



Trial Examination 2017

VCE Biology Unit 1

Written Examination

Question and Answer Booklet

Reading time: 15 minutes

Writing: 1 hour 30 minutes

Student's Name: _____

Teacher's Name: _____

Structure of Booklet

| <i>Section</i> | <i>Number of questions</i> | <i>Number of questions to be answered</i> | <i>Number of marks</i> |
|----------------|----------------------------|---|------------------------|
| A | 25 | 25 | 25 |
| B | 6 | 6 | 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 correction fluid/tape.

No calculator is allowed in this examination.

Materials supplied

Question and answer booklet of 20 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.

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.

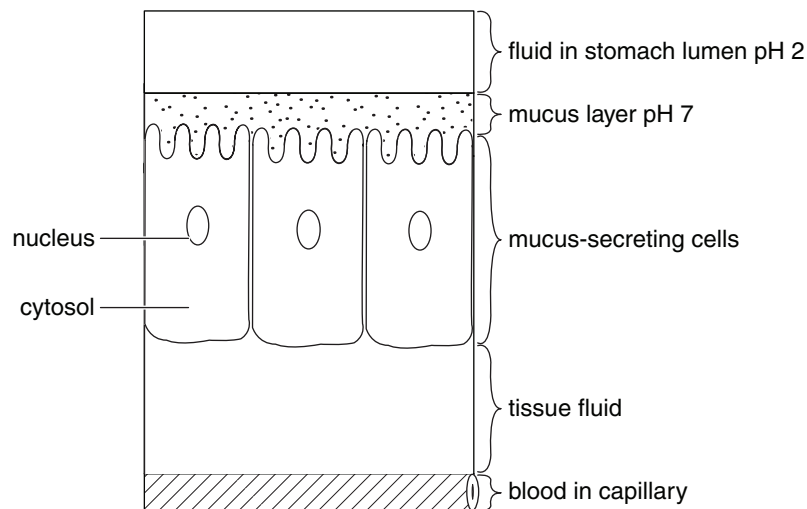
A correct answer scores 1, an incorrect answer scores 0.

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

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

Use the following information to answer Questions 1–6.

The following diagram shows some cells lining the stomach that secrete mucus (consisting of large glycoprotein molecules in a watery solution) into the cavity or lumen of the stomach.

**Question 1**

Which of the following organelles in these mucus-secreting cells would be involved in the secretion of the mucus?

- A. ribosomes
- B. vesicles
- C. endoplasmic reticulum
- D. lysosomes

Question 2

The process involved in the secretion of the mucus glycoprotein molecules from these cells is called

- A. osmosis.
- B. active transport.
- C. endocytosis.
- D. exocytosis.

Question 3

In the diagram of the mucus-secreting cells, the parts shown which make up the internal environment of the human body include

- A. mucus.
- B. stomach lumen fluid.
- C. tissue fluid.
- D. cytosol.

Question 4

The surface of the mucus-secreting cells facing the lumen of the stomach is shaped differently to the other three surfaces of the cells.

This is a

- A. structural adaption to increase mucus absorption.
- B. functional adaptation to aid food movement through the stomach.
- C. structural adaptation to increase surface area.
- D. physiological adaption to help keep the surface moist.

Question 5

Comparing the differences in the pH values of the various fluids in the regions shown on the diagram, it can be deduced that the mucus is important to

- A. help make the stomach lining slippery to aid food movement.
- B. stop the enzymes which aid food digestion from damaging the cells.
- C. form a protective barrier for the cells from the acid stomach fluid.
- D. neutralise the internal and external fluids.

