

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	8	50
	<b>Total</b>	<b>75</b>

- 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 17 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

## 2009

### BIOLOGY

#### Unit 3 Trial Examination

## MULTIPLE CHOICE ANSWER SHEET

<b>STUDENT NAME:</b>	
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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 **SHADING** the letter of your choice.

ONE ANSWER PER LINE					ONE ANSWER PER LINE				
1	A	B	C	D	14	A	B	C	D
2	A	B	C	D	15	A	B	C	D
3	A	B	C	D	16	A	B	C	D
4	A	B	C	D	17	A	B	C	D
5	A	B	C	D	18	A	B	C	D
6	A	B	C	D	19	A	B	C	D
7	A	B	C	D	20	A	B	C	D
8	A	B	C	D	21	A	B	C	D
9	A	B	C	D	22	A	B	C	D
10	A	B	C	D	23	A	B	C	D
11	A	B	C	D	24	A	B	C	D
12	A	B	C	D	25	A	B	C	D
13	A	B	C	D					

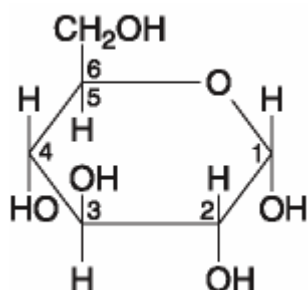
**SECTION A - Multiple Choice Questions****Specific instructions for Section A**

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 shading the letter that corresponds with your choice of the correct answer.

If you wish to change an answer, erase it and shade 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**

If 130 of the molecule drawn above were joined together in a sequence, the single molecule formed would be a:

- A. polysaccharide.
- B. polypeptide.
- C. monosaccharide.
- D. polyunsaturated fat.

**Question 2**

The  $\alpha$  helix and the  $\beta$  pleated sheet are both common polypeptide forms found in:

- A. the primary structure of proteins.
- B. the secondary structure of proteins.
- C. the tertiary structure of proteins.
- D. the quaternary structure of proteins.

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2009

**BIOLOGY**  
**Unit 3 Trial Examination**  
**MULTIPLE CHOICE ANSWER SHEET**

<b>STUDENT NAME:</b>	
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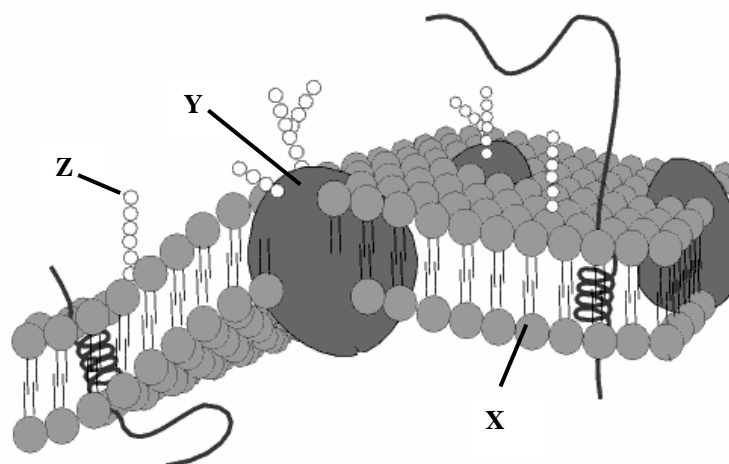
<b>INSTRUCTIONS:</b>	<b>USE PENCIL ONLY</b>
<ul style="list-style-type: none"><li>• Write your name in the space provided above.</li><li>• Use a <b>PENCIL</b> for <b>ALL</b> entries.</li><li>• If you make a mistake, <b>ERASE</b> it – <b>DO NOT</b> cross it out.</li><li>• Marks will <b>NOT</b> be deducted for incorrect answers.</li><li>• <b>NO MARK</b> will be given if more than <b>ONE</b> answer is completed for any question.</li><li>• Mark your answer by <b>SHADING</b> the letter of your choice.</li></ul>	

