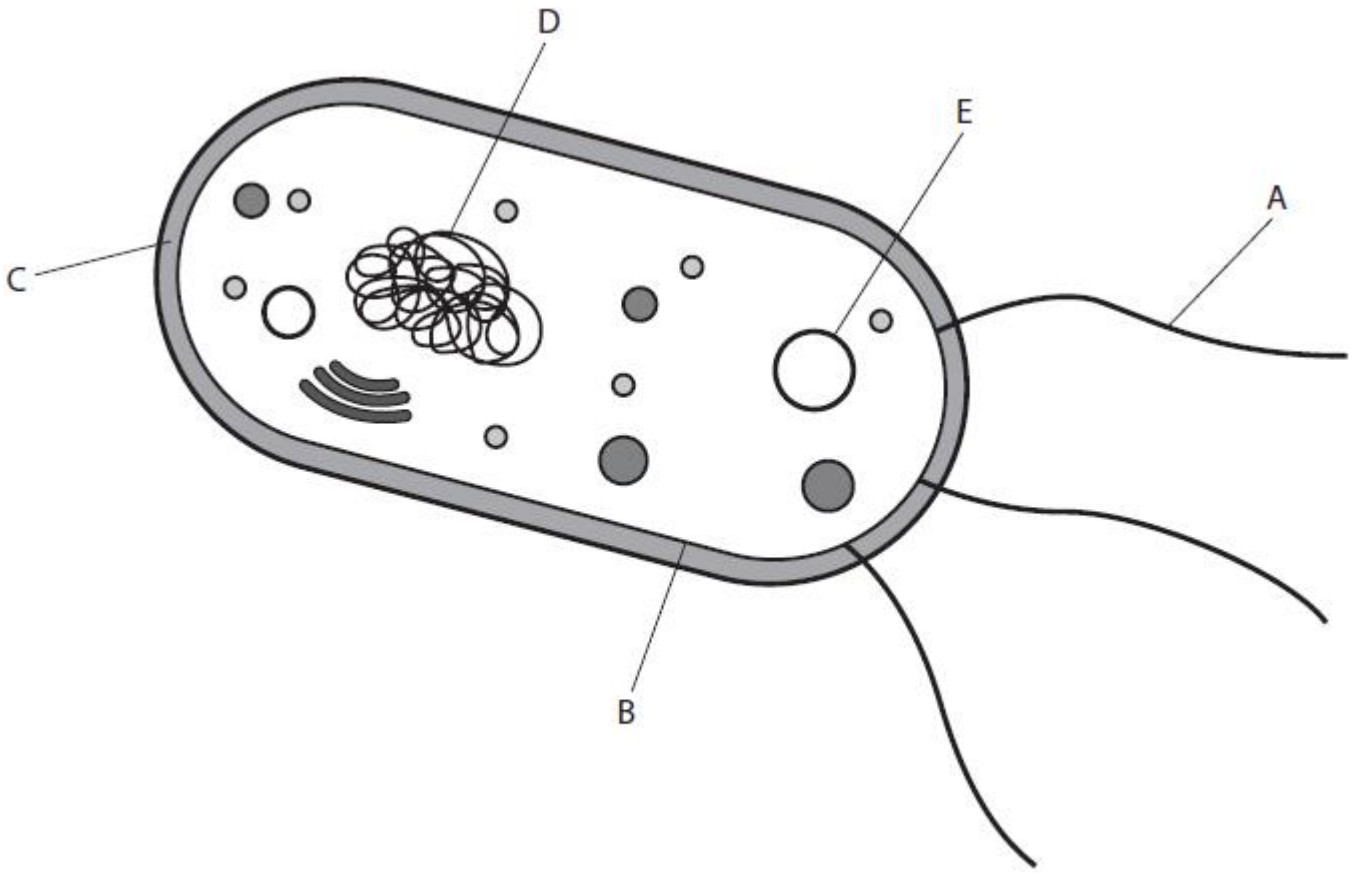
Questions

Q1.

Answer the questions with a cross in the box you think is correct ☒. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.

The diagram shows a bacterium with structures A, B, C, D and E labelled.



(a) (i) Which structure contains the genetic material used by the bacterium in reproduction?

(1)

- ☒ **A**
- ☒ **B**
- ☒ **C**
- ☒ **D**

(ii) Which structure controls the substances entering and leaving the bacterium?

(1)

- ☒ **A**
- ☒ **B**
- ☒ **D**
- ☒ **E**

(b) Give three differences between the structure of this bacterium and the structure of a plant cell.