Question 6

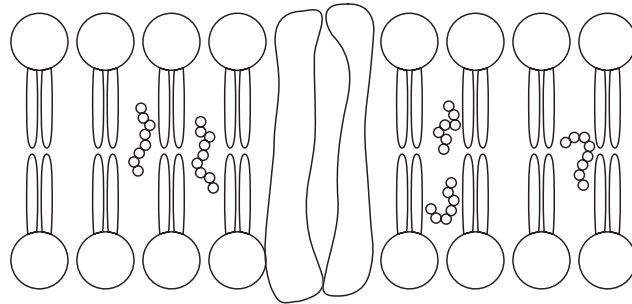
Most absorption occurs in the small intestine, however certain lipid-soluble substances (for example, aspirin) and 10–20% ethanol (alcohol) are absorbed in the stomach.

The absorption of alcohol into the blood capillary would be by

- A. diffusion through the phospholipid bilayer of the cell membranes.
- B. facilitated diffusion through protein channels of the cell membranes.
- C. osmosis through the small spaces in the phospholipid bilayer.
- D. active transport using protein carriers in the cell membranes.

Use the following information to answer Questions 7–9.

The following diagram shows the structure of the plasma membrane in cells as modelled in the fluid mosaic model.



Question 7

The hydrophilic part of the plasma membrane faces the outer and inner environments of the cell to

- A. absorb water.
- B. repel lipid-soluble substances.
- C. allow lipid-soluble substances to pass through.
- D. keep both surfaces moist.

Question 8

Cholesterol molecules are present in the membrane to make it

- A. more stable.
- B. more fluid.
- C. less firm.
- D. more mobile.

Question 9

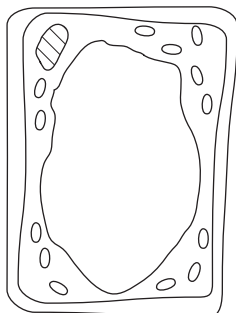
From the diagram above, what does the image below represent?



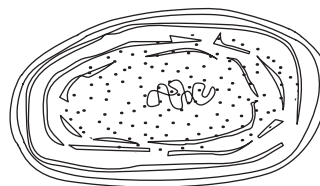
- A. the phospholipid bilayer
- B. 2 glycerol and 1 fatty acid
- C. a phospholipid molecule
- D. a triglyceride molecule

Use the following information to answer Questions 10–14.

The following two diagrams show a plant green leaf cell, cell A, and a cyanobacterial cell, cell B.



cell A (× 400)



cell B (× 30 000)

Question 10

Which of the following would not be present in both cell types?

- A. cell wall
- B. cell membrane
- C. nucleolus
- D. ribosomes

Question 11

For cell A, which pair of terms is correct?

- A. heterotroph/chemosynthetic
- B. heterotroph/photosynthetic
- C. autotroph/chemosynthetic
- D. autotroph/photosynthetic

Question 12

Cell B is classified as a prokaryotic cell as it

- A. is an extremely small cell.
- B. has no distinct nucleus.
- C. has no cell membrane.
- D. has a very simple structure.

Question 13

Cell B would not carry out aerobic cellular respiration as it

- A. absorbs and uses light energy for its activities.
- B. does not contain mitochondria.
- C. obtains its energy from other chemical reactions.
- D. does not contain chlorophyll.

Question 14

Cell A would carry out

- A. photosynthesis during the day and cellular respiration at night.
- B. both photosynthesis and cellular respiration during the day.
- C. both photosynthesis and cellular respiration at night.
- D. neither photosynthesis or cellular respiration at night.

Question 15

Australian vultures eat carcasses of dead kangaroos, wombats and other animals. These carcasses could be dangerous to other animals like quolls as the carcasses may be infected with disease-causing bacteria that may cause the quoll to become very ill or die.

This relationship between the vulture and quoll is called

- A. mutualism.
- B. parasitism.
- C. amensalism.
- D. commensalism.

Use the following information to answer Questions 16–21.

In the heat of the day, kangaroos spend long periods of time lying in the shade of trees. The faeces (droppings) of the kangaroos accumulate under the trees providing mineral nutrients for the trees. Red kangaroos, *Macropus rufus*, have excellent thermoregulatory abilities, including heat loss by panting, sweating and licking their fur. Kangaroos and wallabies have a network of special blood vessels near the skin of their forelegs to facilitate heat loss during licking. This is particularly well developed in *M. rufus*. Experimental data suggests that licking the fur of the forelegs provides most of the non-respiratory heat loss in red kangaroos.