	ONE ANSWER PER LINE		ONE ANSWER PER LINE
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2	<input type="checkbox"/> A <input type="checkbox"/> B <input type="checkbox"/> C <input type="checkbox"/> D	15	<input type="checkbox"/> A <input type="checkbox"/> B <input type="checkbox"/> C <input type="checkbox"/> D
3	<input type="checkbox"/> A <input type="checkbox"/> B <input type="checkbox"/> C <input type="checkbox"/> D	16	<input type="checkbox"/> A <input type="checkbox"/> B <input type="checkbox"/> C <input type="checkbox"/> D
4	<input type="checkbox"/> A <input type="checkbox"/> B <input type="checkbox"/> C <input type="checkbox"/> D	17	<input type="checkbox"/> A <input type="checkbox"/> B <input type="checkbox"/> C <input type="checkbox"/> D
5	<input type="checkbox"/> A <input type="checkbox"/> B <input type="checkbox"/> C <input type="checkbox"/> D	18	<input type="checkbox"/> A <input type="checkbox"/> B <input type="checkbox"/> C <input type="checkbox"/> D
6	<input type="checkbox"/> A <input type="checkbox"/> B <input type="checkbox"/> C <input type="checkbox"/> D	19	<input type="checkbox"/> A <input type="checkbox"/> B <input type="checkbox"/> C <input type="checkbox"/> D
7	<input type="checkbox"/> A <input type="checkbox"/> B <input type="checkbox"/> C <input type="checkbox"/> D	20	<input type="checkbox"/> A <input type="checkbox"/> B <input type="checkbox"/> C <input type="checkbox"/> D
8	<input type="checkbox"/> A <input type="checkbox"/> B <input type="checkbox"/> C <input type="checkbox"/> D	21	<input type="checkbox"/> A <input type="checkbox"/> B <input type="checkbox"/> C <input type="checkbox"/> D
9	<input type="checkbox"/> A <input type="checkbox"/> B <input type="checkbox"/> C <input type="checkbox"/> D	22	<input type="checkbox"/> A <input type="checkbox"/> B <input type="checkbox"/> C <input type="checkbox"/> D
10	<input type="checkbox"/> A <input type="checkbox"/> B <input type="checkbox"/> C <input type="checkbox"/> D	23	<input type="checkbox"/> A <input type="checkbox"/> B <input type="checkbox"/> C <input type="checkbox"/> D
11	<input type="checkbox"/> A <input type="checkbox"/> B <input type="checkbox"/> C <input type="checkbox"/> D	24	<input type="checkbox"/> A <input type="checkbox"/> B <input type="checkbox"/> C <input type="checkbox"/> D
12	<input type="checkbox"/> A <input type="checkbox"/> B <input type="checkbox"/> C <input type="checkbox"/> D	25	<input type="checkbox"/> A <input type="checkbox"/> B <input type="checkbox"/> C <input type="checkbox"/> D
13	<input type="checkbox"/> A <input type="checkbox"/> B <input type="checkbox"/> C <input type="checkbox"/> D		



*The following information applies to questions 3 and 4.*

The diagram below shows a cell membrane.



**Fluid-mosaic model of membrane structure**

### Question 3

According to the fluid mosaic model of the cell membrane, the structures represented by **X**:

- A. have hydrophilic tails in the centre of the membrane.
- B. can move laterally along the plane of the membrane.
- C. occur in an uninterrupted bilayer with proteins restricted to the surface of the membrane.
- D. are free to depart from the membrane and dissolve in the surrounding tissue fluid.

### Question 4

Cell-cell recognition is associated with the cell membrane. The structures that are important for cell-cell recognition in the diagram above are:

- A. the hydrophobic part of structure **X**.
- B. the hydrophilic part of structure **X**.
- C. the glycoprotein labelled structure **Y**.
- D. sugar molecule labelled structure **Z**.

### Question 5

A biologist ground up some plant cells and then centrifuged the mixture. The centrifuging separated the organelles according to their weight. Complete organelles in the heavier fraction were able to produce ATP in the light and the organelles in the lighter fraction were able to produce ATP in the dark. These heavier and lighter fractions would most likely contain, respectively:

- A. mitochondria and chloroplasts.
- B. chloroplasts and mitochondria.
- C. thylakoids and grana.
- D. grana and stroma.

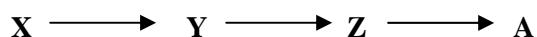
**Question 6**

Ions and small molecules can travel directly from the cytoplasm of one cell to the cytoplasm of an adjacent cell through:

- A. desmosomes
- B. gap junctions
- C. tight or occluding junctions
- D. intermediate fibres

**Question 7**

A series of enzymes catalyse the reaction:

