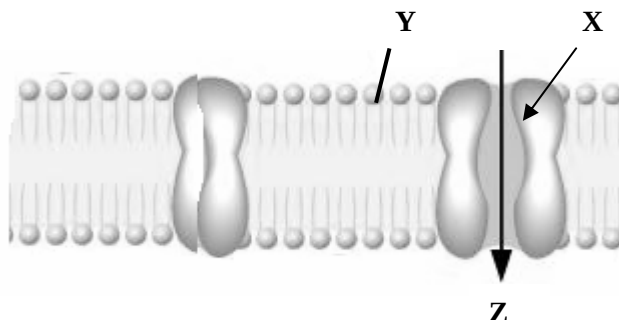
UCUUCAUAA

It is reasonable to conclude from this base sequence that:

- A. each base in this base sequence is attached to a deoxyribose sugar.
- B. this base sequence codes for 3 different amino acids.
- C. this base sequence codes for 9 different amino acids.
- D. a complementary template base sequence would be **AGAAGTATT**

Question 6

The following diagram represents a section through the cell membrane.



The labels, X, Y and Z represent:

- | X | Y | Z |
|--------------------------|-----------------------|-----------------|
| A. protein channel | phospholipid molecule | steroid hormone |
| B. protein channel | phospholipid molecule | sodium ions |
| C. phospholipid molecule | protein channel | sodium ions |
| D. phospholipid molecule | protein channel | steroid hormone |

Question 7

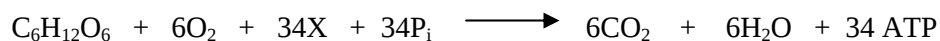
During childbirth the hormone oxytocin increases labor contractions. As the baby moves down the birth canal, from the uterus, pressure receptors at the outlet of the uterus send messages to the brain to produce oxytocin. Oxytocin travels through the bloodstream to the uterus, stimulating the muscles of the uterus to contract even more strongly. When the baby has passed out of the birth canal, the pressure on the pressure receptors ends and oxytocin production ceases.

It is reasonable to state that:

- A. the stimulus is oxytocin.
- B. this is an example of a negative feedback as the production of oxytocin ceases.
- C. this is an example of a positive feedback as the production of oxytocin increases the original stimulus.
- D. this is not an example of a feedback mechanism because there is an increase in the response.

Question 8

The following is an overall simplified equation for an important biological process.



The substance depicted as X is:

- A. the monosaccharide glucose.
- B. the energy source for the reaction.
- C. the enzyme that catalyses the reaction.
- D. ADP.

Question 9

A human insulin molecule is composed of two polypeptide chains held together by disulfide bonds. Chain A consists of 21 amino acids and chain B consists of 30 amino acids. Chain A contains two sections of alpha helices and chain B contains one large section of alpha helix as shown in the following simplified diagram.



Simplified insulin molecule

In terms of protein structure:

- A. the order of amino acids in chain B is termed the secondary structure as it is the second chain.
- B. the alpha helices formed by the chains are part of the secondary structure.
- C. there is no quaternary structure for insulin as there are only two chains not four.
- D. the tertiary structure of insulin results from the two chains being held together by disulfide bonds.

Question 10

Both protein and starch are biological molecules found in plants. There are hundreds of different protein molecules found in plants but only one type of starch molecule. The reason for this is:

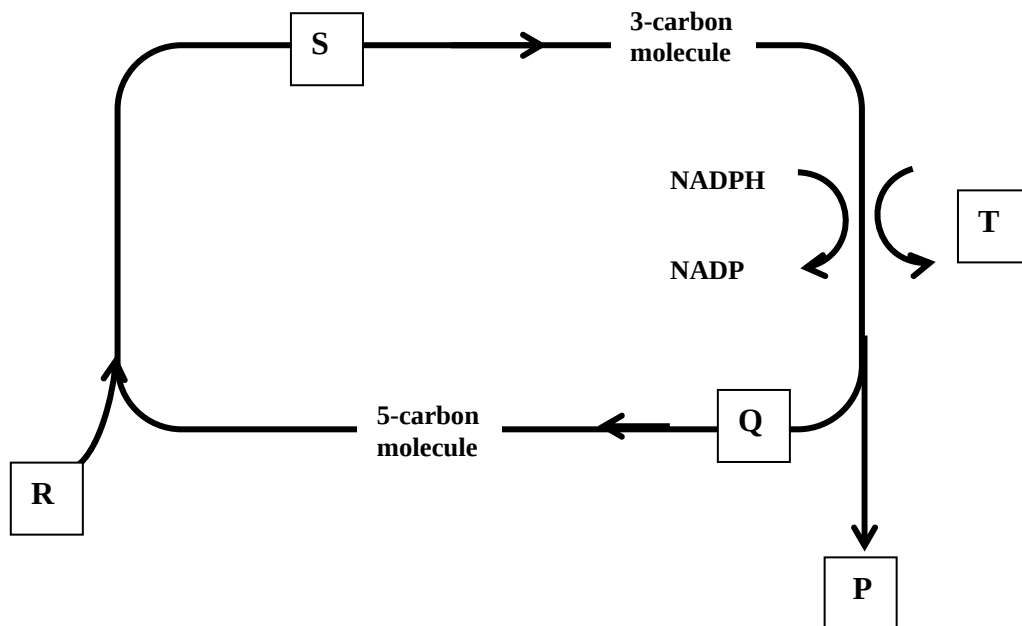
- A. starch consists of carbon, hydrogen and oxygen only, whereas protein contains nitrogen as well as carbon, hydrogen and oxygen.
- B. starch is a storage carbohydrate for plants whereas proteins have many functions.
- C. the monomers making up protein are amino acids.
- D. the monomers making up starch are all identical and rearranging them produces the same polymer.

Question 11

Cholinesterase is an enzyme that catalyses the breakdown of the neurotransmitter acetylcholine. Some snake venom contains toxins that inhibit the action of cholinesterase. If a person is bitten by such a snake the result would be that:

- A. acetylcholine would not stimulate the post-synaptic neuron.
- B. the post-synaptic neuron would be continually stimulated.
- C. acetylcholine would diffuse more quickly across the synapse.
- D. acetylcholine would stimulate the pre-synaptic membrane.

Questions 12 and 13 refer to the following information and diagram.



Above is a simplified flow diagram of the light-independent reactions of photosynthesis.

Question 12

It is reasonable to conclude that carbon dioxide is represented by the letter:

- A. R
- B. Q
- C. P
- D. S

Question 13

It is reasonable to conclude that the letter **T** represents:

- A. ATP from the light-dependent reaction forming ADP.
- B. ATP from the light-independent reaction forming ADP.
- C. a glucose molecule being formed.
- D. an oxygen molecule being given off.

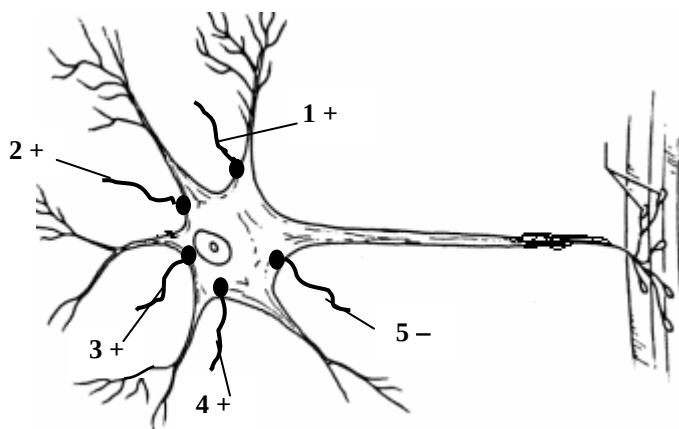
Question 14

A neurohormone is a substance that:

- A. passes across the synapse of a nerve cell to bring about contraction of a muscle fibre.
- B. is released from a neuron into the bloodstream where it travels to target cells.
- C. is released by endocrine cells and directly affects nerve cells.
- D. acts to prevent normal functioning of the nervous system.