Question 16

The kangaroos and shade trees have a relationship called

- A. mutualism.
- B. parasitism.
- C. amensalism.
- D. commensalism.

Question 17

The kangaroos lying in the shade in the heat of the day is an example of a

- A. structural adaptation.
- B. functional adaptation.
- C. physiological adaptation.
- D. behavioral adaptation.

Question 18

By lying in the shade, the kangaroos

- A. increase heat loss by evaporation.
- B. increase heat gain by conduction.
- C. reduce heat gain by radiation.
- D. increase heat loss by convection.

Question 19

The special blood vessel network in the kangaroo forelegs and the experimental results suggest that kangaroos and some wallabies lose most of their heat by

- A. sweating from the skin of their forelegs.
- B. evaporation of water licked onto the foreleg skin.
- C. passive diffusion of water from the skin blood vessels.
- D. conduction of heat from the blood in the skin blood vessels.

Question 20

The efficient cutaneous (skin) thermoregulation mechanisms of kangaroos aid in maintaining a relatively constant internal body temperature despite the environmental temperatures reaching up to 50°C during the day.

This is specifically called

- A. homeostasis.
- B. homeoregulation.
- C. homeothermy.
- D. homeobalance.

Question 21

On a very hot day, when the air temperature is well above thermoneutral levels, which of the following responses would occur as part of the negative feedback pathway in the kangaroo?

- A. migration of the foreleg skin blood vessels closer to the surface
- B. vasodilation of the foreleg skin blood vessels
- C. reduction in sweat secretion from the foreleg skin sweat glands
- D. decrease in loss of water vapour by panting

Question 22

Almost 40% of mammalian extinction that has occurred globally in the last 200 years has been in Australia.

Which of the following is **not** a major factor that has caused this?

- A. planned and organised management of the land
- B. habitat destruction and modification
- C. expansion of invasive introduced species
- D. alteration of fire patterns with more frequent, hotter wild fires

Use the following information to answer Questions 23–25.

The following photograph is of a greater bilby, a nocturnal marsupial that feeds on fruits, seeds, bulbs and insects. It has powerful forelimbs and strong claws for digging. Its senses of smell and hearing are excellent, but it has poor vision. Bilbies do not need to drink.



Bilbies live in deep burrows in the arid grasslands and woodlands of Australia's sandy deserts. Their distribution once covered 70% of mainland Australia, but since European settlement and the introduction of foxes, rabbits and feral cats, the species is classified as vulnerable. As such, it is only found in small areas of western and central Australia. Dingoes, pythons, birds of prey and monitor lizards also eat bilbies. At times when rabbit populations increase dramatically, so too do the number of foxes. However, when the rabbit population collapses, the foxes then prey on the native species, including bilbies. Feral camel populations also are a threat to bilby populations as they trample the suitable grassland with their hard hooves.

Question 23

The reduction in distribution and size of bilby populations in Australia has been due to

- A. competition with monitor lizards for food.
- B. predation by foxes and dingoes.
- C. death from disease introduced by Europeans.
- D. emigration to areas of more fertile grassland.

Question 24

Numbers of feral camels have increased markedly in the sandy deserts of Australia and this has contributed to the reduction in bilby numbers as the feral camels

- A. destroy the bilby habitat.
- B. compete for bilby food.
- C. reduce the land area available.
- D. drink the limited water available.

Question 25

Fire is an important natural component of the ecology of many Australian terrestrial ecosystems. Bilbies rely heavily on plants that bloom after occasional burning for their food. Indigenous Australians traditionally used fire to aid hunting and promote plant regeneration. This would have provided bilbies with an abundant and varied food source.