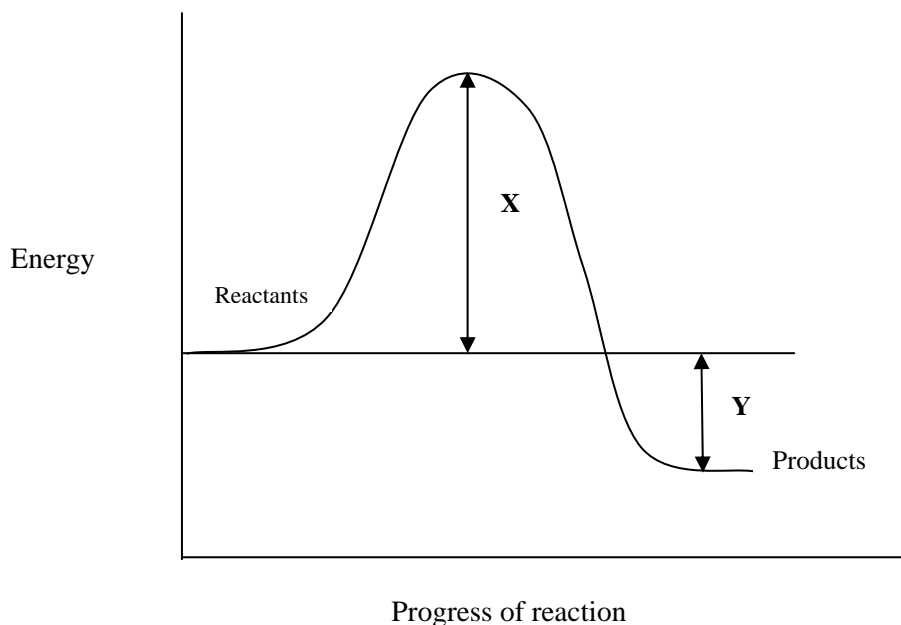


The final product **A** binds to the enzyme that converts **X** to **Y** at a position far from the active site. As a result the activity of the enzyme is reduced. It is reasonable to state that substance **A** functions as:

- A. a non-competitive inhibitor
- B. a coenzyme
- C. the substrate
- D. a competitive inhibitor

**Question 8**

The following graph represents the reaction of an enzyme.



From the graph it is reasonable to state that:

- A. The reaction is endergonic and **X** is the activation energy of the reaction.
- B. The reaction is exergonic and **Y** is the activation energy of the reaction.
- C. The reaction is endergonic and **Y** is the activation energy of the reaction.
- D. The reaction is exergonic and **X** is the activation energy of the reaction.

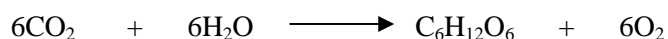
**Question 9**

When comparing eukaryotic cells and prokaryotic cells it is reasonable to state that:

- A. the lack of organelles in prokaryotic cells means that basic cellular functions are different in prokaryotic cells compared to eukaryotic cells.
- B. both prokaryotic cells and eukaryotic cells are able to compartmentalise biochemical processes within the cell.
- C. all membrane functions in prokaryotic cells takes place in the plasma membrane, whereas in eukaryotic cells these functions occur in different organelles.
- D. only eukaryotic cells are able to carry out photosynthesis as they have chloroplasts whereas prokaryotic cells cannot photosynthesis as they do not have chloroplasts.

**Question 10**

The following equation represents the overall process of photosynthesis.



The function of water in this process is to:

- A. combine with  $\text{CO}_2$ .
- B. absorb light energy.
- C. provide  $\text{O}_2$  for the light independent reaction.
- D. supply high-energy electrons in the light-dependent reaction.

**Question 11**

Experiments show that glucose diffuses slowly through artificial phospholipid bilayers. The cells lining the small intestine, however, rapidly move large quantities of glucose from glucose-rich food into the glucose-poor cytoplasm of the cells. Using this information, the transport system most probably functioning in the intestine cells is:

- A. simple diffusion
- B. phagocytosis
- C. an active transport pump
- D. facilitated diffusion

**Question 12**

According to the induced fit hypothesis of enzyme function:

- A. the binding of the substrate to the enzyme depends on the shape of the active site.
- B. some enzymes change their structure when activators bind to the enzyme.
- C. the binding of the substrate to the enzyme changes the shape of the active site.
- D. a competitive inhibitor out-competes the substrate for the active site.

**Question 13**

Plants grown in a partially dark environment will grow towards the light in a response called phototropism. This is because:

- A. the plants need sunlight energy for photosynthesis.
- B. the sun stimulates cell growth.
- C. auxin causes a decrease in cell growth on the side of the stem exposed to light.
- D. auxin causes an elongation of cells on the side of the stem away from the light.



