PEARSON EDEXCEL IGCSE BIOLOGY · 4BI1

BIOLOGY



EXAM QUESTION PACK

SECTION 2: STRUCTURE AND FUNCTIONS IN LIVING ORGANISMS (PACK 6)

SCORE	PERCENTAGE
/300	%

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Q1.

A student uses this method to investigate the effect of fertiliser on the growth of plant seedlings.

- set up two trays with an equal mass of compost in each tray
- plant 100 seeds, equally spaced, in each tray
- place the trays under the same lamp until the seeds start to germinate
- water each tray every day with the same volume of water
- add fertiliser to one of the trays every day
- remove five seedlings from each tray every four days for a period of 20 days
- dry these seedlings in an oven and find their mass

The table shows the student's results.

Day	Dry mass of seedlings in g	
	Without fertiliser	With fertiliser
4	3.5	3.8
8	4.9	5.8
12	5.8	6.7
16	6.3	7.8
20	6.8	8.5

(a) (i) Give two abiotic variables that the student controls.

(2)

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(ii) The student dries the seedlings in an oven to find their dry mass.

Suggest why it is important to use dry mass in this investigation.

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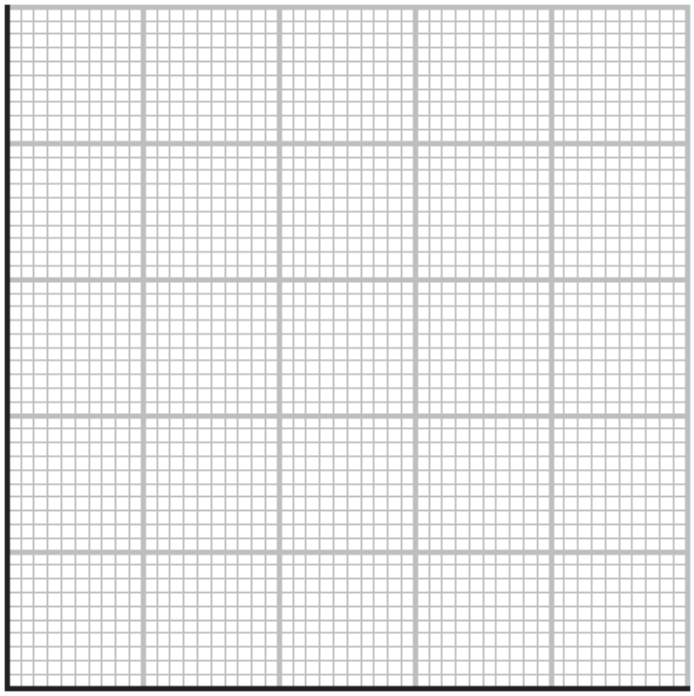
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(b) (i) Plot a line graph to show the dry mass of seedlings without fertiliser and the dry mass of seedlings with fertiliser, from day 4 to day 20.

Use a ruler to join your points with straight lines.

(5)



(ii) The fertiliser contains magnesium ions and nitrate ions.

Explain the effect of these two ions on the growth of the seedlings.

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(Total for question = 13 marks)

Q2.

Human saliva contains amylase.

A student thinks that salty food might affect the ability of amylase to digest starch.

Design an investigation to find out if salt affects the ability of amylase to digest starch.

Include experimental details in your answer and write in full sentences.

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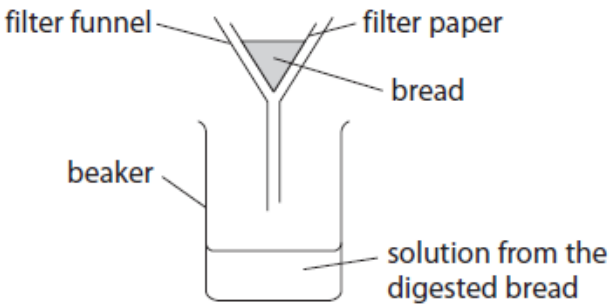
(Total for question = 6 marks)

Q3.

Bread contains starch.

A student investigates how temperature affects the digestion of bread.

This is the apparatus he uses in his method.



This is the student's method.

- add amylase to a sample of bread
- put this bread in the filter funnel
- pour water onto the bread
- do a Benedict's test on the solution from the digested bread that collects in the beaker
- repeat the method at different temperatures

(a) Explain the results of Benedict's test if the amylase digests the starch.

(2)

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(b) The student's method lacks detail.

Rewrite the method so that the student could make a valid conclusion about the effect of temperature on amylase.

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(c) The student predicted that the rate of digestion of starch would keep increasing as temperature increased.

Comment on this prediction.

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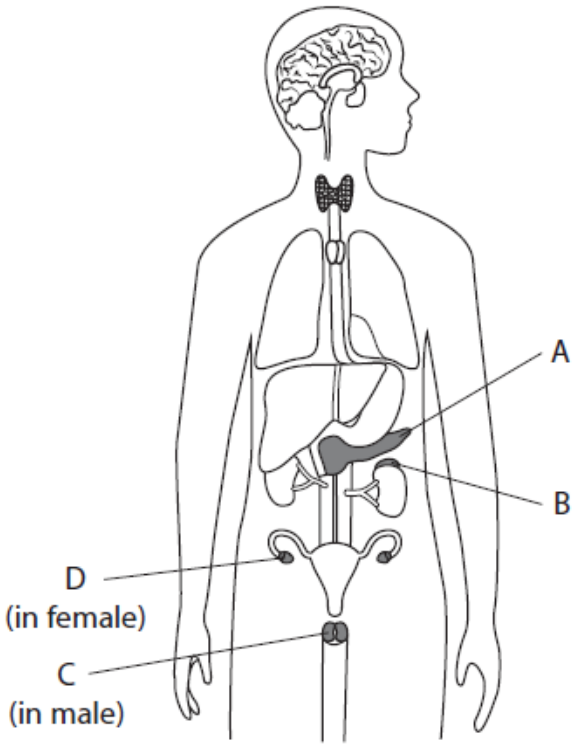
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(Total for question = 10 marks)

Q4.

The human body has different hormones that are produced by endocrine glands.

(a) The diagram labels some of the endocrine glands in the body.



(i) Which gland produces insulin?

(1)

☒ **A**

☒ **B**

☒ **C**

☒ **D**

(ii) Which gland produces progesterone?

(1)

☒ **A**

☒ **B**

☒ **C**

☒ **D**

(b) The human body has two systems of communication, nervous and hormonal.

(i) Students research the speed of nervous and hormonal communication.

They find this data

- hormones travel at a speed of 420 centimetres per minute
- nerve impulses travel at a speed of 55 metres per second

Determine the ratio of the speed of nervous communication to the speed of hormonal communication.

Give your answer in the form n : 1

(3)

ratio = ...

(ii) Describe three other differences between the nervous system and the hormonal system.

(3)

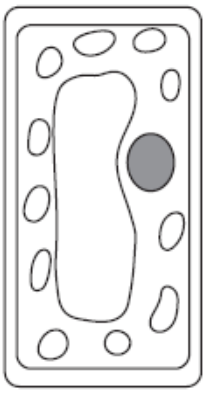
(Total for question = 8 marks)

Q5.

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

Plant cells contain organelles.

The diagram shows a plant cell containing some organelles.



(a) (i) What is the total number of organelles shown in the diagram that absorb light?

(1)

☒ **A** 1

☒ **B** 6

☒ **C** 11

☒ **D** 12

(ii) Name an organelle **not** shown in the diagram that makes ATP.