Question 15

Neurons interact to bring about coordination of an organism. Some signals excite neurons to fire off, whereas some signals inhibit neurons from firing off. The motor neuron depicted below needs at least 3 excitatory presynaptic neurons to fire off. A + sign indicates an activation signal and a – sign indicates an inhibitory signal.

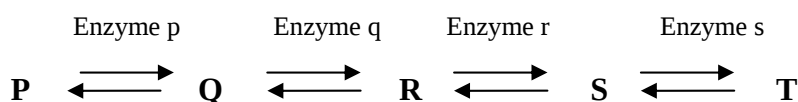


The motor neuron depicted will fire off:

- A. if all axons labelled 1 to 5 are fired off together.
- B. if axons labelled 1, 2, 3 and 5 are all fired off together.
- C. only if axon 5 is **not** fired off.
- D. only if axon 5 is always fired off.

Question 16

The following diagram represents a biochemical pathway in a living organism. The final product, substance T, is essential for the life of the organism.



The organism involved undergoes a mutation and is no longer able to produce enzyme r. It is reasonable to predict that:

- A. the organism will be able to compensate for the lack of enzyme r by using an alternative pathway.
- B. substance Q will tend to accumulate.
- C. enzyme r is the most important enzyme for the survival of this organism.
- D. the lack of enzyme r will be fatal for this organism.

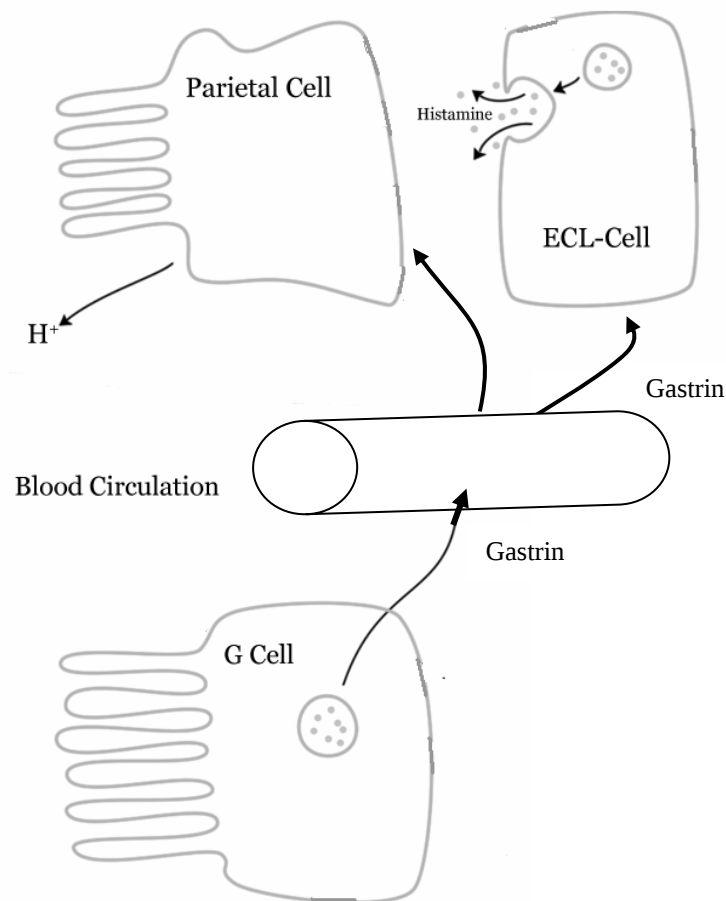
Question 17

The protein fibrinogen is converted to fibrin:

- A. as part of the specific immune response.
- B. for transport of oxygen.
- C. when a blood clot forms.
- D. as part of the cascade reaction of complement proteins.

Questions 18, 19 and 20 refer to the following information and diagram.

Gastrin is a peptide secreted by G cells in the pyloric glands of the stomach in response to the distention of the stomach wall. Gastrin passes into the bloodstream and moves to the parietal cells in the stomach, causing them to secrete acid, and also to ECL cells of the stomach causing them to produce histamine. Histamine also acts on the parietal cells causing them to produce acid. The actions of these substances is shown in the diagram below.



