

- (d) The student measured the real diameter of the field of view to be 0.375 mm.

Calculate the number of open stomata per mm² of leaf for the epidermis placed in 0.4 mol / dm³ salt solution.

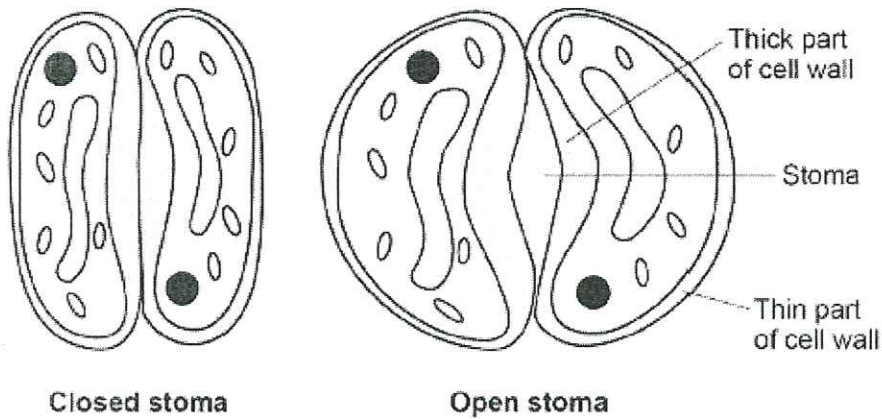
Use information from the table above.

Take π to be 3.14

Number of open stomata = _____ per mm²

(3)

- (e) The diagram below shows two guard cells surrounding a closed stoma and two guard cells surrounding an open stoma.



When light intensity is high potassium ions are moved into the guard cells.

Describe how the movement of potassium ions into the guard cells causes the stoma to open.

(4)

(Total 10 marks)

Q2.

The heart pumps blood to the lungs and to the cells of the body.

- (a) Name the blood vessel that transports blood from the body to the right atrium.

(1)

- (b) The aorta transports blood from the heart to the body.

In a person at rest:

- blood travels at a mean speed of 10 cm/s in the aorta
- blood travels at a mean speed of 0.5 mm/s in the capillaries
- the speed of blood decreases at a rate of 0.4 cm/s² as blood travels from the aorta to the capillaries.

Calculate the time it takes for blood to travel from the aorta to the capillaries.

Assume that the speed of blood decreases at a constant rate.

Use the equation:

$$\text{rate of decrease in speed} = \frac{\text{change in speed}}{\text{time}}$$

Give your answer to 2 significant figures.

Time = _____ s

(4)

- (c) Describe the route taken by oxygenated blood from the lungs to the body cells.