(1)

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(b) The magnification of the cell is calculated using this formula.

$$\text{magnification} = \frac{\text{width of cell in diagram}}{\text{actual width of cell}}$$

The actual width of the cell is 40 µm.

The magnification of the plant cell is

(1)

☒ **A** ×0.06

☒ **B** ×0.6

☒ **C** ×6

☒ **D** ×600

(c) (i) Name an organelle found in a plant cell but not found in an animal cell.

(1)

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(ii) The location of the genetic material in a bacterium is different from the location of the genetic material in a plant cell.

Give a location in a bacterium where genetic material is found.

(1)

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(Total for question = 5 marks)

Q6.

Squirrels are animals that live in woodland. They feed on nuts produced by the trees.

The diagram shows a squirrel eating a nut.



(a) Describe a method you could use to show that the nut contains fat.

(3)

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(b) The table lists substances found in two types of nut, A and B.

The mass of each substance is given in milligram per gram of nut.

Substance	Mass of substance in milligram per gram of nut	
	nut A	nut B
carbohydrate	167	143
protein	150	78
fat	587	693
fibre	96	86
iron	0.05	0.03

(i) Explain the role of fibre in the squirrel's diet.

(2)

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(ii) Explain which nut is better at helping the squirrel make red blood cells.

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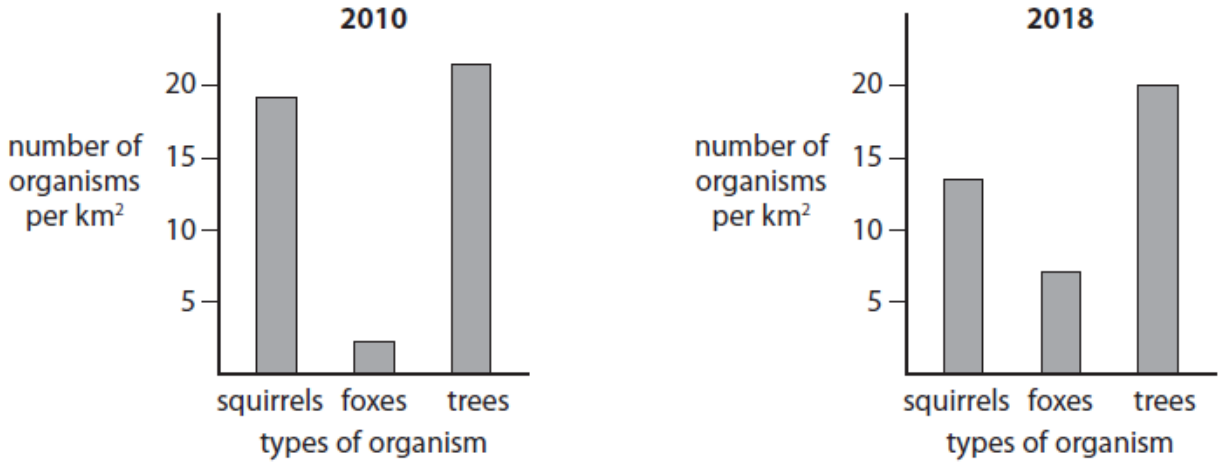
(iii) Nut A has a mass of 28.0 grams.

Calculate the total mass of carbohydrate in this nut.

(2)

total mass of carbohydrate = ... grams

(c) The graphs show the number of squirrels, foxes and trees in a woodland in 2010 and in 2018.



Discuss possible reasons why there is a decrease in the number of squirrels from 2010 to 2018.

Use information from the graphs and your own knowledge in your answer.

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(Total for question = 14 marks)

Q7.

Plant and animal cells have some features in common and some differences.

(a) (i) Which of these structures is not found in animal cells?

(1)

☒ **A** cell membrane

☒ **B** cell wall

☒ **C** mitochondrion

☒ **D** nucleus

(ii) Which of these substances is a carbohydrate stored in plant cells?

(1)

☒

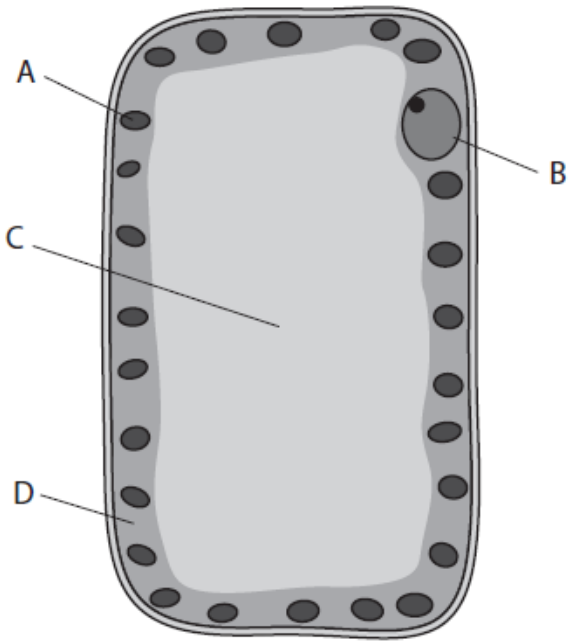
A chlorophyll

☒ **B** glucose

☒ **C** glycogen

☒ **D** starch

(b) The diagram shows a leaf palisade mesophyll cell.



(i) Describe the function of the parts labelled A, B, C and D.

(4)

A .....

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B .....

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C .....

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D .....

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(ii) Explain two ways that the structure of this palisade mesophyll cell is adapted for its function.

(2)

1 .....

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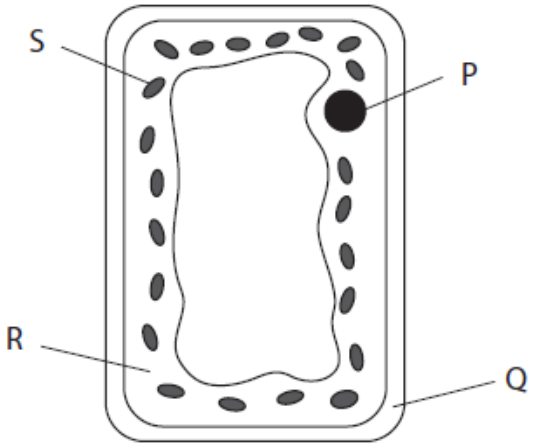
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(Total for question = 8 marks)

Q8.

(a) The diagram shows a plant cell.



(i) Which part of this cell contains chlorophyll?

(1)

☒ **A** P

☒ **B** Q

☒ **C** R

☒ **D** S

(ii) Which of these is found in chlorophyll?

(1)

☒ **A** calcium

☒ **B** iron

☒ **C** magnesium

☒ **D** water

(iii) Describe the role of chlorophyll.

(2)

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(b) Which of these is an example of positive phototropism?

(1)

☒ **A** a plant root growing away from light

☒ **B** a plant root growing downwards due to gravity

☒ **C** a plant stem growing towards light

☒ **D** a plant stem growing upwards due to gravity

(c) The table lists the roles of some substances found in living organisms.

Complete the table by naming each substance.

The first one has been done for you.