From this information, an appropriate strategy to promote an increase in bilby population numbers would be to

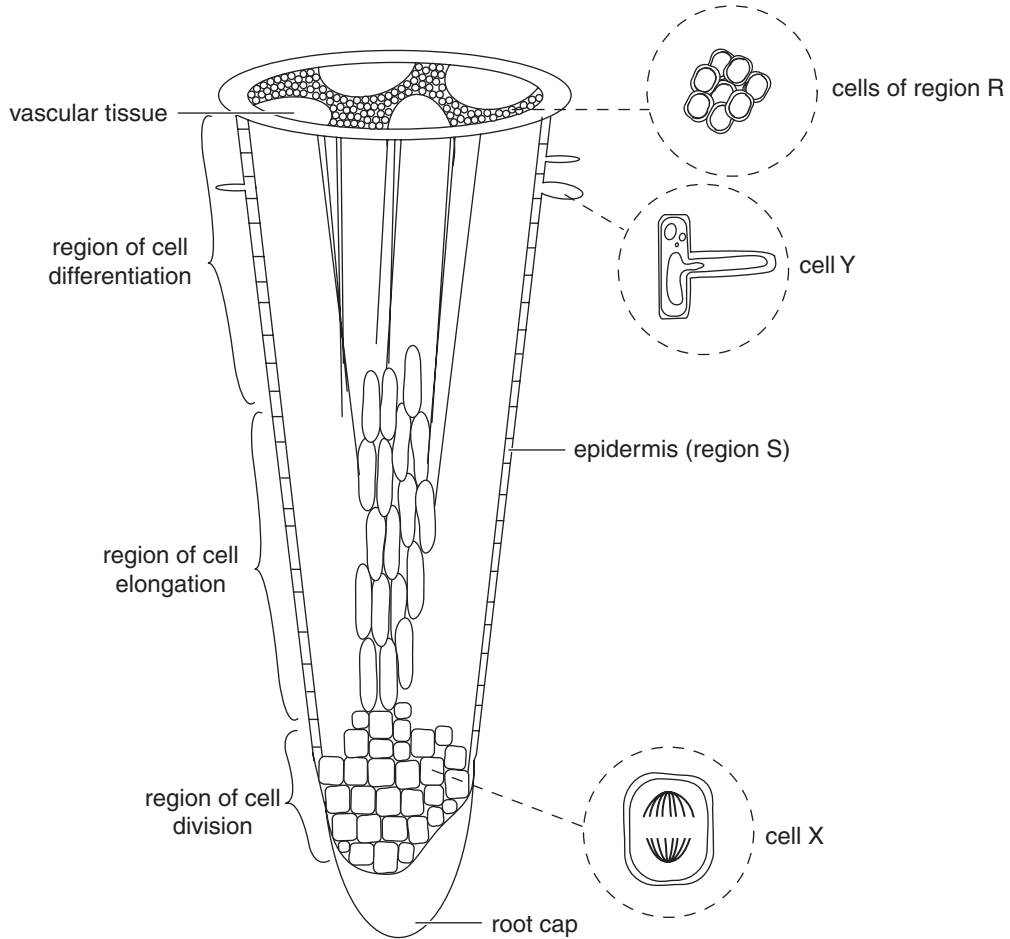
- A. kill all feral cats and camels.
- B. establish greater areas of grassland.
- C. move all bilbies to sanctuaries to save them.
- D. introduce regulated fire management of arid grasslands.

END OF SECTION A

SECTION B – SHORT-ANSWER QUESTIONS

Question 1 (8 marks)

The following diagram shows a three-dimensional representation of a root of a vascular plant showing some specific regions and cell types.



a. For each of the cells X and Y, describe a structural feature of the cell that aids in its specialised function.

i. cell X

1 mark

ii. cell Y

1 mark

- b. i.** Cells in region S are similar in size, shape and function.
What is the general term given to such groups of similar cells? 1 mark

- ii.** What is the specific name given to the group of cells in region R that carry water and mineral salts from the roots up to the stems and leaves? 1 mark

- iii.** What is **one** major difference between the cells in region R and those in region S? 1 mark

The concentration of sodium ions in the soil water surrounding the roots of a plant growing in normal soil was measured at 2 mM, whereas in the cytosol of the root cells, it was measured at 8–10 mM.