(3)

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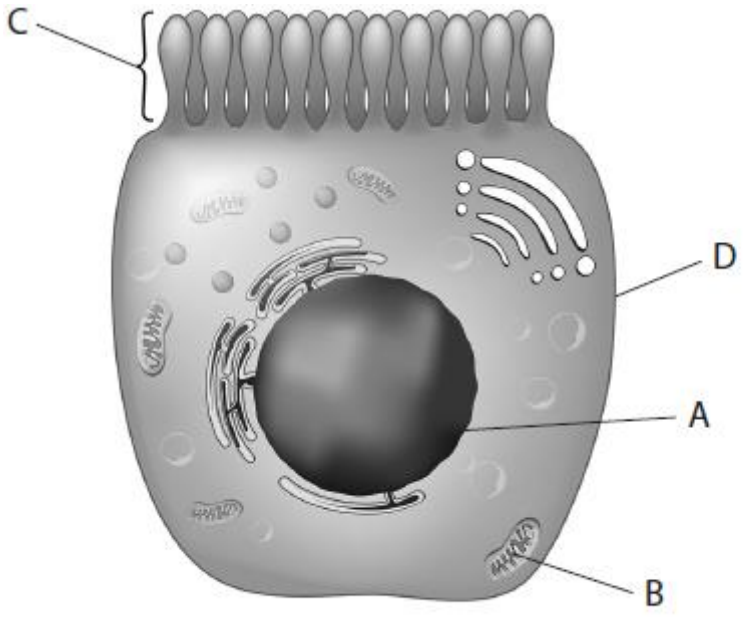
(Total for question = 5 marks)

Q2.

The diagram shows a cell found in the lining of the human small intestine.



(Source: © Designua / Shutterstock)

(a) (i) Which of the labelled structures is a microvillus?

(1)

- ☒ **A**
- ☒ **B**
- ☒ **C**
- ☒ **D**

(ii) Which of the labelled structures produces ATP?

(1)

- ☒ **A**
- ☒ **B**
- ☒ **C**
- ☒ **D**

(b) These cells form the lining of the small intestine.

Explain how the structure of the small intestine is adapted for absorption.

(4)

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(c) Cells in the human placenta also have microvilli.

Describe the role of the human placenta.

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(Total for question = 9 marks)

Q3.

Scientists collect data from a grassland ecosystem.

For each trophic level they determine

• the mean number of organisms in a square metre

• the mean dry mass of these organisms in a square metre

The table shows the scientists' data.

Trophic level	Mean number of organisms	Mean dry mass in g
producer	592	821.0
primary consumer	68	37.0
secondary consumer	35	10.60
tertiary consumer	3	2.40

(a) (i) Draw a labelled pyramid of numbers for this data.

(2)

(ii) Describe how you could collect data to find the mean number of producers per square metre in the ecosystem.

(3)

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(b) The mass of organisms at each trophic level is called the biomass.

The percentage of biomass in the producers that is transferred to the primary consumers is 4.5%.

(i) Calculate the percentage of biomass in the secondary consumers that is transferred to the tertiary consumers.

(1)

percentage = ... %

(ii) Comment on the energy transfers in this ecosystem.
In your answer, refer to data from the table and the percentages of biomass transferred.

(4)

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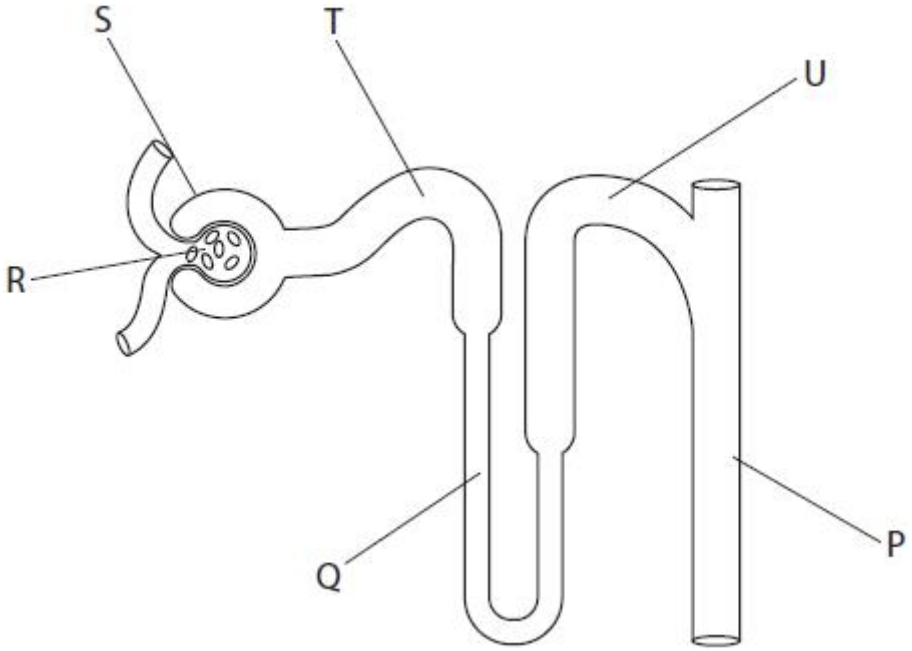
(Total for question = 10 marks)

Q4.