(3)

Role of substance	Name of substance
positive phototropism	auxin
digests fat	
diffuses across a synapse	
prevents scurvy	

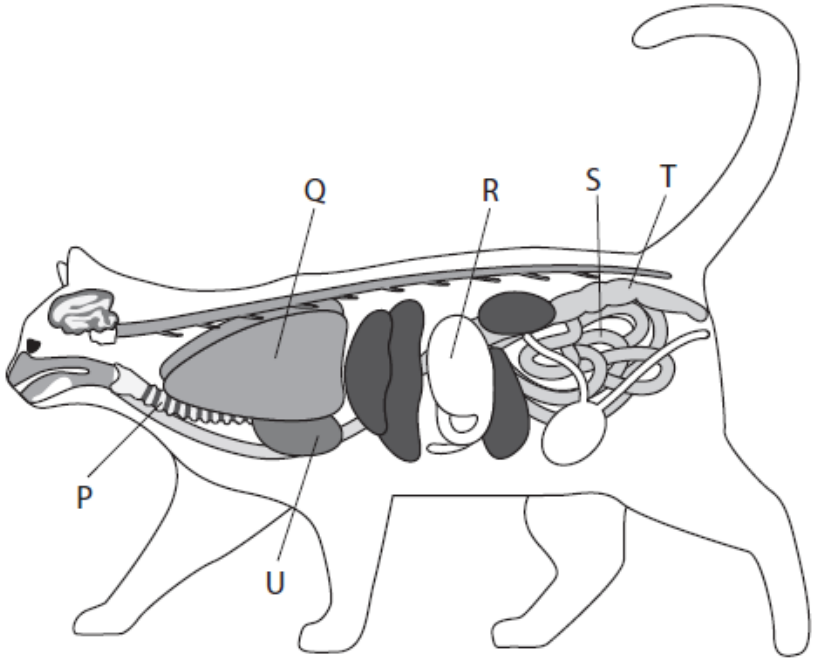
(Total for question = 8 marks)

Q9.

Some questions must be answered with a cross in a box ☒. 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 the internal anatomy of a cat with some organs labelled.



(Source: VectorMine / Shutterstock)

(a) (i) Some of the organs labelled are part of the digestive system.

Which of these structures is part of the digestive system?

(1)

☒ **A** structure P

☒ **B** structure Q

☒ **C** structure S

☒ **D** structure U

(ii) One of the organs labelled is part of the circulation system.

Which of these structures is part of the circulation system?

(1)

☒ **A** structure P

☒ **B** structure R

☒ **C** structure S

☒ **D** structure U

(b) Ventilation and gas exchange take place in the cat's lungs.

The movement of air into the lungs is caused by the movement of the rib cage and the

diaphragm.

Which of these makes the cat breathe in?

(1)

☒ **A** diaphragm contracts and the volume within the rib cage decreases

☒ **B** diaphragm contracts and the volume within the rib cage increases

☒ **C** diaphragm relaxes and the volume within the rib cage decreases

☒ **D** diaphragm relaxes and the volume within the rib cage increases

(c) The table gives some information about the composition of inhaled air and exhaled air.

It compares the volumes of three gases in inhaled air and in exhaled air.

Gas	Volume of gas in one litre of inhaled air in cm^3	Volume of gas in one litre of exhaled air in cm^3
oxygen	200	160
carbon dioxide	0.4	40
nitrogen	790	790

(i) Determine which gas shows the greatest percentage change from its volume in inhaled air to its volume in exhaled air.

(2)

(ii) Explain the differences between the composition of inhaled air and exhaled air shown in the table.

(4)

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(iii) Explain how the structure of the lungs is adapted for efficient gas exchange.

(4)

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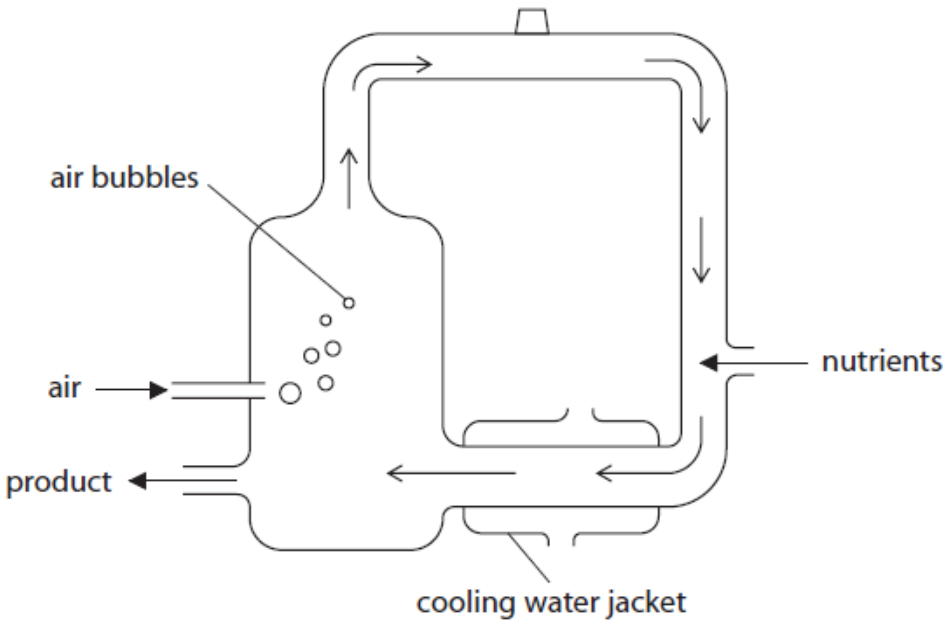
(Total for question = 13 marks)

Q10.

Mycoprotein is protein produced by fungi that can be made into meat substitutes.

Large amounts of fungus are grown in fermenters to produce the mycoprotein.

The diagram shows a typical mycoprotein fermenter.



(a) (i) Explain why air is bubbled into the fermenter.

(2)

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(ii) Explain why the fermenter is cleaned using steam before the fungus and nutrients are added.

(2)

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(b) A scientist investigates the production of mycoprotein by a genetically modified (GM) fungus and a non-genetically modified fungus (non-GM).

The scientist claims that the GM fungus will be better for large-scale production of mycoprotein.

The scientist measures the mass of mycoprotein produced by the fungi in fermenters for 30 days.

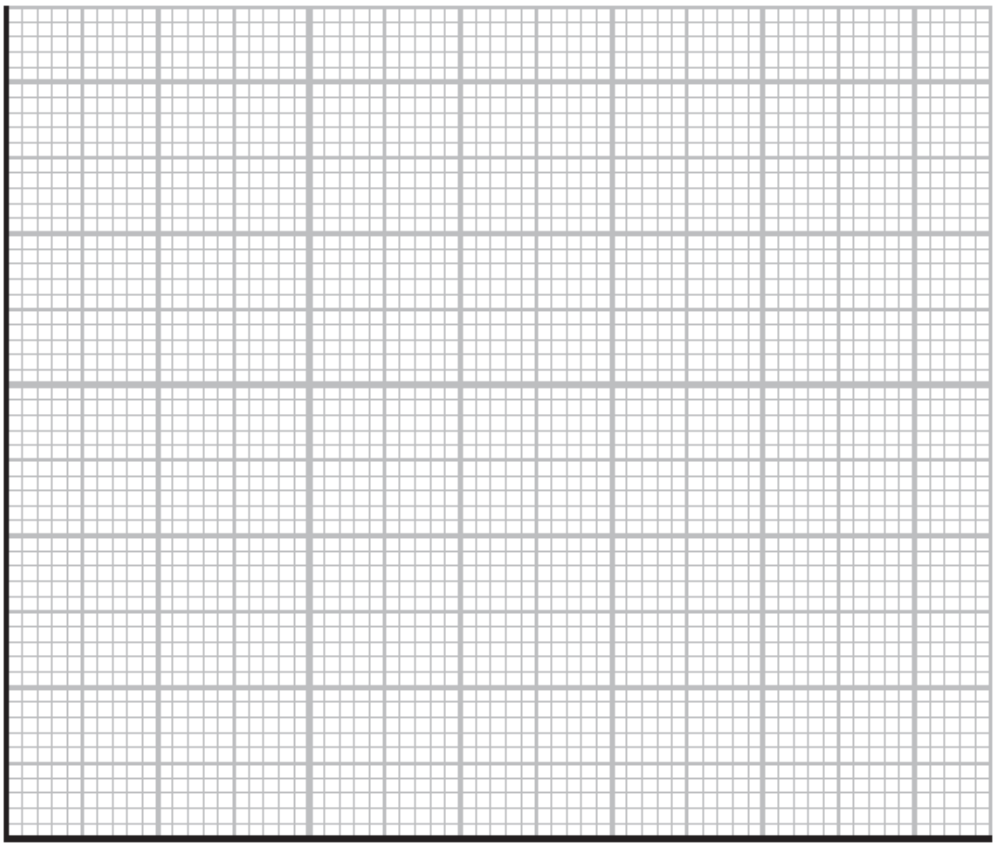
The table shows the scientist's results.