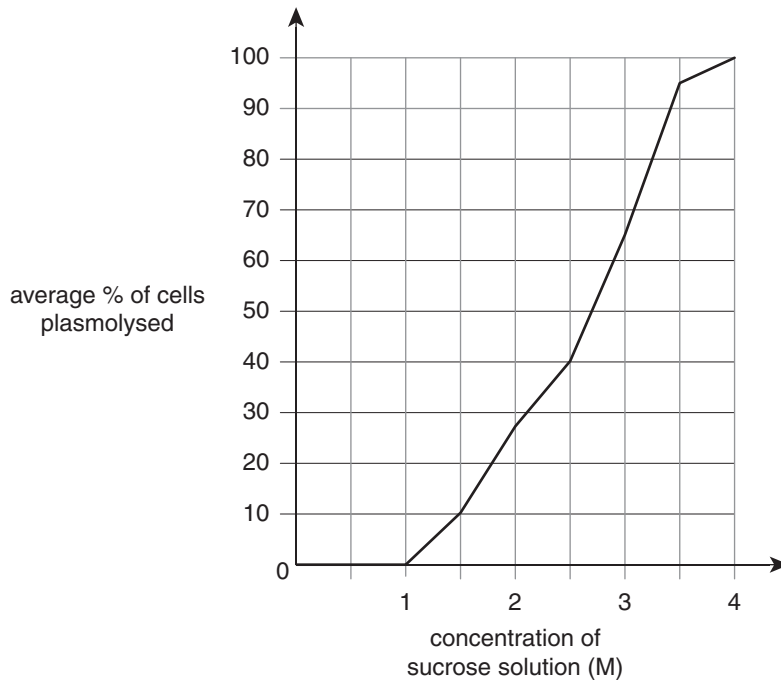
- c. i.** By what process would sodium ions enter the root cells in this plant? 1 mark

- ii.** Name **two** essential organelles or structures that would be necessary in the root cells for the process named in part **c.i.** to occur, and explain why each is essential. 2 marks

Question 2 (8 marks)

A Year 11 Biology student carried out an experiment to demonstrate plasmolysis (shrinkage of the cell cytoplasm in plant cells in some solutions) in the outer pink epidermal cells of the stem of rhubarb. A thin peel of these outer cells was taken and cut into one cm lengths. Several pieces were then placed in solutions of distilled water and 1 M, 2 M, 3 M and 4 M sucrose. After 30 minutes, a piece was removed from each solution and examined under a microscope to determine the percentage of cells in the field of view that were plasmolysed. This counting procedure was then repeated for two more pieces of peel from each solution and the average percentage plasmolysis in each solution was determined. This was then plotted against the concentration of each sucrose solution.

The following graph illustrates the results obtained.



- a.** Suggest a hypothesis proposed by the Biology student which lead to designing this experiment. 1 mark

- b. i.** What was the independent variable in this experiment? 1 mark

- ii.** Describe **two** strengths in the experimental design of this experiment. 2 marks

- c.** Plasmolysis does not occur in molar solutions of sucrose which are isotonic or hypotonic to the cell sap.

Explain why for each type of solution.

- i.** isotonic solution 1 mark

- ii.** hypotonic solution 1 mark

- d.** From the graph, determine the concentration of sucrose at which the cells began to plasmolyse. 1 mark

- e.** Could this same experiment be carried out with animal cell tissue to determine the percentage plasmolysis? Explain. 1 mark

Question 3 (10 marks)

A small amount of leg muscle tissue was removed from a rat that had been running through a maze looking for food. It was then analysed for the chemical substances it contained.