The diagram shows a nephron from a human kidney with some structures labelled.



(a) (i) Which structure is the Bowman's capsule?

(1)

- ☒ **A** P
- ☒ **B** R
- ☒ **C** S
- ☒ **D** T

(ii) Which structure is the loop of Henle?

(1)

- ☒ **A** P
- ☒ **B** Q
- ☒ **C** S
- ☒ **D** U

(iii) Which structure is affected by ADH?

(1)

- ☒ **A** P
- ☒ **B** Q
- ☒ **C** S
- ☒ **D** T

(b) (i) Blood plasma contains much glucose, but urine normally does not.

Explain what happens to glucose in the kidney.

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(ii) Describe how a sample of urine could be tested for glucose.

(2)

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(c) As a person sweats, they may become dehydrated.

Describe the changes in a person's urine if they become dehydrated.

(2)

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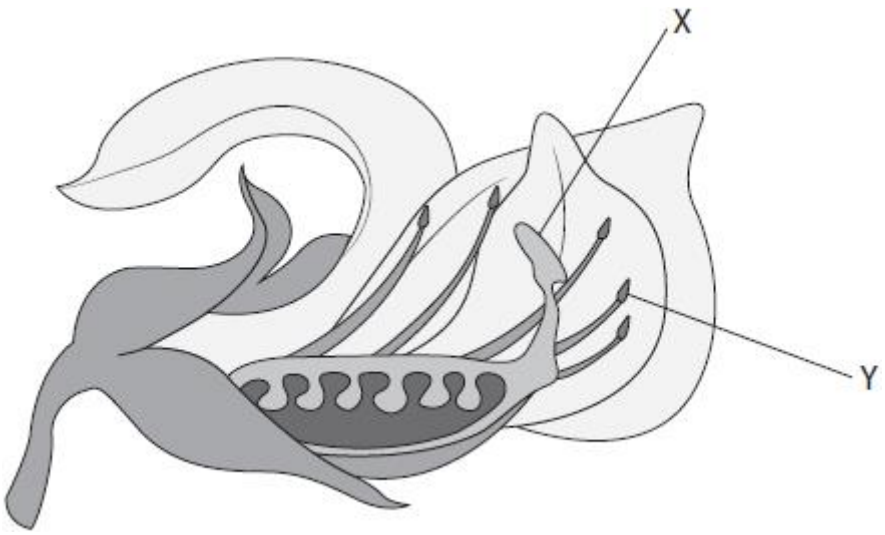
(Total for question = 10 marks)

Q5.

(a) The diagram shows a pea flower with structures labelled X and Y.



(i) Give the names of structures X and Y.

(2)

X .....

Y .....

(ii) Explain how two structures, present in the diagram, show how the flower is pollinated.

(3)

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(b) A scientist uses this method to compare the carbohydrates present in ungerminated and germinating pea seeds.

- carry out an iodine test and a Benedict's test on ungerminated seeds
- soak another set of seeds in water and allow them to germinate in unsealed jars
- after three days, carry out an iodine test and a Benedict's test on the germinating seeds

The table shows the scientist's results.

Seeds	Colour of iodine solution	Colour of Benedict's solution
ungerminated	black	blue
germinating	black	red

(i) State which carbohydrates the scientist identified in the ungerminated seeds and the germinating seeds.

(2)

ungerminated seeds

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germinating seeds

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(ii) Explain the difference in the carbohydrate composition of the ungerminated seeds and the germinating seeds.

(3)

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(iii) Explain why the jars used in the investigation are not sealed.

(2)