**Question 14**

Some body cells respond differently to the same peptide hormones. This is because:

- A. different target cells have different genes.
- B. a target cell's response is determined by the product of a signal transduction pathway.
- C. the circulatory system regulates responses of hormones to specific target cells.
- D. the different target cells will have different receptor molecules for these peptide hormones.

**Question 15**

The electron transport chain forms one of the stages of aerobic respiration. The electron transport chain occurs in:

- A. the mitochondria and the end product is carbon dioxide.
- B. the mitochondria and is part of the krebs cycle.
- C. the mitochondria and the end product is water.
- D. the cytosol and is the start of the breakdown of glucose.

**Question 16**

The lymphatic system in mammals:

- A. removes excess fluid from extracellular spaces and returns it to the blood vascular system.
- B. contains arteries, capillaries and veins like the blood vascular system.
- C. operates under the same pressure as the blood vascular system in order to keep the lymph flowing.
- D. produces lymphocytes.

**Question 17**

In humans the thyroid gland produces the hormone thyroxin that controls basal metabolic rate. Iodine obtained from the diet forms part of the thyroxin molecule. The anterior lobe of the pituitary gland produces a hormone, thyroid stimulating hormone (TSH) that stimulates the production of thyroxin by binding to a trans-membrane receptor on the surface of the thyroid gland. When the level of thyroxin rises above a certain level it inhibits the production of TSH.

Using this information it is reasonable to conclude that a person whose diet was deficient in iodine:

- A. would produce more thyroxin to compensate.
- B. would produce little thyroxin and little TSH.
- C. would be expected to have a higher than normal level of TSH in their blood.
- D. would produce a form of thyroxin that was less efficient than normal iodine containing thyroxin.

**Question 18**

Which of the following is true about complement?

- A. Complement assists in the second line of defence by destroying the membranes of invading bacteria.
- B. Complement forms part of the body's third line of defence by coating specific invading bacteria.
- C. Complement is a protein produced by cells invaded by virus particles.
- D. Complement is produced by mucous membranes as part of the first line of defence against bacteria.

**Question 19**

Plants are susceptible to viral infections. When plants are infected by viruses:

- A. they can attempt to control these infections by the production of antibodies.
- B. they do not show visible signs of viral infection.
- C. they show little effect on their growth when infected.
- D. the viruses are able to spread throughout the plant by passing through plasmodesmata.

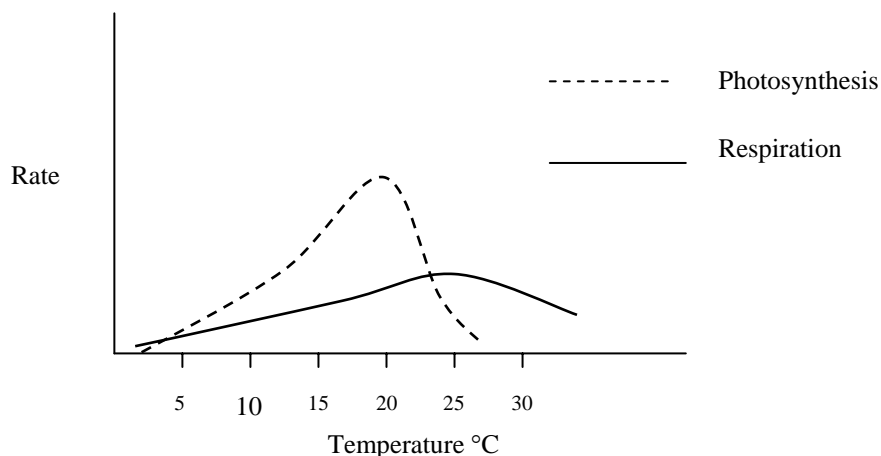
**Question 20**

Which cell and signalling molecule are responsible for initiating the inflammatory response?

- A. phagocytes and complement protein
- B. mast cells and histamine
- C. B cells and antibodies
- D. lymphocytes and interferon

**Question 21**

Potato plants are temperate climate plants. The plant produces tubers (the potatoes) as a storage organ for the storage of starch. The graph below shows the rates of photosynthesis and respiration for a particular variety of potato over a range of temperatures.



When this variety of potato was grown in a hot climate with a mean temperature of 24°C it did not produce any tubers. The best reason for this observation is that:

- A. the plant cannot photosynthesise above 24°C.
- B. the enzymes involved in photosynthesis are destroyed at this temperature.
- C. if the rate of respiration is equal to or greater than the rate of photosynthesis there is no nett gain of organic matter for storage.
- D. potatoes are temperate climate plants.