- a. i.** Compared to a similar analysis of the leg muscle tissue taken from the rat in a ‘rested’ state, name **two** substances that would be expected to be in a much higher concentration? 2 marks

- ii.** In the space below, write a balanced chemical equation for the process that produced the two chemical substances named in part **a.i.** 2 marks

- iii.** In the leg muscle cells carrying out the process in part **a.ii.**, draw, name and label **one** of the organelles that would be the main site of the process. 2 marks

- b.** If the rat could not find any food and kept running around very vigorously searching for another two minutes, what **two** differences would there be in the chemical substances found in the muscle cells when their contents were then analysed? 2 marks

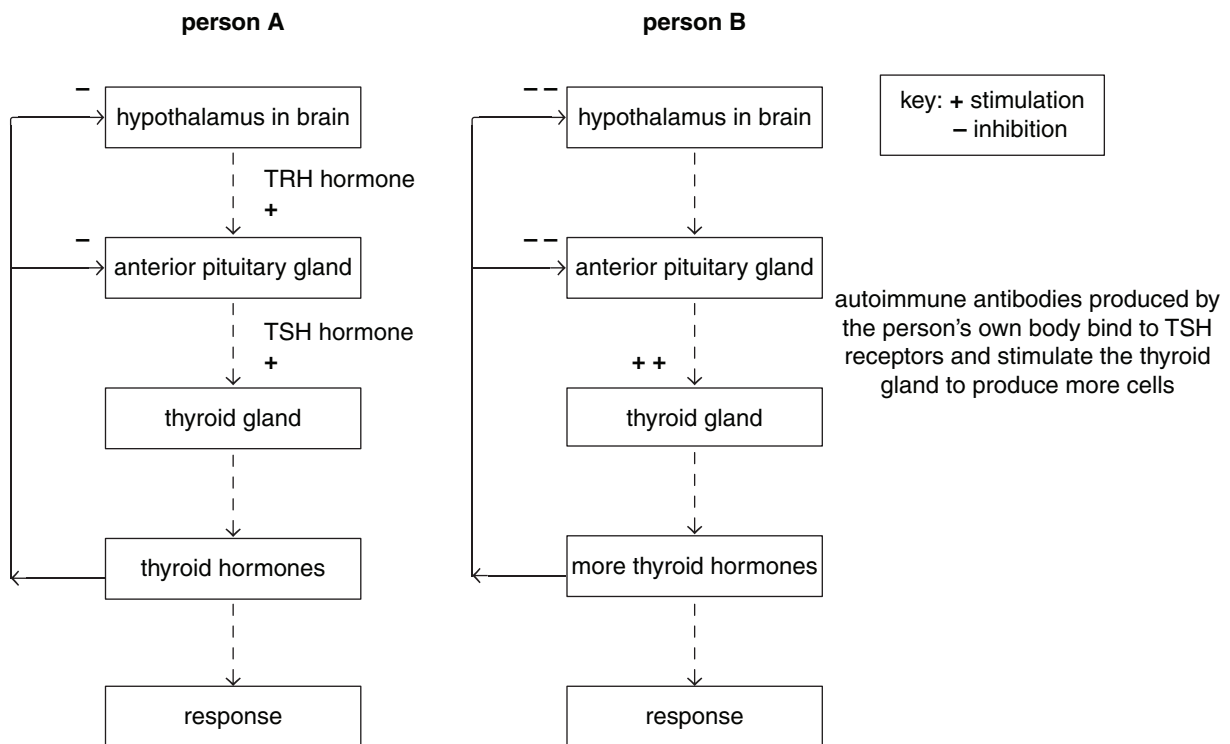
- c.** A student, Jim, who had been observing this experiment commented: “Obviously the circulatory system was the only system necessary for the process occurring in the muscle cells”.
Explain whether you agree or disagree with Jim. 2 marks

Question 4 (8 marks)

The thyroid is one of the glands of the endocrine system in the human body. It produces thyroid hormones important in regulation of body temperature, metabolism and heart rate. Disorders of thyroid hormone secretion are second only to diabetes mellitus caused by lack of insulin.