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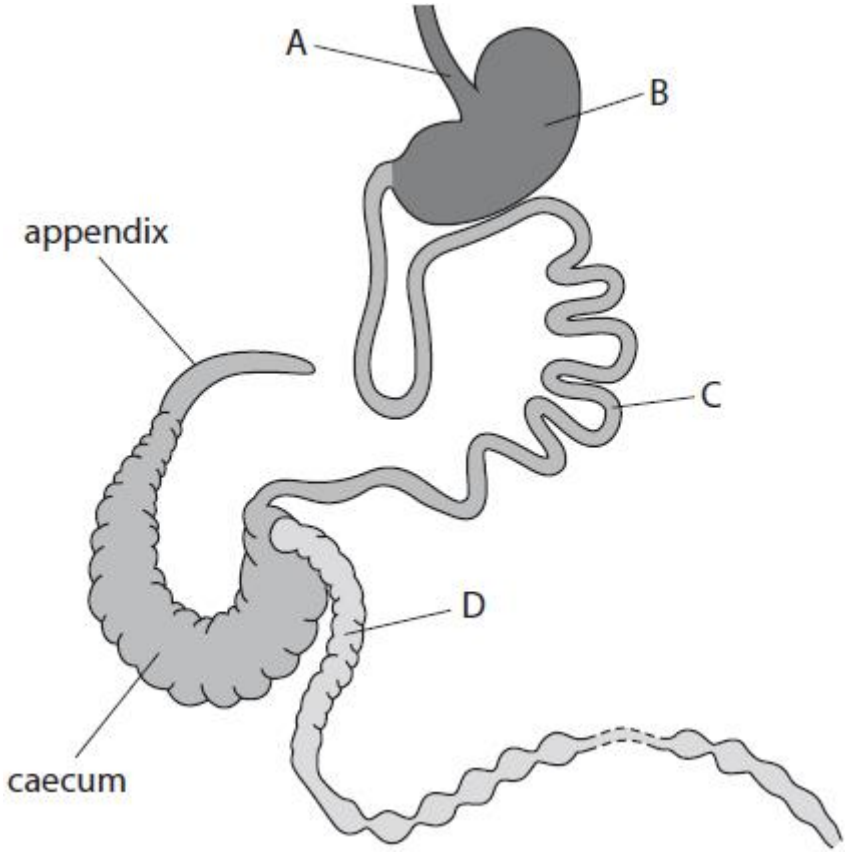
(Total for question = 12 marks)

Q6.

The diagram shows part of the gut of a rabbit.

The rabbit is a primary consumer and eats mainly grass and other vegetable material.



(a) Name the parts labelled A, B, C and D.

(4)

A .....

B .....

C .....

D .....

(b) The gut of a rabbit has a large caecum and appendix. These contain bacteria that are able to produce the enzyme cellulase.

Explain how these bacteria help the rabbits with their diet of plant material.

(3)

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(c) The human gut has a caecum and appendix but they are much smaller than those in the rabbit.

(i) Suggest why the human gut only has a small caecum and appendix.

(1)

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(ii) In humans the appendix also acts as a store of useful bacteria. Scientists have discovered that patients who have had their appendix removed are more likely to develop infections of the colon.
Explain how having no appendix may increase the likelihood of bacterial infections of the colon.

(2)

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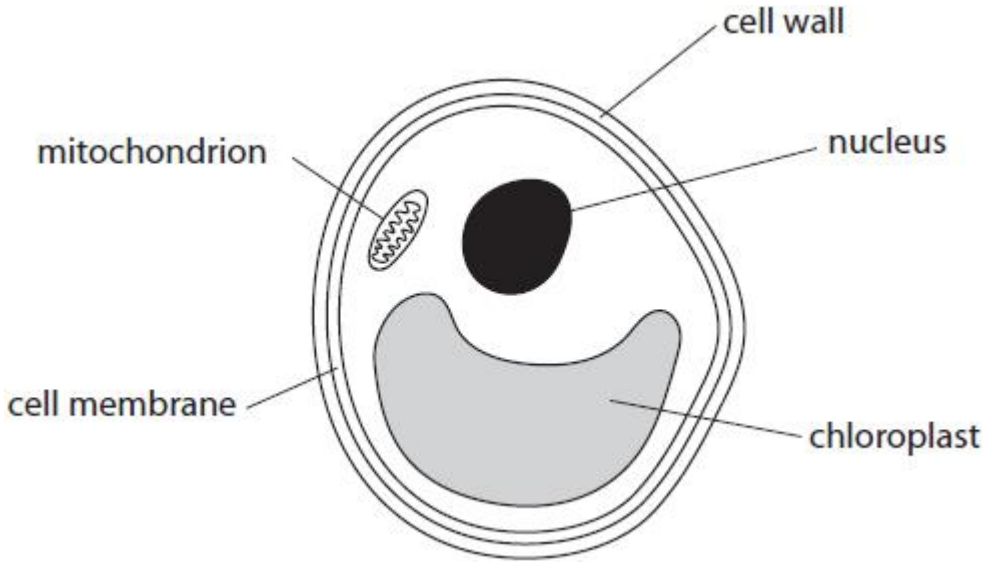
(Total for question = 10 marks)

Q7.

The diagram shows a single-celled organism called *Chlorella* that lives in fresh water.

Chlorella has a chloroplast and can photosynthesise.



(a) (i) Which of these groups of organisms contains *Chlorella*?