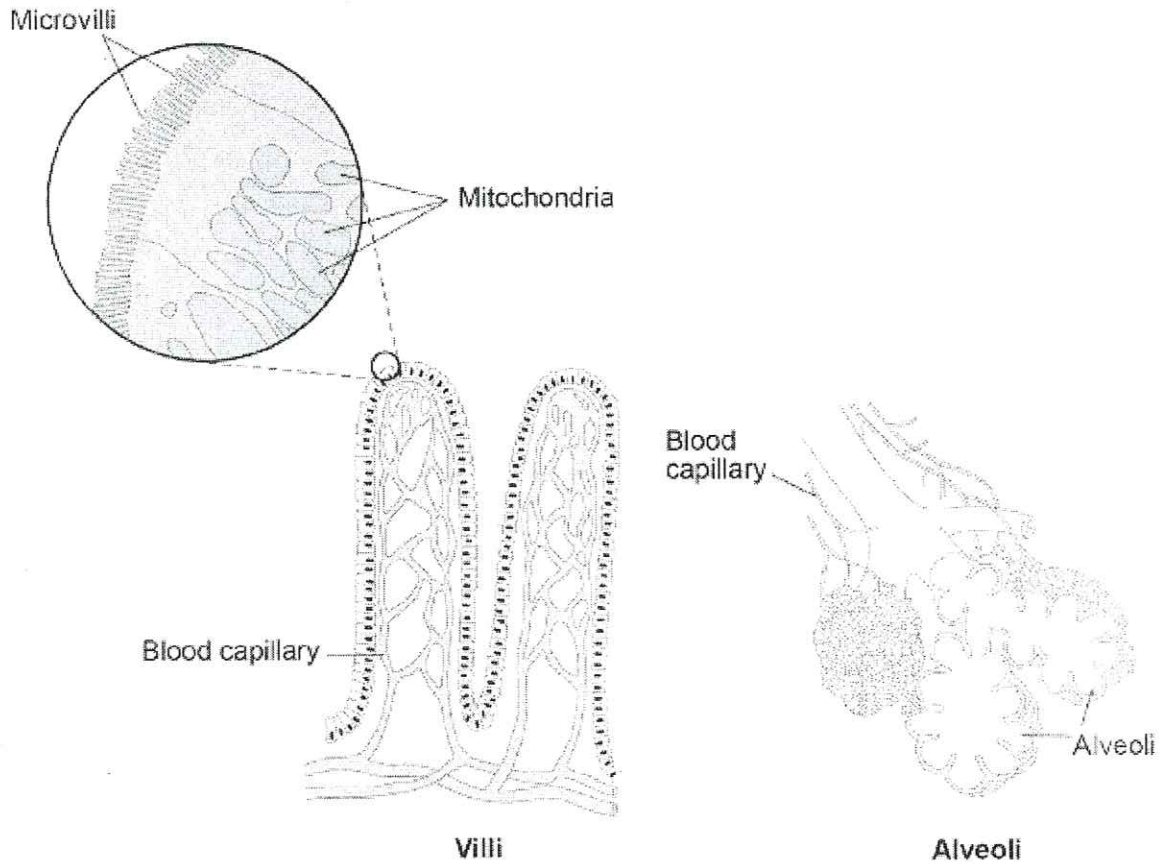
(4)

- (d) The digestive system and the breathing system both contain specialised exchange

surfaces.

- In the digestive system, digested food is absorbed into the blood stream in structures called villi.
- In the breathing system, gases are absorbed into the blood stream in the alveoli.

The diagram below shows the structure of villi and alveoli.



Explain how the villi and the alveoli are adapted to absorb molecules into the bloodstream.

(6)

(Total 15 marks)

Q3.

Meiosis and mitosis are different types of division in human cells. Compare the two processes by referring to where each takes place and the kind of products that are made.

(Total 6 marks)

Q4.

Diffusion and active transport take place in healthy kidneys.

(a) Explain what is meant by:

(i) diffusion _____

(2)

(ii) active transport _____

(2)

(b) Describe, as fully as you can, how urine is produced by the kidneys.

(5)

(Total 9 marks)

Q5.

Many functions of the human body are controlled by chemicals called hormones.

(a) What is a hormone?