**Question 22**

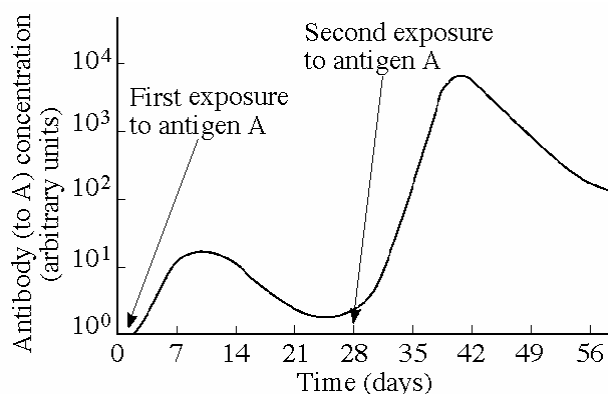
The camel is an animal that is well suited to hot, dry conditions. It has thick fur and can go without water for much longer than humans. The camel is also able to allow its temperature to rise by as much as 6°C when deprived of water.

It is reasonable to state that:

- A. a human is smaller than a camel and has a smaller surface area and therefore loses less heat to its surroundings than a camel.
- B. a camel, by allowing its temperature to rise, can lose more water to keep itself cool.
- C. the thick fur of a camel increases its surface area for evaporative cooling.
- D. the enzymes of a camel are able to function over a wider range of temperatures than the enzymes of humans.

**Question 23**

The graph below shows the level of antibodies in a person's blood after exposure to the same antigen, antigen A.



B memory cells would be produced:

- A. between 0 and 7 days.
- B. between 7 and 14 days.
- C. between both 0 and 7 days and between 28 and 35 days.
- D. between 35 and 42 days.

**Question 24**

The possibility of snakebite is a problem in the summer months in the Australian bush. Anti-venom as a treatment for snakebite is prepared by injecting snake venom in small quantities into horses over a long period of time and then bleeding the horses to obtain the serum to prepare the anti-venom. The anti-venom can then be injected into a person suffering from snakebite.

The injection of anti-venom is an example of:

- A. passive immunity as antibodies have been generated in the horse.
- B. active immunity as antibodies are made by the person.
- C. non-specific immunity as the horse serum can be given to any animal that has been bitten by a snake.
- D. an example of an attenuated vaccine as the snake venom has been weakened over time by its passage through the horse.

**Question 25**

The formation of a blood clot is part of the body's defence system. The item listed that initiates the formation of a clot is:

- A. the red blood cells.
- B. the platelets.
- C. the white blood cells.
- D. fibrinogen.

**END OF SECTION A**

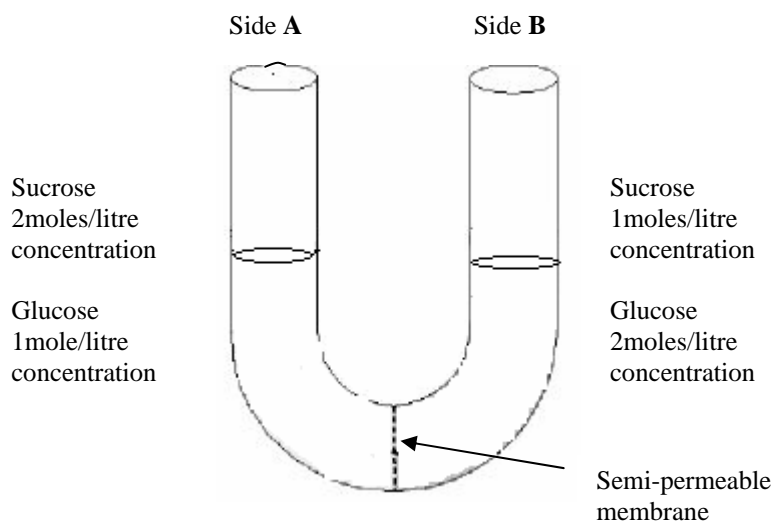
**SECTION B - Short Answer Questions**

**Specific instructions for Section B**

This section consists of 8 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**

A student investigating movement of water and molecules across semi-permeable membranes set up the following U-tube containing solutions as shown. The semi-permeable membrane was permeable to water and glucose but not to sucrose. Initially Side A and Side B were set up with the solutions as shown.