Time in days	Mass of mycoprotein produced in kg	
	GM fungus	Non-GM fungus
5	130	125
10	220	190
15	330	270
20	420	360
30	430	460

(i) Plot a line graph to show how the mass of mycoprotein changes over the 30 days for each type of fungus.

Use a ruler to join the points with straight lines.

(5)



(ii) The scientist claims that the GM fungus will be better for large-scale production of mycoprotein than the non-GM fungus.

Comment on the scientist's claim.

(2)

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(iii) The table shows the nutritional composition of mycoprotein and the nutritional composition of lamb.

Nutritional component	Mass of nutritional component in 100 grams of food in grams	
	mycoprotein	lamb
protein	10.5	20.2
cholesterol	0.0	0.1
fat	3.0	25.5
fibre	6.0	0.7
iron	0.00039	0.0025
calcium	0.048	0.010

Discuss whether eating mycoprotein is more healthy than eating lamb for a growing human.

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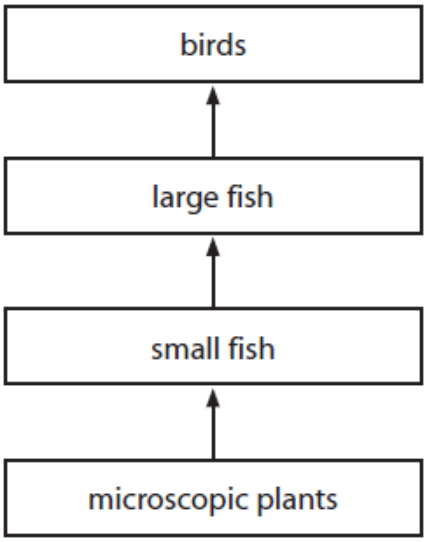
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(Total for question = 16 marks)

Q11.

The diagram shows a food chain from a lake.



(a) Name the primary consumer in this food chain.

(1)

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(b) The microscopic plants convert light energy into chemical energy.

(i) Describe the process that converts light energy into chemical energy.

(3)

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(ii) Give two reasons why some of the energy in the microscopic plants is not transferred to the small fish.

(2)

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(c) The birds do not have teeth.

The fish they eat is initially crushed in part of their digestive system called a gizzard.

Suggest why crushing the fish in the gizzard helps the birds to digest the fish.

(2)

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(Total for question = 8 marks)

Q12.

Genetic modification is a process used to improve crop yield.

(a) Describe the role of a named vector in the process of genetic modification.

(2)

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(b) Weeds are plants that grow where they are not wanted.

Removing weeds reduces competition for mineral ions and improves crop yield.

(i) Name the mineral ion used to make chlorophyll.

(1)

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(ii) Two different methods can be used to remove weeds to improve crop yield.

- Method A pull weeds out of the ground by hand
- Method B spray weeds with a chemical that kills them

Design an investigation to find out which method produces the highest crop yield.

Include experimental details in your answer and write in full sentences.

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(Total for question = 9 marks)

Q13.

Plants make sugars by the process of photosynthesis.

(a) (i) Which of the following factors is least likely to limit the rate of photosynthesis?

(1)

☒ **A** carbon dioxide concentration

☒ **B** light intensity

☒ **C** oxygen concentration

☒ **D** temperature

(ii) Which combination of factors is most likely to limit the rate of photosynthesis in the early morning?

(1)

☒ **A** carbon dioxide concentration and soil pH

☒ **B** temperature and light intensity

☒ **C** water content of soil and soil pH

☒ **D** water content of soil and light intensity

(b) A student carried out an experiment to investigate the need for chlorophyll in photosynthesis.

He uses a variegated leaf as shown.



The green part of the leaf has cells that contain chlorophyll. The white part of the leaf has cells that do not contain chlorophyll.

(i) Describe the procedure used to test this leaf for starch.

(4)

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(ii) Draw a labelled diagram of the leaf to show its appearance after the student had completed the test for starch.

(2)

(c) Suggest a method the student could use to measure the area of the green part of the leaf.

(2)

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(Total for question = 10 marks)

Q14.

Plants make sugars by the process of photosynthesis.

(a) (i) Which of the following factors is least likely to limit the rate of photosynthesis?

(1)

☒ **A** carbon dioxide concentration

☒ **B** light intensity

☒ **C** oxygen concentration

☒ **D** temperature

(ii) Which combination of factors is most likely to limit the rate of photosynthesis in the early morning?

(1)

☒ **A** carbon dioxide concentration and soil pH

☒ **B** temperature and light intensity

☒ **C** water content of soil and soil pH

☒ **D** water content of soil and light intensity

(b) A student carried out an experiment to investigate the need for chlorophyll in photosynthesis.

He uses a variegated leaf as shown.



The green part of the leaf has cells that contain chlorophyll. The white part of the leaf has cells that do not contain chlorophyll.

(i) Describe the procedure used to test this leaf for starch.

(4)

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(ii) Draw a labelled diagram of the leaf to show its appearance after the student had completed the test for starch.

(2)

(c) Suggest a method the student could use to measure the area of the green part of the leaf.

(2)

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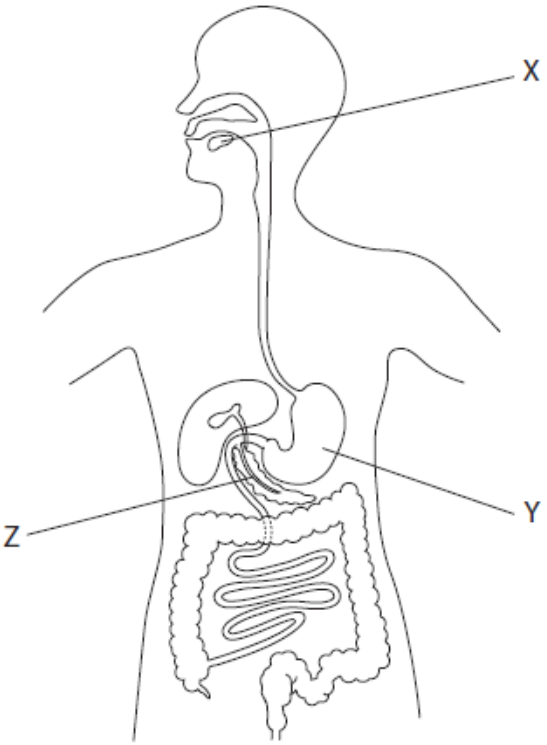
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(Total for question = 10 marks)

Q15.