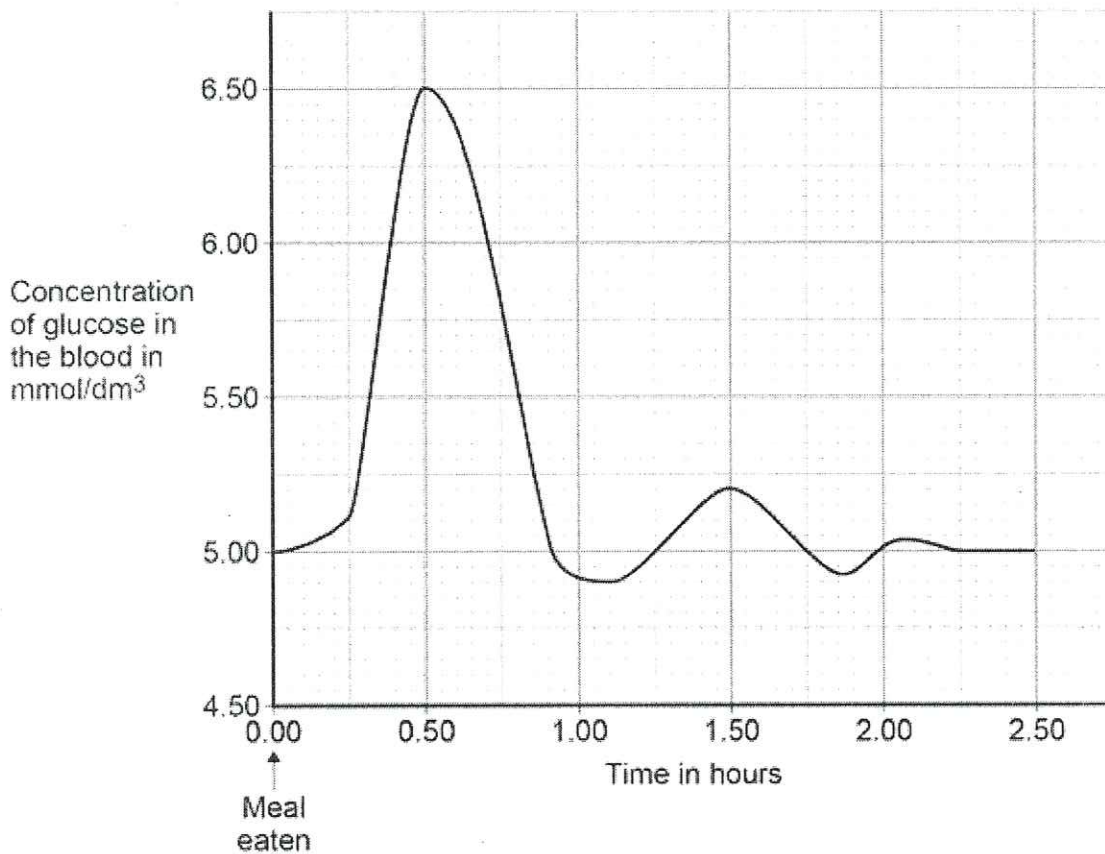
(3)

(b) Name the **two** hormones that control blood glucose concentration.

_____ and _____

(1)

The graph shows changes in the concentration of glucose in the blood of a healthy person following a meal.



(c) Explain how negative feedback controls the blood glucose concentration during the first one and a half hours after the meal.

(4)
(Total 8 marks)

Q6.

The use of cloned animals in food production is controversial.

It is now possible to clone 'champion' cows.

Champion cows produce large quantities of milk.

- (a) Describe how adult cell cloning could be used to produce a clone of a 'champion' cow.

(4)

- (b) Read the passage about cloning cattle.

The Government has been accused of 'inexcusable behaviour' because a calf of a cloned American 'champion' cow has been born on a British farm. Campaigners say it will undermine trust in British food because the cloned cow's milk could enter the human food chain.

But supporters of cloning say that milk from clones and their offspring is as safe as the milk we drink every day.

Those in favour of cloning say that an animal clone is a genetic copy. It is not the same as a genetically engineered animal. Opponents of cloning say that consumers will be uneasy about drinking milk from cloned animals.

Use the information in the passage and your own knowledge and understanding to evaluate whether the government should allow the production of milk from cloned 'champion' cows.

Remember to give a conclusion to your evaluation.

(5)

(Total 9 marks)

Q7.

Penicillin is an antibiotic which stops bacteria from reproducing. It was used a lot in the past to treat bacterial infections in humans and other animals. In many hospitals there are now strains of penicillin resistant bacteria.

Explain how natural selection could have produced these strains of penicillin resistant bacteria.