**a** Is side **A** isotonic, hypertonic or hypotonic relative to side **B**? Explain your answer.

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(2 marks)

After several hours the system had reached equilibrium.

**b** How would the glucose concentration have changed on each side of the tube?

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(1 mark)

**c** How would the sucrose concentration have changed on each side? Explain your answer.

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(2 marks)

**Total 5 marks**

**Question 2**

A student carried out an experiment measuring the oxygen consumption of a fresh water crayfish and a mouse at different temperatures. The animals were kept at 20°C for one hour and their oxygen consumption measured. The animals were then exposed to a temperature of 10°C for an hour and their oxygen consumption measured.

- a** Complete the table to state whether the oxygen consumption would increase or decrease when the animal went from 20°C to 10°C.

<b>Animal</b>	<b>Decreased or increased</b>
mouse	
crayfish	

(2 marks)

- b** Explain the answers given in the table in **a**.

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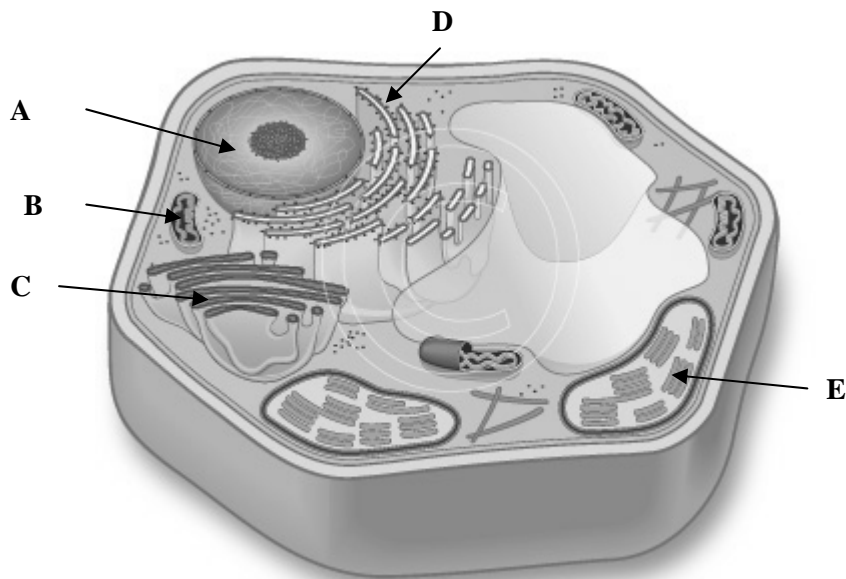
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(4 marks)

**Total 6 marks**

**Question 3**

The diagram below is of a typical plant cell.



**a** Using the labelling provided, give **two** structures that contain DNA.

\_\_\_\_\_ (2 marks)

**b** A section of DNA, that codes for protein is shown below. Complete the table by writing the complementary DNA base sequence below that given.

TGA CGG GAC ACC CCG TTC

**c** Name the process that takes place in structure **E** in the cell diagram above. (1 mark)

\_\_\_\_\_ (1 mark)

The Calvin cycle forms part of the process named above.

**d** What is the main input into the Calvin cycle?

\_\_\_\_\_ (1 mark)

**e** What is the main output of the Calvin cycle?

\_\_\_\_\_ (1 mark)

Some plants, called thermogenic plants, such as *Philodendron selloum* carry out an alternative form of respiration using mitochondria and lipids. The lipids are stored in the buds prior to blooming. Analysis of heat production shows that all the energy in the substrates ends up as heat and not as high energy compounds.

**f** What is the normal substrate for respiration?

\_\_\_\_\_  
(1 mark)

**g** Name a high energy compound formed in normal respiration.

\_\_\_\_\_  
(1 mark)

The main reason for the heat production in these thermogenic plants is to vaporize organic compounds.

**h** Suggest a function of these vaporized organic molecules?

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
(1 mark)

**Total 9 marks**

#### Question 4

The male *Bombyx mori* moth can respond to as little as a few molecules of a chemical substance that is emitted by a female moth of the same species.

**a** What term is given to such a substance?

\_\_\_\_\_  
(1 mark)

A single molecule binds to a receptor on the antenna of the male moth and this elicits a response.

**b** Suggest how a male moth is able to respond to only a single molecule?

\_\_\_\_\_  
(1 mark)

**c** Describe an application in agriculture for these chemical substances.

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
(2 marks)

**Total 4 marks**



**Question 5**

Type I diabetes develops when the islet cells in the pancreas are not able to produce the protein hormone insulin. Insulin enables cells to absorb glucose from the blood. One form of treatment has been to inject a large quantity of islet cells from up to four matching donors into a patient. The patient then needs to take immunosuppressant drugs for the rest of his or her life.