Question 18

It is reasonable to conclude that:

- A. the receptor sites associated with the parietal cells for histamine and gastrin will be the same as both gastrin and histamine cause the parietal cells to produce acid.
- B. the receptor sites for gastrin associated with the parietal cells and the ECL cells would be different as the substances secreted by these cells are different.
- C. the receptor sites associated with the parietal cells for histamine and gastrin will be the same as it is the same cell type.
- D. the receptor sites for gastrin associated with the parietal cells and the ECL cells would be the same as gastrin is binding in both cases.

Question 19

It is reasonable to conclude that:

- A. Gastrin, being a peptide, would be fat-soluble and hence pass across the cell membrane, attach to a receptor in the cytosol of the cell and start up a signal transduction.
- B. Gastrin, being a peptide, would attach to a receptor on the cell surface that would activate another protein and start a signal transduction in the cell cytosol.
- C. Gastrin, being a peptide, would be small enough to pass through the pores of the cell membrane, attach to a receptor in the cytosol and start up a signal transduction.
- D. Gastrin, being a peptide, would pass through protein channels in the cell membrane, attach to a receptor in the cytosol of the cell and start up a signal transduction.

Question 20

From the diagram it is reasonable to conclude that:

- A. Gastrin is a signalling molecule that forms part of the paracrine system.
- B. Histamine is a signalling molecule that forms part of the endocrine system.
- C. Gastrin is a signalling molecule that forms part of the endocrine system.
- D. the acid from the parietal cells is a signalling molecule that forms part of the paracrine system.

Question 21

Tonsils are lymph nodes that form part of the lymphatic system. Many children have their tonsils removed (called a tonsillectomy) after severe bouts of tonsillitis.

It is reasonable to state that:

- A. after a tonsillectomy there would be a reduced production of T cells.
- B. after a tonsillectomy the lymph stream would reverse direction in that area.
- C. after a tonsillectomy a person would no longer be able to fight infections in the throat area.
- D. tonsils are lymph nodes whose function is to filter the lymph of bacteria so they are prone to becoming infected.

Question 22

The immune system in humans does not complete development until sometime after birth. A baby is protected from infection in its first few months of life by:

- A. antibodies crossing the placenta into the baby resulting in naturally acquired passive immunity.
- B. antibodies being formed immediately the baby is born due to the baby's exposure to antigens at birth, resulting in naturally acquired active immunity.
- C. antibodies being absorbed in the breast milk when feeding as an example of naturally acquired active immunity.
- D. being vaccinated as an example of artificially acquired passive immunity.

Question 23

Cyclosporin is a drug given to patients that have undergone a transplant operation. This drug is designed to minimize the rejection of the transplanted organ. Cyclosporin would possibly work by:

- A. blocking the active sites of enzymes that break down transplanted organs.
- B. suppressing cytotoxic T cell production.
- C. suppressing B lymphocyte production.
- D. blocking the action of histamines at the site of the transplanted organ.

Question 24

A vaccine has been developed in Australia against infection due to Human Papilloma virus, using inactivated parts of the virus. This virus has been implicated in cervical cancer in women. The vaccine is given in 3 doses to females aged 12 to 25. Measuring the antibody production in individuals one would expect:

- A. a decrease in antibody production with each dose, as the individuals are already immune to the virus after the first dose of vaccine.
- B. an increase in antibody production with each dose due to the initial laying down of B memory cells after the first dose and therefore their rapid response to subsequent doses of vaccine.
- C. an increase in antibody production as increased amounts of virus particles are always injected with each vaccination.
- D. a decrease in antibody production as antibody production only occurs when the actual Human Papilloma virus is contracted.

Question 25

Allergic responses to foreign proteins (allergens) such as pollen or peanuts cause reactions in some people from sneezing to severe breathing difficulties that can be life threatening. These allergic responses are due to:

- A. mast cells secreting histamine after forming cross-links with the allergen and IgE antibodies that triggers the allergic response.
- B. mast cells secreting specific IgE antibodies that combine with the allergen that triggers the allergic response.
- C. IgE antibodies secreting histamine when they combine with the allergen that triggers the allergic response.
- D. IgE antibodies breaking down the allergen that releases toxins that bring about the allergic response.