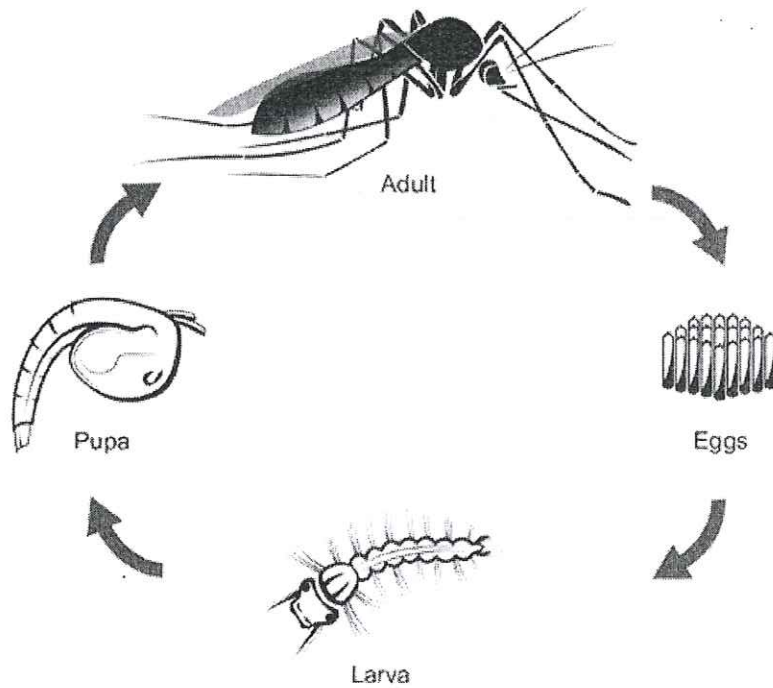
(Total 5 marks)

Q8.

Malaria is a disease caused by a microorganism carried by mosquitoes.

The microorganism is transferred to humans when adult female mosquitoes feed on human blood.

The figure below shows the life cycle of a mosquito.



The World Health Organisation estimates that 3×10^8 people are infected with malaria every year.

Scientists estimate that malaria kills 2×10^6 people every year.

The people who are infected with malaria but do not die, may be seriously ill and need health care for the rest of their lives.

- (a) Based on the estimated figures, what percentage of people infected with malaria die from the disease?

(2)

- (b) An internet article states:

- 1 Mosquito larvae are at the start of the food chain for some fish.
- 2 Adult mosquitoes provide food for bats and birds.
- 3 Mosquitoes are also important in plant reproduction because they feed from flowers of crop plants.

- (i) The first sentence in the article is **not** correct.

Explain why.

(2)

- (ii) A company plans to produce genetically modified (GM) adult male mosquitoes. The GM mosquitoes will carry a gene from bacteria. The gene causes the death of offspring before they become adults.

Male mosquitoes do **not** feed on blood.

Scientists are considering releasing millions of adult male GM mosquitoes into the wild.

Do you think scientists should release millions of male GM mosquitoes into the wild?

In your answer you should give advantages and disadvantages of releasing GM mosquitoes into the wild.

(4)

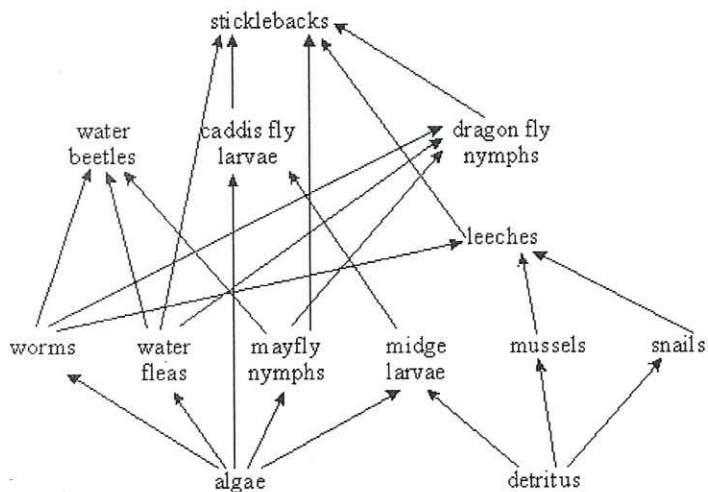
- (iii) Describe the process for creating a GM mosquito.