(a) The diagram shows the human alimentary canal with structures labelled X, Y and Z.



(i) Which of these structures produce amylase?

(1)

☒ **A** X only

☒ **B** X and Y

☒ **C** X and Z

☒ **D** Y and Z

(ii) Table 1 gives the names of some enzymes, the molecules they digest, and the products formed.

Complete Table 1 by giving the missing information.

(3)

Enzyme	Molecule	Product
		maltose
	lipid	
protease		

Table 1

(b) Table 2 shows the recommended daily amounts (RDA) of some dietary components for a person.

Table 2 also shows the actual amounts of these dietary components in a person's diet in one day.

	Amount of dietary component						
	Energy in kJ	Protein in g	Vitamin A in mg	Vitamin C in mg	Calcium in mg	Iron in mg	Fibre in g
RDA	2200	46	0.70	65	1300	15	26
Diet of person	2700	46	0.72	32	800	16	12

Table 2

(i) One 100 g serving of lentils provides 25 g of protein.

Calculate the mass of lentils that contains 46 g of protein.

(2)

mass of lentils = ... g

(ii) Discuss the possible long-term effects of this person eating the same diet every day.

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(iii) Suggest two reasons why the RDA for energy may not be the actual amount required by this person.

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(Total for question = 13 marks)

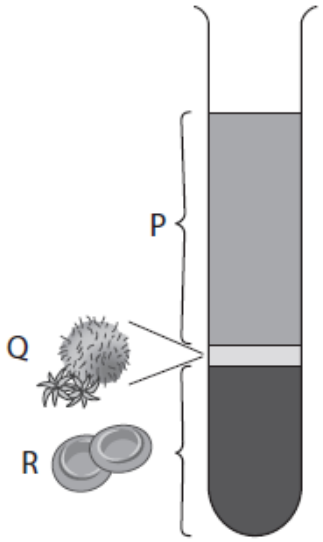
Q16.

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

Human blood cells have different roles within the body.

(a) The diagram shows a blood sample containing layers labelled P, Q and R.

The sample has been spun in a machine called a centrifuge, which separates the components into layers depending on their density.



(i) Which component does layer P contain?

(1)

☒ **A** plasma

☒ **B** platelets

☒ **C** red cells

☒ **D** white cells

(ii) The diagram can be used to estimate the percentage of total blood volume that is made up by each layer.

The estimated percentage of each layer is

(1)

☒ **A** P 5% Q 40% R 55%

☒ **B** P 40% Q 55% R 5%

☒ **C** P 55% Q 5% R 40%

☒ **D** P 55% Q 40% R 5%

(iii) Some people have a condition called anaemia, in which the blood contains less haemoglobin. This alters the
percentage of each layer.

Describe how a blood sample from a person with anaemia would differ in appearance from a normal blood sample.

(1)

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(b) Explain how white blood cells protect the body from disease.

(4)

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(c) Name two substances that are transported around the body in plasma.

(2)

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2 .....

(Total for question = 9 marks)

Q17.

The table gives the percentage composition by mass of human breast milk, and of cow's milk.

Substance	Percentage by mass (%)	
	Breast milk	Cow's milk
water	87.0	88.0
vitamins	trace	trace
fat	3.8	5.0
carbohydrate	7.9	3.0
minerals	0.2	0.7
protein	1.0	3.3

(a) Discuss whether cow's milk is a suitable alternative to breast milk for young babies.

Use data from the table and your own knowledge to support your answer.

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(b) Human breast milk may contain insufficient vitamin D for a growing child.

Give two ways that additional vitamin D could be provided for the child.

(2)

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2 .....

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(c) Describe how a sample of cow's milk could be tested for protein.

(2)

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(Total for question = 10 marks)

Q18.

The photograph shows a type of fish called a salmon.



(Source: © Alexander Raths/Shutterstock)

Some humans eat salmon as a source of protein.

Protein is a component of a balanced diet.

(a) Which statement describes what happens to salmon protein in the human stomach?

(1)

☒ **A** it is digested into amino acids

☒ **B** its surface area is increased by bile

☒ **C** its pH is raised by hydrochloric acid

☒ **D** it is absorbed by villi

(b) The table lists other components of a balanced diet and their functions.

Complete the table by giving a function of each component.

The first one has been done for you.

(3)

Component	Function
lipid	store of energy
vitamin D	
iron	
fibre	

(c) A student investigates the effect of genetic modification on the growth of salmon.

The student measures the mass and length of one normal salmon and one genetically modified salmon when both salmon are 18 months old.

The table shows the student's results.

Type of salmon	Mass in g	Length in cm
normal	1250	33
genetically modified	3000	61

(i) It is recommended that a 15-year-old person needs 50 g of protein per day for a balanced diet.

A normal salmon contains 20% protein.

Calculate how many 15-year-olds can have their recommended daily allowance of protein supplied by the 18-month-old normal salmon.

(2)

number = ...

(ii) The student concludes that his results show that genetically modified (GM) salmon are useful in providing a balanced diet.

Discuss the student's conclusion.

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(d) The passage describes the role of enzymes involved in the genetic modification of salmon.

Complete the passage by writing a suitable word in each space.

(3)

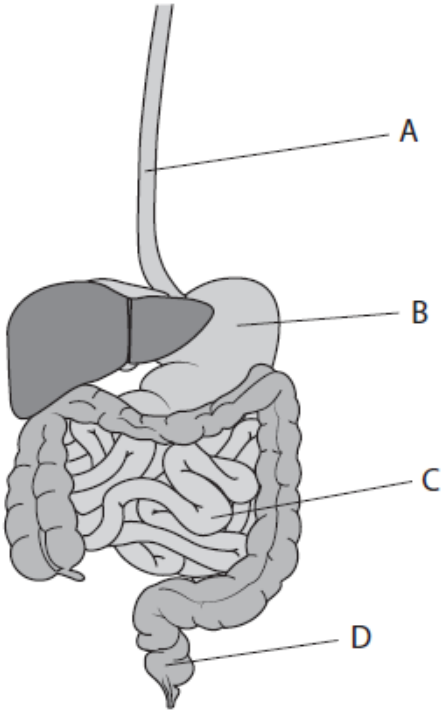
All salmon contain a length of DNA called a ....., which controls the production of growth hormone. Another length of DNA, from a different species of fish, is cut out using a ..... enzyme. This DNA is then joined to the salmon DNA using an enzyme called ..... .

This causes the salmon to produce growth hormone at all times.

(Total for question = 15 marks)

Q19.

(a) The diagram shows part of the human digestive system.



(i) In which of these parts is hydrochloric acid produced?

(1)

☒ **A**

☒ **B**

☒ **C**

☒ **D**

(ii) In which of these parts are faeces stored?

(1)

☒ **A**

☒ **B**

☒ **C**

☒ **D**

(b) The liver produces bile.

Explain the role of bile in digestion.