(1)

- ☒ **A** animals
- ☒ **B** bacteria
- ☒ **C** plants
- ☒ **D** protoctists

(ii) Which of these labelled structures would also be present in an animal cell?

(1)

- ☒ **A** cell membrane and chloroplast
- ☒ **B** cell membrane and mitochondrion
- ☒ **C** cell wall and chloroplast
- ☒ **D** cell wall and mitochondrion

(b) Complete the balanced chemical symbol equation for photosynthesis.

(2)

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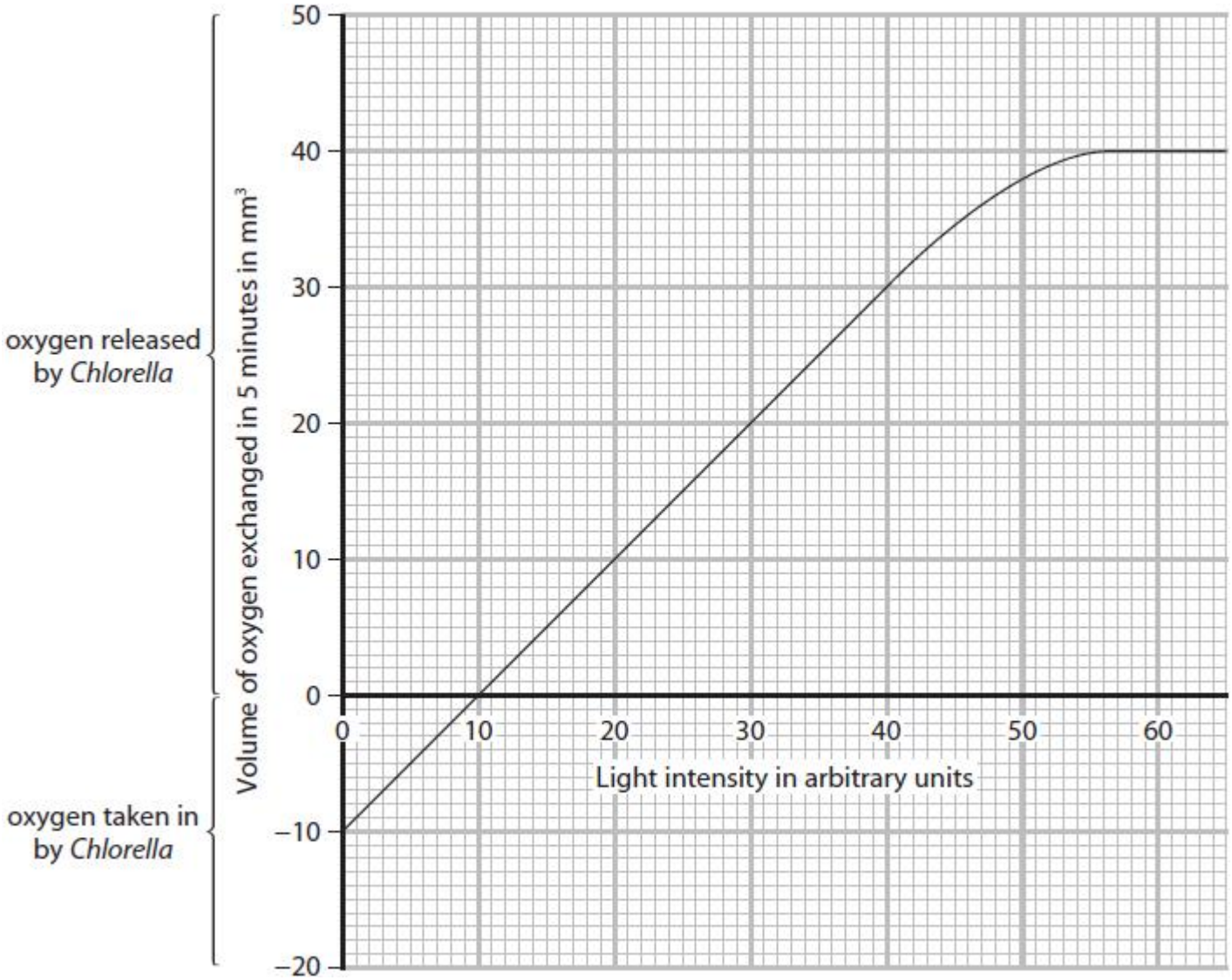
..... + $6O_2$

(c) The graph shows the effect of light intensity on gas exchange by *Chlorella*.



(i) Explain why *Chlorella* takes in oxygen at light intensities below 10 arbitrary units.

(2)

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(ii) Explain the changes in the volume of oxygen released as the light intensity increases from 10 arbitrary units.