END OF SECTION A

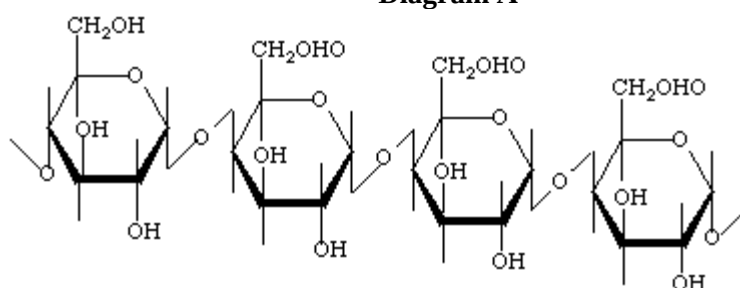
SECTION B - Short Answer Questions**Specific instructions for Section B**

This section consists of 7 questions. There are 50 marks in total for this section.

Write your responses in the spaces provided. You should attempt **all** questions. Please write your responses in **blue** or **black ink**.

Question 1

Below is a diagram of a structural biomacromolecule.

Diagram A**Biomacromolecule 1**

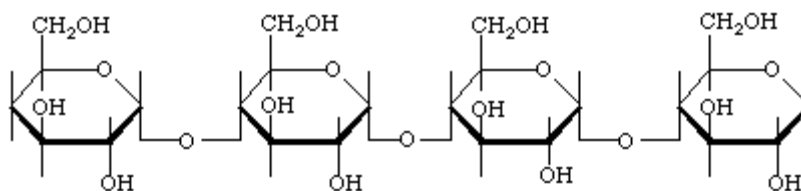
- a** Name the class of chemicals to which this biomacromolecule belongs.

(1 mark)

- b** Name the monomers making up this biomacromolecule.

(1 mark)

Below is a similar biomacromolecule.

Diagram B**Biomacromolecule 2**

- c** How are these biomacromolecules similar?

(1 mark)

Although these biomacromolecules are similar, humans are only able to breakdown biomacromolecule 2 in digestion.

- d** Explain why humans can breakdown biomacromolecule 2 but not biomacromolecule 1 even though they are similar in structure.

(2 marks)

When the biomacromolecule in diagram **B** is digested it is broken down into its monomers. These monomers are then absorbed by the cells of the intestine.

- e** Explain how these monomers enter the cells of the intestine.

(1 mark)

Total 6 marks

Question 2

Cancer cells often show metabolism that differs from the non-cancerous cells in the surrounding tissue. Cancer cells often have a higher intake of certain amino acids or vitamins such as folic acid than normal cells from the same tissue. Nanotechnology, using particles called dendrimers of the order of 10^{-9}m that can pass through cell membranes, have been used in medicine to destroy cancer cells. Anticancer drugs that destroy cells are attached to dendrimers and these are injected into patients. The problem is that the anticancer drugs can also destroy normal healthy cells.

- a** Using the above information, suggest how a dendrimer could be designed that would focus more on destroying cancer cells and not normal cells.

(1 mark)

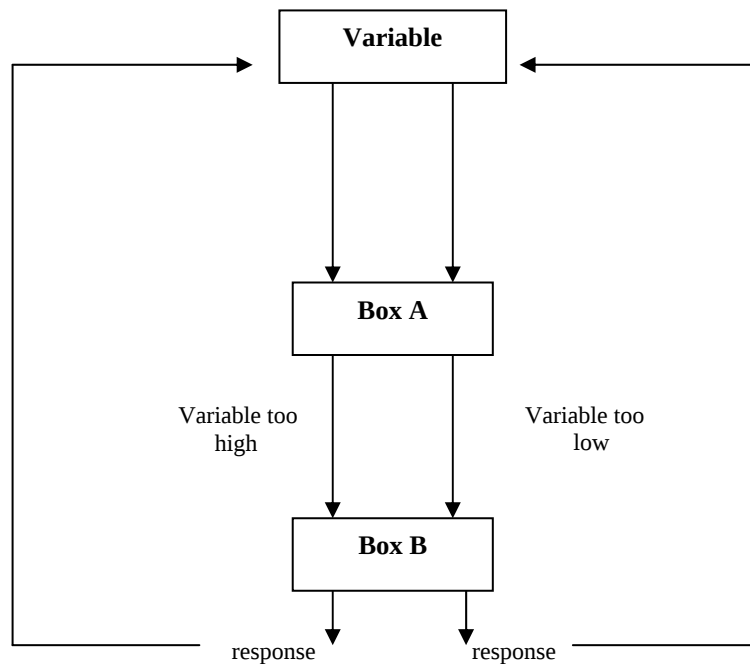
- b** You have a well equipped laboratory with mice at your disposal. Outline how you would set up an experiment to investigate the effectiveness of your answer to **a** above.