The pituitary gland and hypothalamus are both involved in controlling the thyroid. When thyroid levels drop too low, the hypothalamus secretes TRH hormone, which stimulates the pituitary gland to produce TSH hormone, which in turn stimulates the thyroid gland to release thyroid hormone into the blood. An increase of thyroid hormone in the blood will result in decreased stimulation of the hypothalamus.

Hyperthyroidism, most commonly caused by Grave’s disease, is an autoimmune disease in which antibodies produced by the person’s own body cells stimulate more thyroid gland cells to be produced. This results in an increased release of thyroid hormone which causes markedly reduces stimulation of the hypothalamus and pituitary glands. This information is summarised in the following flow charts for person A, who is healthy, and person B, who has Grave’s disease.



In a normal, healthy person, this process of regulation is important for the internal environment.

- a.** What makes up the internal environment of the human body? 1 mark

- b. i.** In both persons A and B, what is the effector in the pathway described? 1 mark

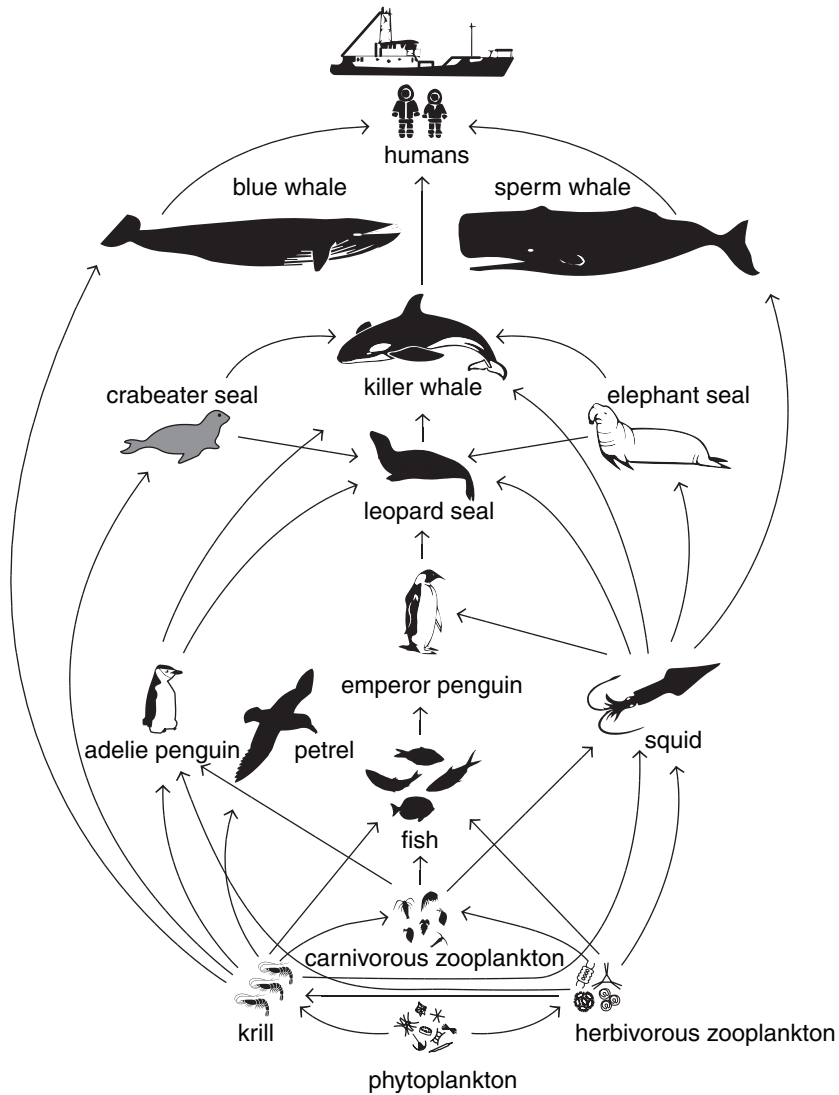
- ii.** For person B with Grave’s disease, what would be **two** of the physiological responses and subsequent symptoms the person would exhibit? 2 marks