(3)

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(iii) The volume of oxygen released by *Chlorella* is the difference between the oxygen produced by photosynthesis and the oxygen taken in.
Use the graph to calculate the volume of oxygen produced in five minutes by photosynthesis at a light intensity of 50 arbitrary units.

(2)

volume of oxygen = ... mm^3

(d) Describe how hydrogen-carbonate indicator could be used to investigate the effect of light intensity on carbon dioxide exchange by *Chlorella*.

(3)

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(Total for question = 14 marks)

Q8.

The photograph shows a variety of chicken called a silkie chicken.

(Source: © YVES LANCEAU/NATURE PICTURE LIBRARY/SCIENCE PHOTO LIBRARY)

Silkie chickens have feathers that have a fluffy appearance.

Feather structure is controlled by a single gene.

The allele for producing silkie feathers (f) is recessive to the allele for producing normal feathers (F).

(a) (i) State what is meant by the term **gene**.

(1)

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(ii) Give the possible genotypes of a chicken with normal feathers.

(1)

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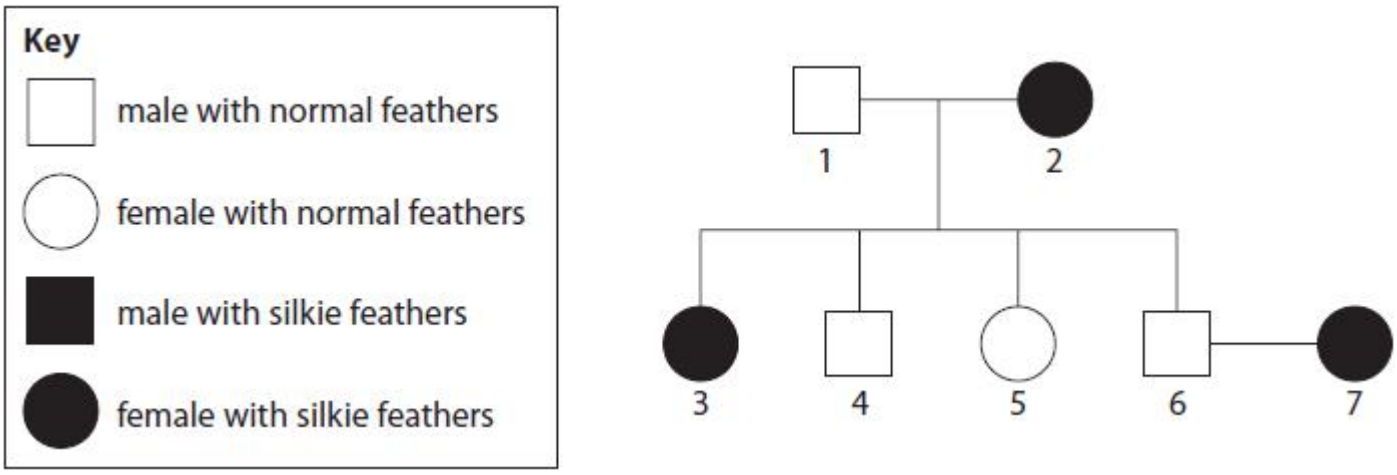
(b) A scientist investigates the inheritance of feather types in chickens.

The diagram shows a family pedigree for some chickens.



(i) How many chickens in the family pedigree are heterozygous?

(1)

- ☒ **A** 0
- ☒ **B** 3
- ☒ **C** 4
- ☒ **D** 5

(ii) Use a genetic diagram to determine the probability of one of the offspring of individual 6 and individual 7 being a chicken with silkie feathers.

(4)

probability = ...

(iii) The scientist observes that the chickens have either normal feathers or silkie feathers.
However, the chickens have a wide range of different heights.
Explain why there is a wider range of variation in height than in feather type.

(3)