(3 marks)

Total 4 marks

Question 3

Below is a general diagram illustrating the key features of homeostasis.



- a** What is the general name given to structures that would be represented by Box A and Box B in the diagram?

Box A _____

Box B _____

(2 marks)

- b** What term is given to the effect of responses shown by the structures represented by Box B? Explain your answer.

(2 marks)

- c Choose an example of homeostasis that you have studied and fit it to the model above by completing the following:

Variable/stimulus

Box A

Box B

Response

(3 marks)

Total 7 marks

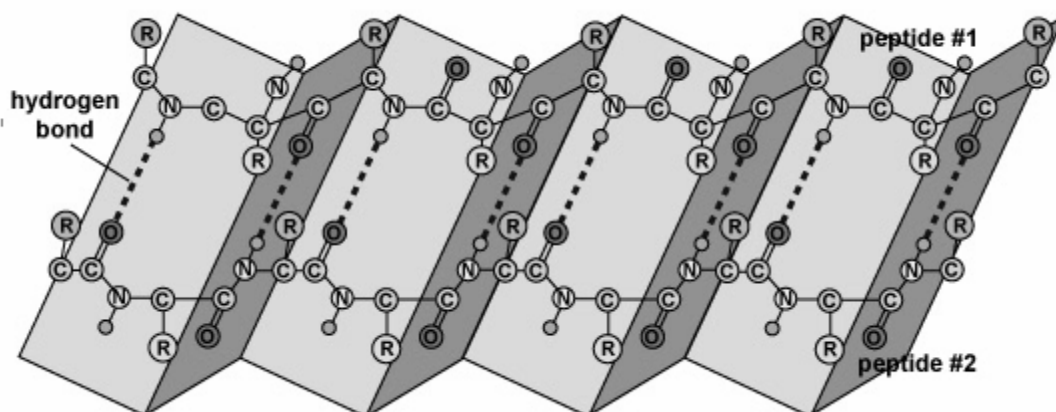
Question 4

Fibrillin is an extracellular protein that is important in strengthening connective tissue, acting like a mesh to hold the cells in place. Fibrillin forms part of the extracellular microfibrils that give connective tissue long range elasticity.

- a What type of protein is fibrillin?

(1 mark)

The diagram below shows part of the structure of the fibrillin.



- b Name the level of structure shown above.

(1 mark)

- c** Explain the link between the structure and function of fibrillin.

(1 mark)

Marfan's syndrome is a genetic disease that results from mutations in the extracellular protein fibrillin. Such a mutation occurs in the DNA at nucleotide 1734 where **G** is replaced by **A**. The normal DNA triplet is **TGT** whereas the mutated DNA is **TAT**.

- d** What does the letter **G** stand for in **TGT**?

(1 mark)

The Universal Genetic code

	T	C	A	G	
T	Phenylalanine	Serine	Tyrosine	Cysteine	T
	Phenylalanine	Serine	Tyrosine	Cysteine	C
	Leucine	Serine	STOP	STOP	A
	Leucine	Serine	STOP	Tryptophan	G
C	Leucine	Proline	Histadine	Arginine	T
	Leucine	Proline	Histadine	Arginine	C
	Leucine	Proline	Glutamine	Arginine	A
	Leucine	Proline	Glutamine	Arginine	G
A	Isoleucine	Threonine	Asparagine	Serine	T
	Isoleucine	Threonine	Asparagine	Serine	C
	Isoleucine	Threonine	Lysine	Arginine	A
	Methionine	Threonine	Lysine	Arginine	G
G	Valine	Alanine	Aspartic acid	Glycine	T
	Valine	Alanine	Aspartic acid	Glycine	C
	Valine	Alanine	Glutamic acid	Glycine	A
	Valine	Alanine	Glutamic acid	Glycine	G