- c.** Explain the importance of this process of regulation to the human body, including the term used to describe this condition. 2 marks

- d.** In a person with Grave's disease, would this be called negative or positive feedback? Explain using the information provided. 2 marks

Question 5 (9 marks)

The following shows a diagram of a generalised food web found in an ecosystem in Antarctica.



a. What is the original source of energy for this Antarctic food web? 1 mark

b. Jane noted there were three groups of plankton in the food web and concluded there were three groups of producers. Do you agree with her? Explain, including details of the three groups. 3 marks

- c.** In the food web shown, most of the arrows point upwards, whereas in other food web diagrams, the arrows can point downwards or sideways.
What does the direction of the arrows actually indicate? 1 mark

- d.** A killer whale is one of the top order consumers in the Antarctic food web, but it fits into several different levels in the food web.
Explain this statement, using **two** examples to aid your explanation. 2 marks

Whale hunting for their meat and oil has been markedly reduced, however some permits for hunting of limited numbers and for scientific research are still issued and so whaling continues. At least five of the thirteen great whale species are listed as endangered, including blue whales and Sei whales.

- e. i.** Explain what impact whale hunting would have on the Antarctic ecosystem. 1 mark

- ii.** Blue whale numbers declined dramatically from 30 000 to 40 000 in the 1930s, to less than 5000 in 1994; Sei whale numbers however increased from 9000 in 1978, to 28 000 in 2002.
Suggest a strategy that was probably introduced which resulted in the increase in Sei whale numbers to a level where it has been suggested that Sei whales should no longer be on the endangered list. 1 mark

Question 6 (7 marks)

'Sharkskin' swimsuits received a lot of attention during the 2008 Olympic Games. When examined under an electron microscope, shark skin is made up of millions of overlapping scales (dermal denticles), each with a groove running down their length in alignment with the direction of water flow. These grooves disrupt the formation of turbulent swirls of water making the water pass by faster. The rough shape of the skin also discourages parasitic growth of algae and bacteria.

- a.** Why is the growth of algae and bacteria on sharks and other sea-dwelling animals referred to as parasitic? 1 mark

Scientists have been able to replicate dermal denticles in the bottom surface of cargo hulls. This makes them more efficient, enabling faster transport and less frequent chemical cleaning of their hulls.

- b.** What is the term used for such copying or imitating of biological examples from nature to solve complex human problems or for technical applications? 1 mark

Scientists are also applying this principle to create surfaces in hospitals that resist bacterial growth by being too rough to permit bacterial adhesion. One dangerous species of bacteria found in hospitals is *Staphylococcus aureus* which causes skin and internal organ infections. There are over thirty different types of bacteria classified as *Staphylococcus*, including *S.epidermidis*, *S. saprophyticum* and *S. schleifen*, all of which are also responsible for skin infections.

- c. i.** What international system of naming has been used for these species of bacteria? 1 mark

- ii.** What level of classification do these four types of bacteria fall into, as indicated by their same first name? 1 mark

Over the last ten years many methods have been used to analyse selected DNA for species level identification.

d. i. Where in a *Staphylococcus* bacterial cell would DNA be located? 1 mark

ii. Consider the following four bacterial species.

A. *Streptococcus oralis*

B. *Staphylococcus epidermidis*

C. *Streptococcus pneumoniae*

D. *Saccharomonospora viridis*

Which **two** of the following bacterial species would show the least variation in the sequence of the *sodA* gene which is often used in DNA analysis? Give the letters of the two bacterial species chosen and explain your choice. 2 marks

END OF QUESTION AND ANSWER BOOKLET