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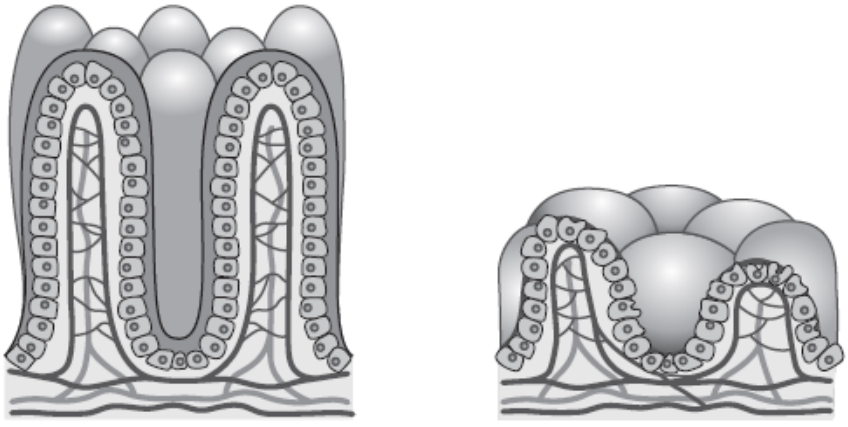
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(c) Some people have a condition called coeliac disease.

In this condition the body reacts to eating gluten, a protein found in wheat.

This reaction damages the villi in the small intestine.

The diagram shows how the villi in the small intestine are damaged.



Undamaged Damaged

(i) Explain how the undamaged villi are adapted for their function.

(4)

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(ii) Explain why children with untreated coeliac disease may grow more slowly and become tired more easily than children without coeliac disease.

Use the information from the diagram and your own knowledge to support your answer.

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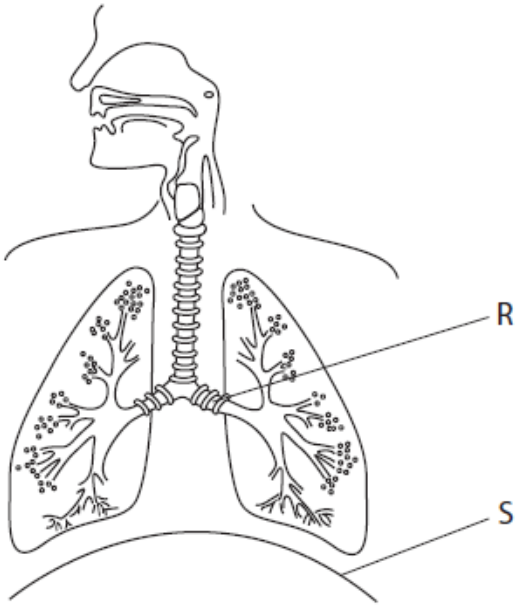
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(Total for question = 13 marks)

Q20.

(a) The diagram shows part of a human thorax with structures labelled R and S.



(i) What is the name of structure R?

(1)

☒ **A** bronchiole

☒ **B** bronchus

☒ **C** oesophagus

☒ **D** trachea

(ii) Explain how changes in structure S enable a person to breathe in.

(3)

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(b) A scientist uses this method to investigate the effect of exercise on the ventilation rate of a person.

Step 1: rest for 10 minutes

Step 2: measure the volume of air in each breath

Step 3: measure the breathing rate

Step 4: ride a bicycle at 15 kilometres per hour for 10 minutes

Step 5: measure the volume of air in each breath

Step 6: measure the breathing rate

The scientist repeats Step 4, Step 5 and Step 6 at increasing cycling speeds.

The table shows some of the results.

Cycling speed in km per hour	Volume of air in each breath in cm^3	Breathing rate in breaths per minute	Ventilation rate in dm^3 per minute
0	500	14	7
15	1500	14	21
20	2000	14	28
25	2500	16	40
30	2600	20	52
35		25	65

(i) State the independent variable in the investigation.

(1)

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(ii) At a cycling speed of 35 km per hour the person has a breathing rate of 25 breaths per minute.

They also have a ventilation rate of 65 dm^3 per minute.

Calculate the volume of air, in cm^3, in each breath.

[1 dm^3 = 1000 cm^3]

(2)

volume = ... cm^3

(iii) Comment on the effect of increasing cycling speed on ventilation rate.

Refer to the data in the table in your answer.

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(iv) State how the scientist could make the investigation more reliable.

(1)

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(Total for question = 12 marks)

Q21.

The table gives the masses of protein and lipid (fat) in the same volume of milk from a cow and from a human.

	Protein in g	Lipid in g
cow	3.3	3.9
human	1.3	4.1

(a) Describe how you would test a sample of cow's milk and a sample of human milk to show they contain different masses of protein.

(2)

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(b) Some of the proteins in milk are antibodies.

Explain why antibodies in milk are useful for babies.

(2)

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(c) Give two ways that lipid in milk is used by babies.

(2)

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(d) Milk is used to make yoghurt.

(i) Name the carbohydrate in milk used to make yoghurt.

(1)

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(ii) Name the bacteria added to milk to make yoghurt.

(1)

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(iii) Explain why milk needs to be heated to a high temperature at the start of the process for making yoghurt.

(2)

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(Total for question = 10 marks)

Q22.

Hypertrophic myopathy is a heart condition that can affect some cats. It is caused by a dominant allele.

Hypertrophic myopathy causes the left ventricle wall of the heart to be less elastic.

(a) (i) Explain why cats with hypertrophic myopathy are unable to run quickly.

(2)

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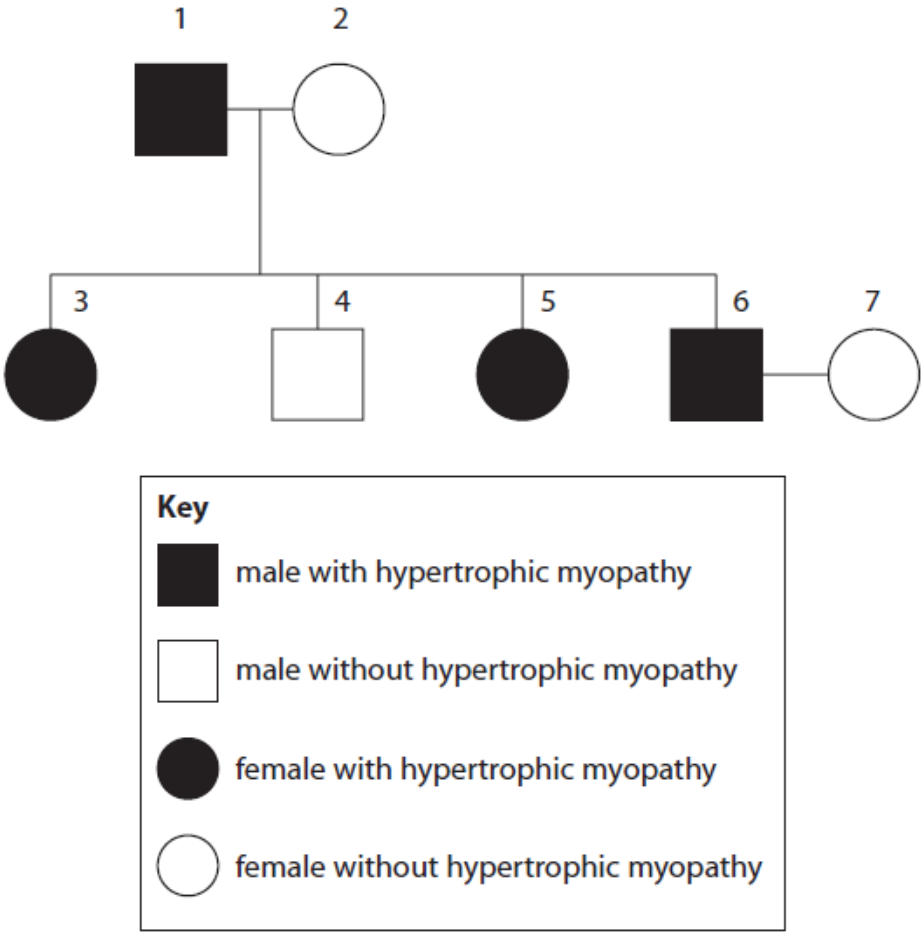
(ii) State what is meant by a dominant allele.