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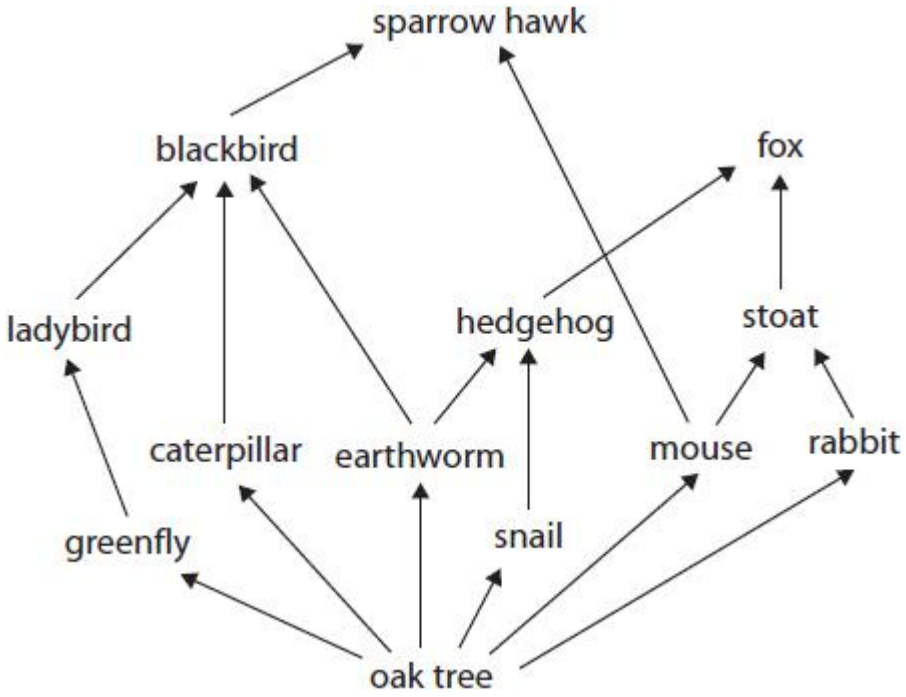
(Total for question = 10 marks)

Q9.

This food web comes from a woodland ecosystem.



(a) (i) Which organism is the producer?

(1)

- ☒ **A** caterpillar
- ☒ **B** earthworm
- ☒ **C** oak tree
- ☒ **D** stoat

(ii) Which organism is a secondary consumer?

(1)

- ☒ **A** caterpillar
- ☒ **B** earthworm
- ☒ **C** fox
- ☒ **D** ladybird

(iii) Which organism is both a secondary and a tertiary consumer?

(1)

- ☒ **A** blackbird
- ☒ **B** earthworm
- ☒ **C** fox
- ☒ **D** stoat

(b) A farmer is using a pesticide in fields next to the woodland.

The pesticide is reducing the numbers of greenfly and caterpillars in the woodland.

(i) Explain what effect this may have on the blackbirds in the woodland.

(3)

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(ii) Describe a different method the farmer could use to reduce the number of greenfly on his crops.

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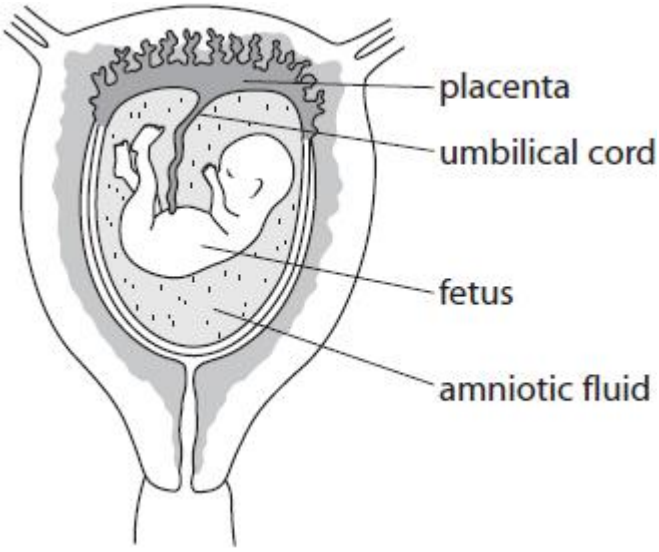
(Total for question = 9 marks)

Q10.

The diagram shows a fetus in the uterus of a woman.



The umbilical cord transports blood from the placenta to the fetus.

This blood contains molecules from the mother that are needed by the developing fetus.

(a) (i) Explain how some of these molecules allow active transport to occur in cells of the fetus.

(3)

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(ii) Explain how one type of molecule from the mother helps to protect the fetus from infection.

(2)

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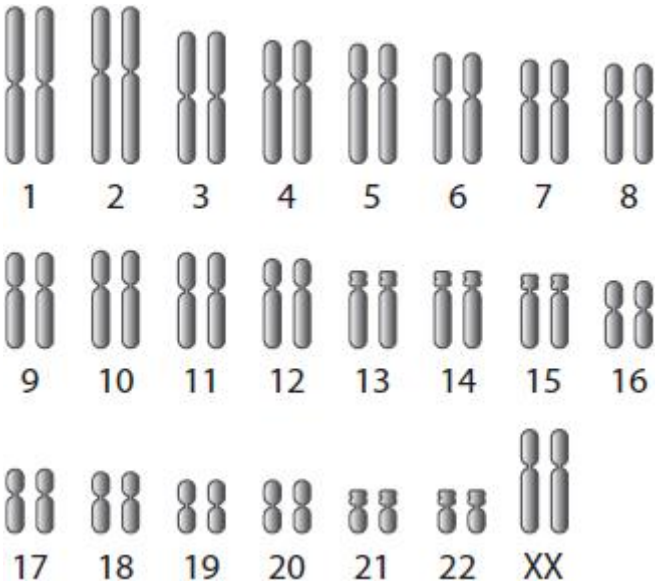
(b) The amniotic fluid contains cells from the fetus.