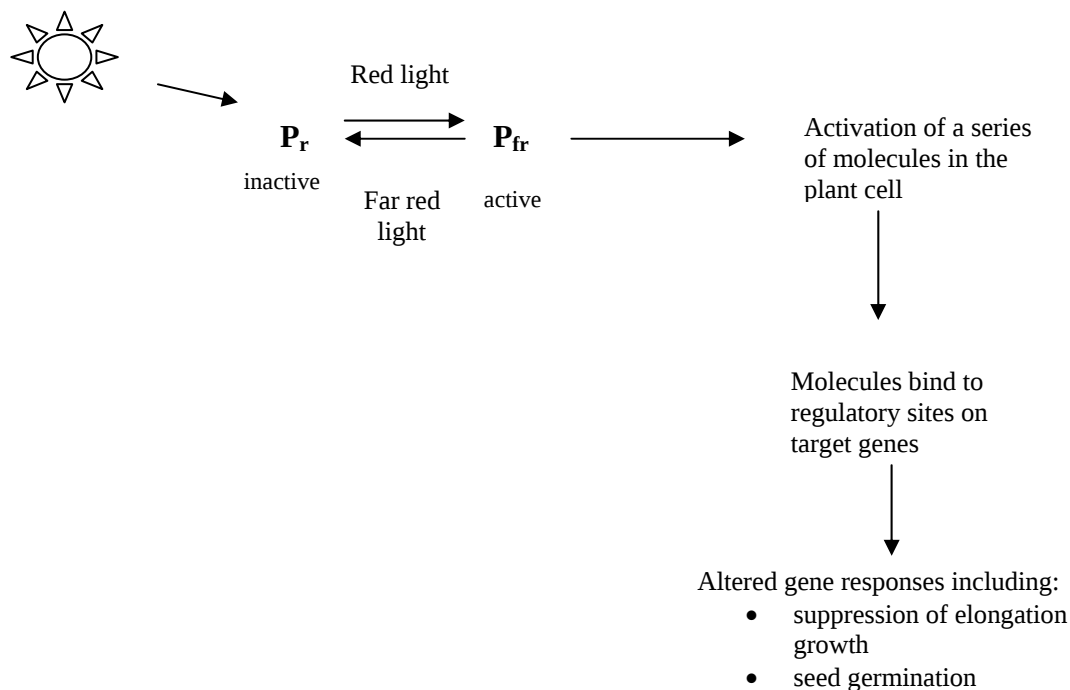
- e** Using the table above state how the fibrillin molecule in a person with Marfan's syndrome is different from a normal person.

(1 mark)

Total 5 marks

Question 5

Light is vital for plant survival. Phytochromes are red light receptor proteins found in plants. The phytochrome molecule exists as an inactive form P_r until it is activated by a photon of red light to the active form P_{fr} . The active form P_{fr} activates other molecules in the cell resulting in various biological activities as outlined below.



a What term is given to such a series of cellular events triggered by an external stimulus?

(1 mark)

A group of students were investigating the effect of red light and far red light on the germination of lettuce seeds. They placed 50 seeds on water soaked filter paper in 2 petri dishes and exposed one group to red light (R) and the other group to far red (FR). The result of the experiment is shown below.

Treatment	% germination
R	95 %
FR	2 %

b What conclusion can be drawn from this experiment?

(1 mark)

It was suggested that the experiment did not discount the possibility that the far red could have destroyed the embryo in the seed and therefore prevented germination.

c Outline how the experiment could be improved to discount this possibility.

(2 marks)

The students repeated the experiment but this time exposing the two groups of seeds to red and far red light in a random fashion, sometimes finishing with red light and sometimes finishing with far red light.

Exposure	Final Exposure	% germination
R/FR/R/FR/.....R		90 %
R/FR/R/FR/.....FR		4 %

d Suggest an hypothesis for this investigation.