(1)

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(iii) The diagram shows a family pedigree for cats with and without hypertrophic myopathy.



Draw a genetic diagram to show the possible genotypes and phenotypes of the offspring produced by individuals 6 and 7.

Use **H** as the allele for hypertrophic myopathy and **h** as the allele for normal heart development.

(4)

(iv) Calculate the probability that the next offspring produced by individuals 6 and 7 is male and has hypertrophic myopathy.

(1)

probability = ...

(b) Cat breeders often try to remove harmful alleles from populations by selective breeding.

Suggest why it is more difficult to remove harmful recessive alleles from populations than harmful dominant alleles from populations.

(2)

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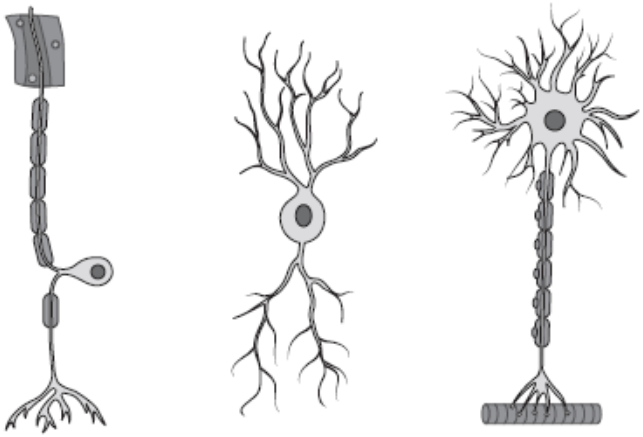
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(Total for question = 10 marks)

Q23.

(a) The diagram shows three types of neurone.



(i) Give the names of these neurones.

(3)

A .....

B .....

C .....

(ii) Explain the role of these neurones in the withdrawal reflex of a finger from a hot object.

(3)

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(b) A teacher uses this method to estimate the speed of a nerve impulse.

- students stand in a circle and hold hands
- student A in the circle starts a timer and at the same time squeezes the hand of student B on his left
- when student B feels his hand being squeezed, he immediately squeezes the hand of the student on his left
- this process continues around the circle of students until student A feels his hand being squeezed and he stops the timer

(i) Explain what other measurements the teacher would need to make in order to calculate the speed of a nerve impulse.

(2)

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(ii) Describe whether the teacher's method is likely to give an accurate estimate of the speed of a nerve impulse.

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(Total for question = 10 marks)

Q24.

Bread contains starch.

(a) Describe how you would test a piece of bread to show it contains starch.

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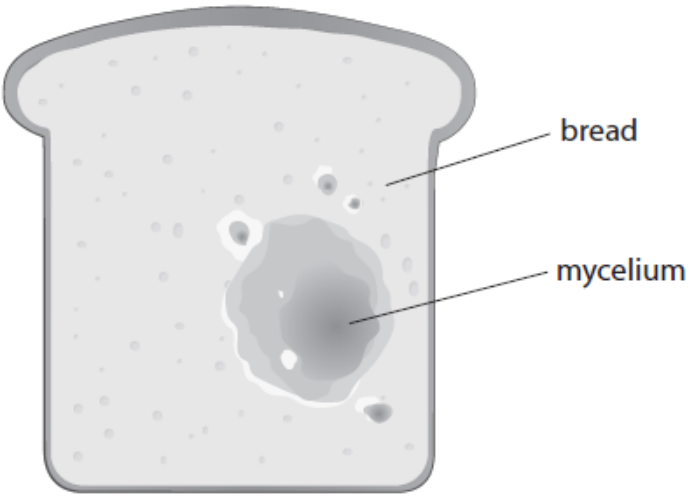
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(b) The diagram shows the mycelium of an organism growing on a piece of bread.



(i) Which type of organism is shown growing on the bread?

(1)

☒ **A** bacterium

☒ **B** fungus

☒ **C** protoctist

☒ **D** virus

(ii) Which enzyme is released by the organism to digest starch?

(1)

☒ **A** amylase

☒ **B** ligase

☒ **C** lipase

☒ **D** protease

(Total for question = 4 marks)

Q25.

Pollution of air or water can affect ecosystems.

(a) (i) Explain the biological consequences of air pollution by sulfur dioxide.

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(ii) State how sulfur dioxide pollution can be reduced.

(1)

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(b) Some scientists have suggested that adding hydrogencarbonate solution to soil, instead of adding water, can increase
plant growth.

Design an investigation to discover the effect that adding hydrogencarbonate solution has on the growth of seedlings.

Include experimental details in your answer and write in full sentences.

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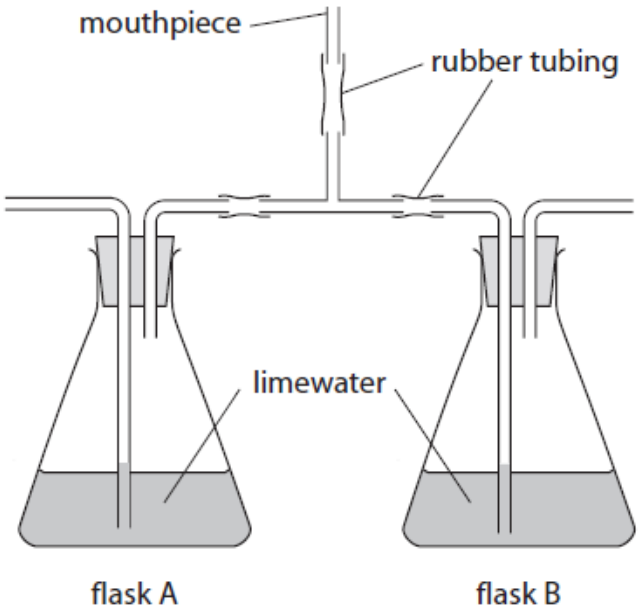
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(Total for question = 10 marks)

Q26.

(a) The diagram shows apparatus a student uses to compare inhaled and exhaled air.



The student breathes into and out of the mouthpiece for one minute.

(i) Explain which flask exhaled air passes through.

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(ii) Explain the changes that will happen in the limewater in flask A and in flask B.

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(iii) The student uses limewater to compare the composition of exhaled and inhaled air.

Suggest an alternative substance that they could use.

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(b) Describe the role of the diaphragm and the intercostal muscles in inhalation.