- a** What cells are targeted by the taking of these immunosuppressant drugs? Explain your answer.

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(2 marks)

Researchers have taken insulin producing pig islet cells and encapsulated them in transparent microspheres made from an alginate extract from seaweed. This encapsulating technology has an effective pore size controlling permeability. When injected into the abdomen of a diabetic patient, these cells continue to produce insulin and the patient does not need immunosuppressant drugs.

- b** What substances need to be able to pass into and out of the alginate coat?

In: \_\_\_\_\_

Out: \_\_\_\_\_

(2 marks)

- c** Why does the patient with this treatment not need to take immunosuppressant drugs?

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(1 mark)

- d** Name the structures within the pig islet cells responsible for the production of insulin.

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(1 mark)

- e** What is the process that enables the insulin to leave the pig islet cells.

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(1 mark)

- f** How does the process named in **e** above differ from the movement of the insulin through the alginate capsule?

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(2 marks)

Insulin is classed as an endocrine signalling molecule.

**g** How does an endocrine signalling molecule differ from a paracrine signalling molecule?

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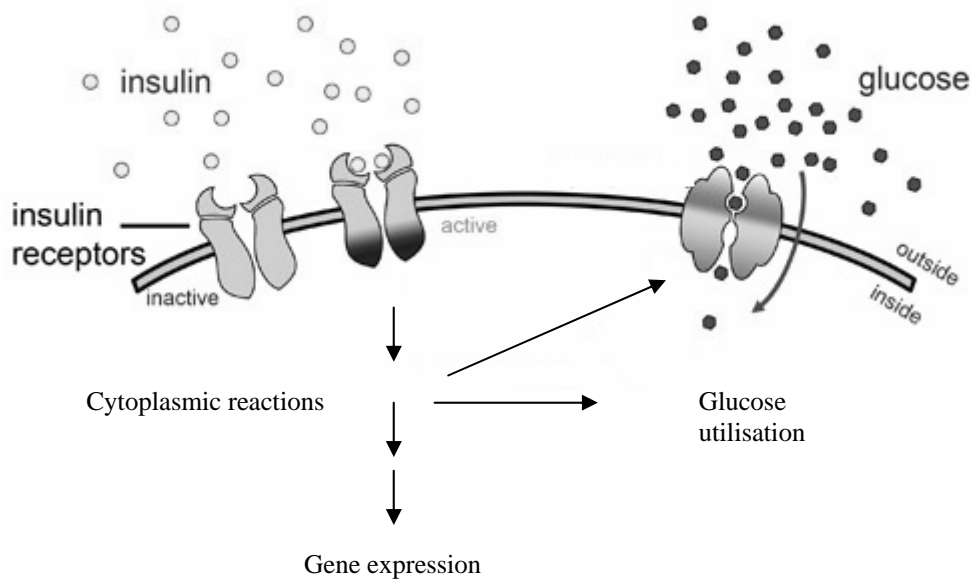
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(2 marks)

Insulin acts by binding to receptors on the surface of target cells and triggering a series of intermediate or secondary messengers as shown in the diagram below.



**h** How is the insulin from pig cells able to function in humans?

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(1 mark)

**i** What term is used for the cytoplasmic reactions depicted in the diagram above?

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(1 mark)

**Total 13 marks**

**Question 6**

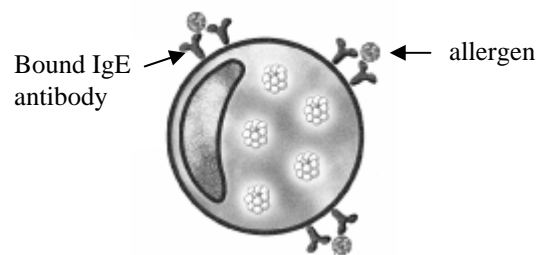
Allergic reactions are becoming more prevalent in children in Western society. The allergens that bring about the allergic response trigger cells to produce specific IgE antibodies against the allergen.

**a** Name the cells that produce IgE antibodies.

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(1 mark)

In the allergic response IgE antibodies bind to cells with specific IgE receptor sites. The allergen then binds to the IgE antibodies as shown in the diagram below.