(3)

(Total 11 marks)

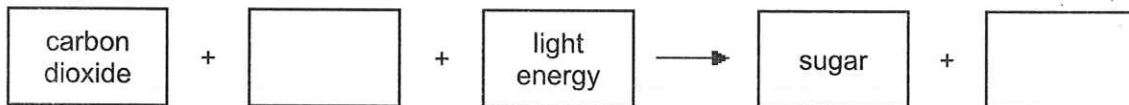
Q9.

The diagram below shows a food web for some of the organisms which live in a pond.



You may need to use information from the food web to help you to answer the following questions.

- (a) The algae photosynthesise. Complete the equation for photosynthesis.



(2)

- (b) Only a small percentage of the Sun's energy captured by the algae is eventually incorporated into the body tissues of the stickleback. Explain, as fully as you can, what happens to the rest of the energy captured by the algae.

(8)

(Total 10 marks)

Q10.

The figures below show the levels of carbon dioxide in air from 150 000 years ago.

TIME	CARBON DIOXIDE CONCENTRATION
1500 years ago	270 parts per million
1800 AD	290 parts per million
1957	315 parts per million
1983	340 parts per million

(a) Explain why carbon dioxide levels in the atmosphere are changing.

(3)

(b) It is suggested that the increased level of carbon dioxide in the air is causing the atmosphere to warm up (the "Greenhouse Effect").

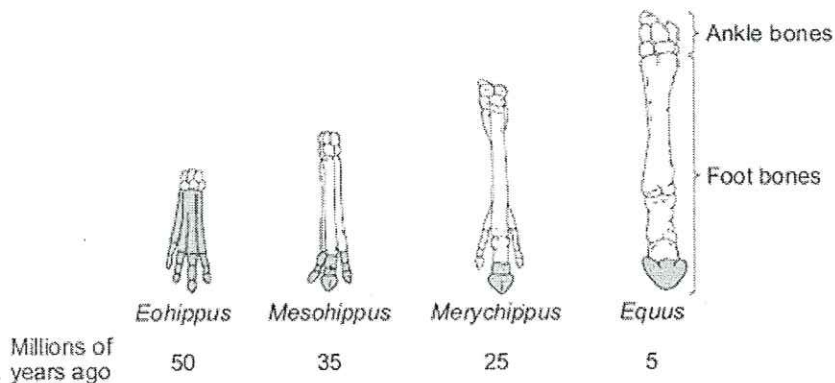
Describe, as fully as you can, **two** major effects of global warming and how these may affect the human population.

(6)

(Total 9 marks)

Q11.

The diagram below shows changes in the foot bones of four ancestors of modern horses over the past 50 million years.



Key: The shaded bones are the bones which touched the ground.

- (a) Describe **two** changes to the bones in the feet of horses that have taken place over the past 50 million years.

(2)

- (b) *Eohippus* lived in swampy areas with soft mud.

Since this time the ground in the habitat has become drier and harder.

All of the horse ancestors were preyed upon by other animals.

- (i) Explain **one** advantage to *Eohippus* of the arrangement of bones in its feet.

(2)

- (ii) The changes in the arrangement of the foot bones of horses support Darwin's theory of evolution by natural selection.

Explain how the arrangement of the foot bones of *Eohippus* could have evolved into the arrangement of the foot bones of *Equus*.

(4)

(Total 8 marks)

Q12.

Explain how the human circulatory system is adapted to:

- supply oxygen to the tissues
- remove waste products from tissues.

(Total 6 marks)