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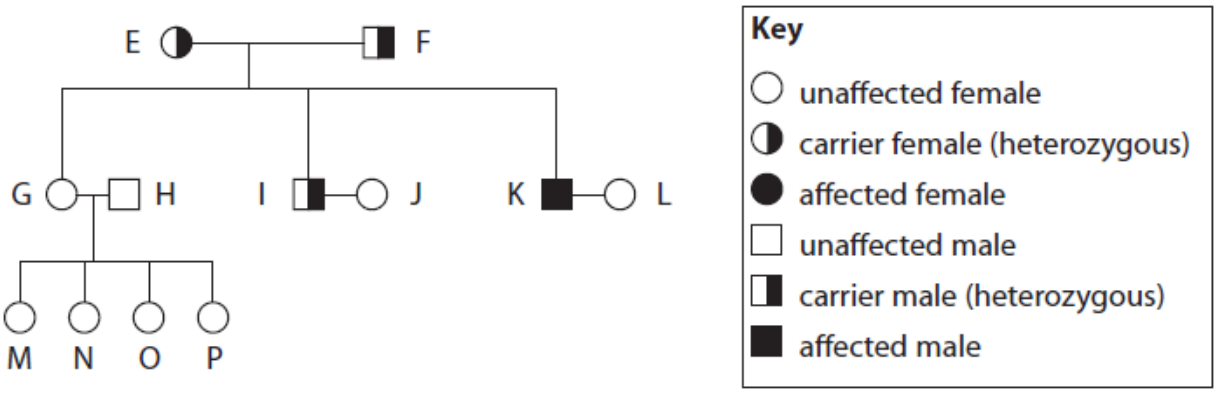
(Total for question = 9 marks)

Q27.

Alkaptonuria is a condition that causes people to produce black urine.

This condition is caused by a recessive allele.

The diagram shows the inheritance of alkaptonuria in a family.



(a) (i) How many people in this family have alkaptonuria?

(1)

☒ **A** one

☒ **B** three

☒ **C** four

☒ **D** eight

(ii) How many people in this family are homozygous?

(1)

☒ **A** one

☒ **B** three

☒ **C** eight

☒ **D** nine

(iii) What is the probability of parents I and J having a child who is a carrier?

(1)

☒ **A** 0.0

☒ **B** 0.25

☒ **C** 0.5

☒ **D** 1.0

(iv) Give the probability of two carrier parents having a female child with alkaptonuria.

(1)

probability = ...

(b) There are 500 000 people in the world with alkaptonuria but only 64 of these people live in the United Kingdom.

Calculate the percentage of people with alkaptonuria that live in the UK.

(2)

percentage = ... %

(c) Alkaptonuria can prevent heart valves from working properly.

Explain how this would affect the ability of a person to exercise.

(3)

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(Total for question = 9 marks)

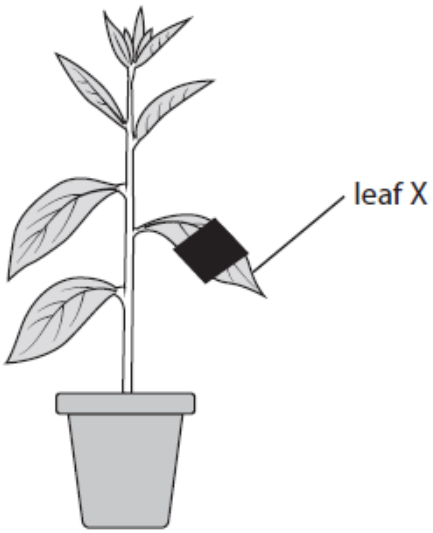
Q28.

A student investigates factors that affect photosynthesis.

(a) In his first experiment, the student uses this method to investigate the effect of light on photosynthesis.

- place a plant in the dark for 24 hours
- cover part of leaf X with black paper
- place the plant in the light for 24 hours

The diagram shows the plant in the light.



Describe how the student tests leaf X to show the effect of light on photosynthesis.

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(b) In his second experiment, the student uses a water plant to investigate the effect of carbon dioxide concentration on the rate of photosynthesis.

He does the experiment at two different light intensities.

The table shows the student's results.

Carbon dioxide concentration in arbitrary units	Rate of photosynthesis in bubbles per minute	
	low light intensity	high light intensity
0.00	0	0
0.02	20	20
0.04	29	35
0.06	35	47
0.08	39	68
0.10	42	84
0.12	45	89
0.14	46	90
0.16	46	90
0.18	46	90

(i) Explain the student's results.

(4)

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(ii) Describe how the student could change the light intensity in this investigation.

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(iii) Give the dependent variable in this investigation.

(1)

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(iv) Give one way in which the student could control the biotic variable in this investigation.

(1)

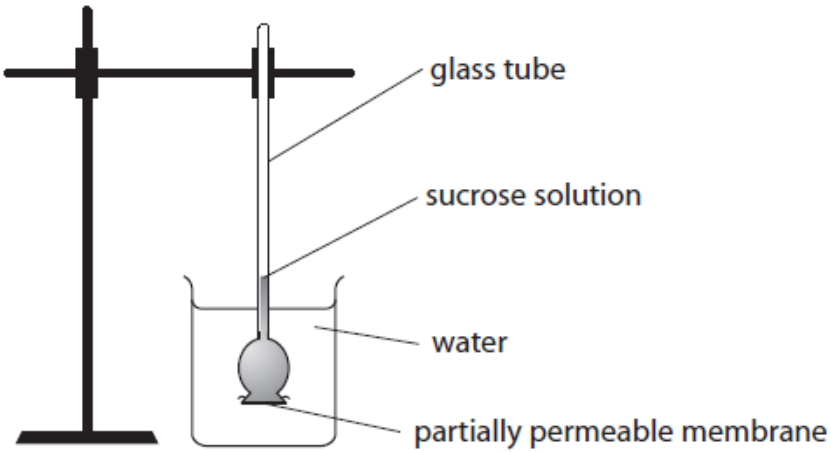
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(Total for question = 11 marks)

Q29.

This apparatus can be used to show osmosis.



(a) Explain what happens to the level of the sucrose solution in the glass tube.

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(b) Describe how this apparatus could be modified to measure the rate of osmosis at different temperatures.

(3)

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(Total for question = 6 marks)

Q30.

(a) A student investigates the sugar content of four different fruit juices.

This is the student's method.

- add 5 cm^3 of fruit juice to a boiling tube
- add 5 cm^3 of Benedict's solution to the boiling tube
- place the boiling tube in a water bath at 70 °C for three minutes
- remove the boiling tube and record the colour of the solution

The student uses this method for each of the four fruit juices.

The table shows the student's results.

Fruit juice	Colour of solution after heating for three minutes
A	blue
B	brick red
C	yellow
D	green

(i) Give two variables that the student controls in his investigation.

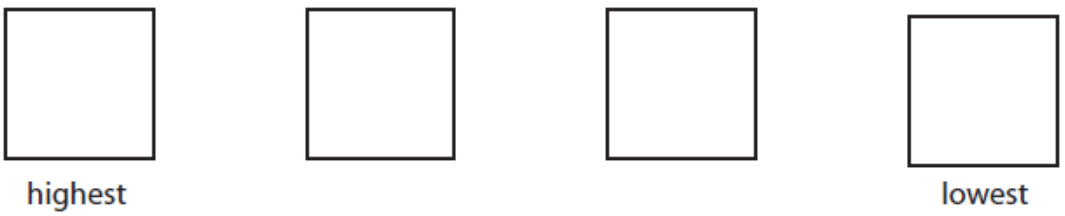
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(ii) Give the juices A, B, C and D in order of sugar content, from highest to lowest.

(2)



(iii) The student is now given sugar solutions with concentrations of 1%, 5%, 10% and 20%.

Explain how the student could use these solutions to estimate the concentration of sugar in the

four fruit juices.

(3)

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(b) Some fruit juices contain high concentrations of sugar.

These fruit juices increase the number of bacteria in the mouth.

This may lead to an increase in tooth decay.

(i) Suggest why high concentrations of sugar may increase tooth decay.

(2)

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(ii) Explain another health risk to children who drink fruit juices with high concentrations of sugars.

(2)

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(Total for question = 11 marks)