It is possible to look at chromosomes in these cells.
A diagram of the chromosomes is called a karyotype.
The diagram shows the karyotype of a fetus cell.



Give two conclusions you can make from this karyotype.

(2)

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(c) Doctors recommend that pregnant women obtain more of some dietary components than women who are not pregnant.

The table shows the recommended percentage increase of some dietary components in the diet of a woman who is pregnant compared to a woman who is not pregnant.

Component	Percentage increase of some dietary components in the diet of a woman who is pregnant compared to a woman who is not pregnant (%)
Energy in kJ	10
Calcium in g	71
Iron in mg	50
Protein in g	14
Vitamin D in μg	300

(i) Explain why a woman who is pregnant requires more of each of the dietary components listed in the table.

(4)

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(ii) The actual mass of additional iron needed by the pregnant woman was 9.0 mg per day.
Calculate the actual total mass of iron needed by the pregnant woman.

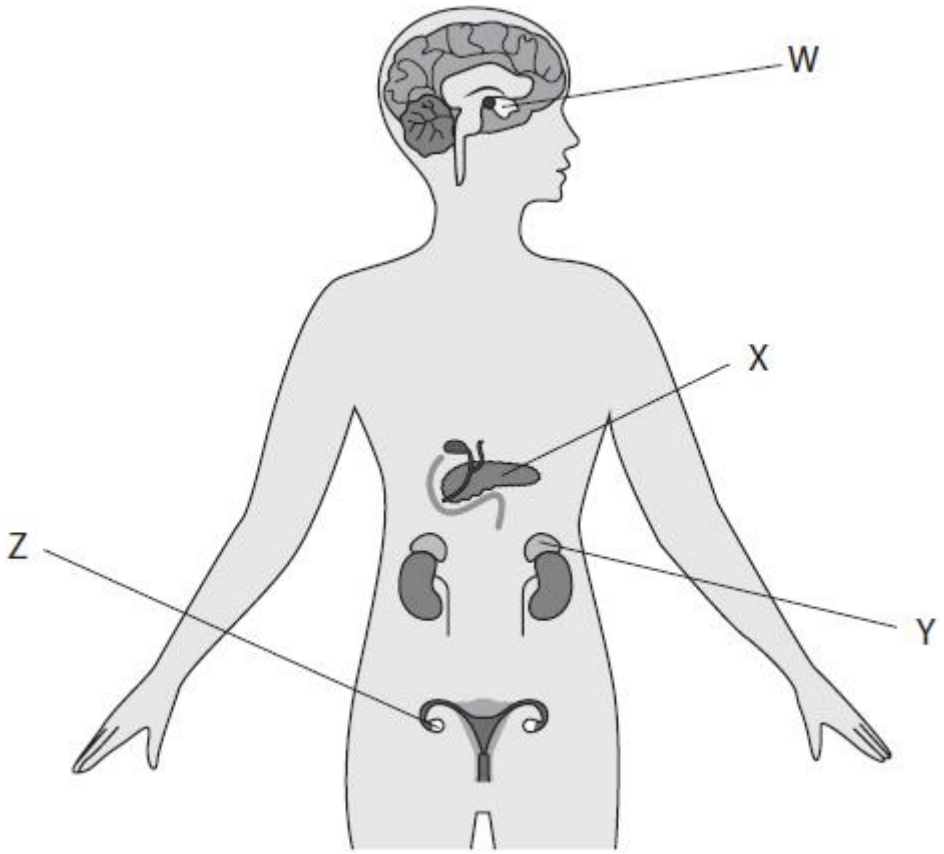
(3)

mass = ... mg per day

(Total for question = 14 marks)

Q11.

The diagram shows the position of some hormone producing glands in the female body.



(a) Which of these structures is the adrenal gland?

(1)

- ☒ **A** W
- ☒ **B** X
- ☒ **C** Y
- ☒ **D** Z

(b) The adrenal gland is an organ that secretes adrenaline.

State what is meant by the term **organ**.

(1)

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(c) Adrenaline is released into the blood when there is danger.

The list gives the effects of adrenaline on different parts of the body.

- dilates the pupil in the eye
- increases heart rate
- narrows small arteries in the intestine
- converts glycogen into glucose in the liver

Explain the advantages of these effects to a person in danger.

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(Total for question = 7 marks)