**b** Name the cell depicted in the diagram.

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(1 mark)

**c** Describe what happens next that results in the allergic response.

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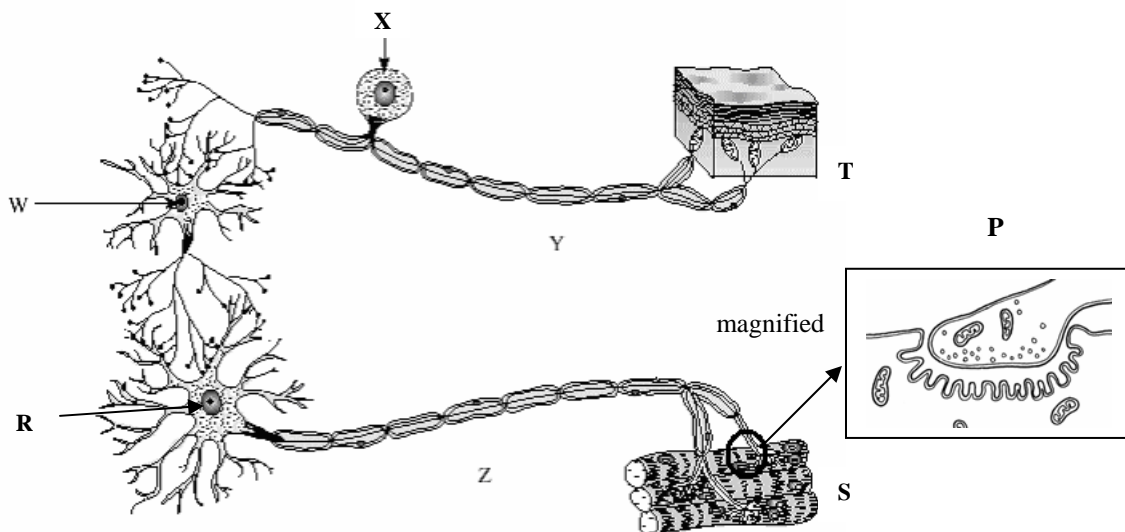
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(2 marks)

**Total 4 marks**

**Question 7**

The diagram below shows a simple nerve pathway.



- a** Use the letters on the diagram to indicate the direction of the nerve impulse when a stimulus is applied.

\_\_\_\_\_ (1 mark)

The area circled has been magnified on the diagram to show the connection between tissue **S** and the neuron labelled as structure **P**.

- b** Name the gap in structure **P**.

\_\_\_\_\_ (1 mark)

Acetylcholinesterase is an enzyme found in the gap of diagram **P**. Some poisons inhibit the action of acetylcholinesterase.

- c** What would be the function of the enzyme acetylcholinesterase?

\_\_\_\_\_  
 \_\_\_\_\_ (1 mark)

- d** What effect would it have on the individual to have the action of acetylcholinesterase inhibited?

\_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_ (1 mark)

**Total 4 marks**

**Question 8**

Both viruses and prions have the ability to cause infectious diseases.

- a** Give one way in which viruses differ from prions?

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(1 mark)

One approach to combating infectious disease is to use a rational drug design approach.

- b** What is rational drug design?

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(1 mark)

Malaria is a disease caused by a protozoa, *Plasmodium falciparum* carried by mosquitoes. The *plasmodium* invades the red blood cells, replicates and then breaks out of the cells liberating more parasites as well as a toxic substance called glycosylphosphatidylinositol or GPI formed by the parasite. GPI causes many of the problems associated with the disease malaria including fatal brain damage.

- c** Using laboratory mice, susceptible to malaria, outline how a vaccine that had been designed could be put through a preliminary trial to see if it is effective.

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(3 marks)

**Total 5 marks**

**END OF EXAMINATION**

**Acknowledgements**

Websites: [www.jordanhill.glasgow.sch.uk/depts/science/biology/All\\_files/image007.gif](http://www.jordanhill.glasgow.sch.uk/depts/science/biology/All_files/image007.gif)  
[www.science-art.com/.../131/131\\_516200716223.jpg](http://www.science-art.com/.../131/131_516200716223.jpg)  
[www.betacell.org/images/CMS/insulin-receptor-GLUT4\\_w500.jpg](http://www.betacell.org/images/CMS/insulin-receptor-GLUT4_w500.jpg)  
[www.theasthmacenter.org/manual/images/fig03.gif](http://www.theasthmacenter.org/manual/images/fig03.gif)  
[www.abbysenior.com/.../image004.gif](http://www.abbysenior.com/.../image004.gif)