(1 mark)

e What conclusion can be drawn from this experiment?

(1 mark)

F If lettuce seeds were buried in soil well below the level of light penetration would you expect them to germinate? Explain your answer.

(2 marks)

Shade avoidance is a set of responses, such as elongation of stems, that plants display when they are subjected to shade, especially by chlorophyll containing leaves of another plant. Chlorophyll absorbs red light but not far red.

- g** Explain the molecular basis of how a plant, shaded by another's leaves, would show shade avoidance behaviour. (Refer to the diagram on the previous page in your answer.)

(3 marks)

Total 11 marks

Question 6

In late 2007 an outbreak of Equine influenza (horse influenza) occurred in Australia. Equine influenza was previously unknown in Australia, New Zealand and Iceland, but occurs throughout the rest of the world. The disease, which is rarely fatal, has the flu-like symptoms of a fever, a cough and nasal discharge. The disease is very contagious with 100% infection rate in a susceptible population. The whole of Australia's horse population is susceptible.

- a** Suggest one way this virus is spread.

(1 mark)

When cells are occupied by virus particles they produce interferon.

- b** What is interferon and what is its function?

(2 marks)

These viruses have haemagglutinin and neuraminidase glycoproteins attach to their outer lipid bilayer. Haemagglutinin enables the virus to get into cells and neuraminidase enables the newly formed viruses to get out of the host cell. This is a *similar* structure to the human influenza virus, however, humans are not affected by Equine influenza.

- c** Explain why humans are not susceptible to Equine influenza.

(1 mark)

Equine influenza virus readily undergoes changes in its glycoprotein structure. This is termed antigenic drift. Because of this, horses in countries where this disease occurs, need to be vaccinated every year with a weakened or attenuated form of the virus.

d Why would these horses need to be vaccinated every year?

(2 marks)

Young foals, whose mothers had been vaccinated against the Equine influenza virus just prior to giving birth, were also vaccinated with an attenuated vaccine, within a week of birth. The foal's own immune response, when tested a few months later, was found to be very poor.

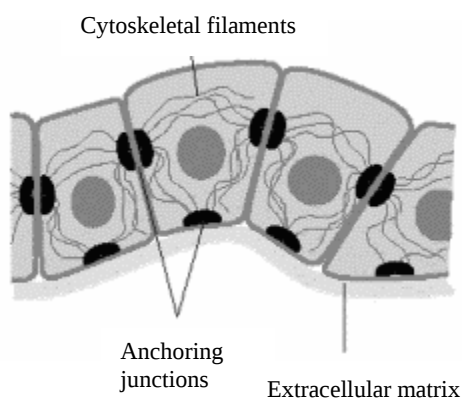
e Suggest a reason for this observation.

(2 marks)

Total 8 marks

Question 7

The diagram below shows anchoring junctions or desmosomes in skin epithelium. These consist of dense plaques of proteins from which extend fine fibrils into the cytosol of adjacent cells.



a Describe the function of desmosomes in relation to their structure.

(2 marks)

A potentially fatal but rare disorder called *Pemphigus* causes skin to form blisters and slough off because the desmosomes break down. The sufferer's body fails to recognize desmoglein 3, a protein that forms part of the desmosomes, as 'self'.

b What type of disease is *Pemphigus*?

(1 mark)

c Explain what is meant by a protein being recognized as 'self', and how the immune system recognizes 'self'.

(2 marks)

One possible treatment for *Pemphigus* is to administer intravenous immunoglobulin G (IVIG). IVIG is a blood product that contains pooled IgG immunoglobulins from the plasma of over 1000 blood donors. IVIG's effects last only between 2 and 3 months.

d Outline how IVIG, when administered, would possibly work.

(1 mark)

e What type of immunity is the administration of IVIG? Explain your answer.

(2 marks)

f Why would this treatment last only 2 to 3 months?

(1 mark)

Total 9 marks

END OF EXAMINATION

Acknowledgements

Websites: www.abbysenior.com/biology/bio.molecules_3.htm
scitec.uwichill.edu.bb
www.altered-states.net/.../elecpotent.jpg
dwb.unl.edu/.../~wathen/chem302/insulin2.gif
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