PEARSON EDEXCEL IGCSE BIOLOGY · 4BI1

BIOLOGY



EXAM QUESTION PACK

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

SCORE	PERCENTAGE
/290	%

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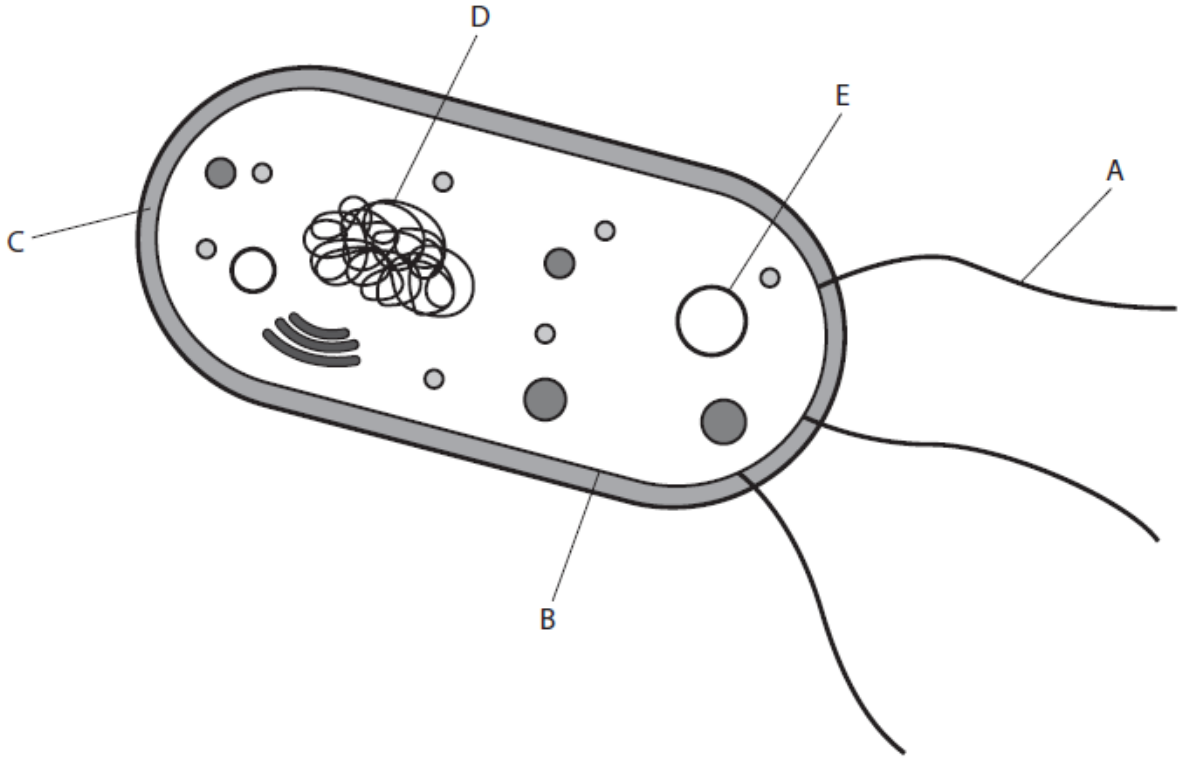
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Q1.

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.



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(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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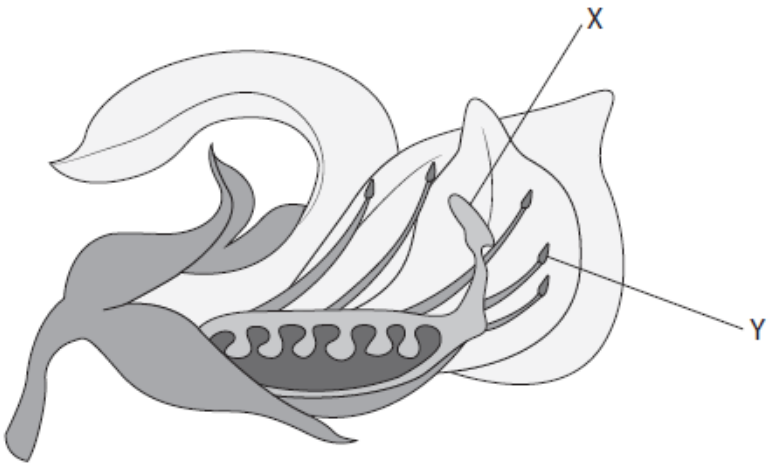
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(Total for question = 5 marks)

Q2.

(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.

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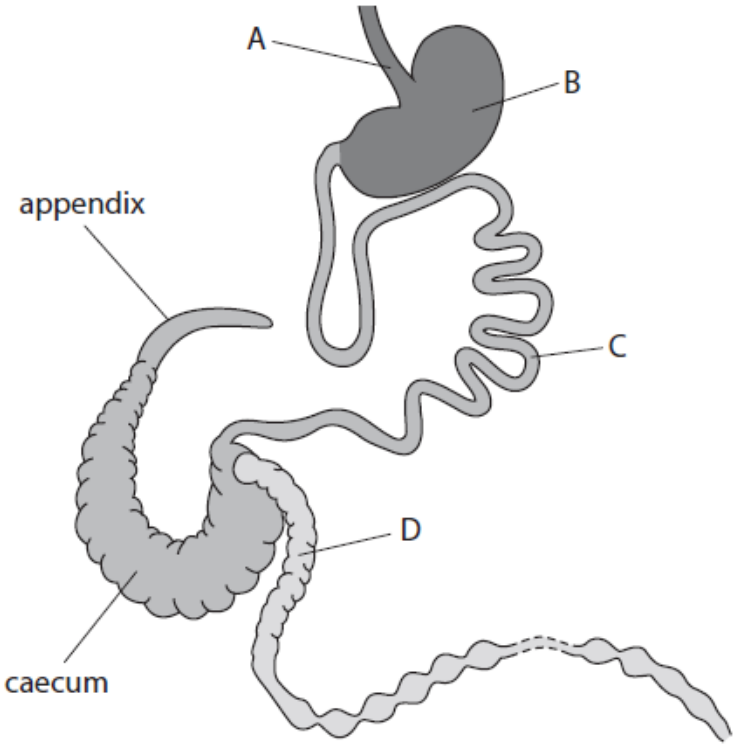
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(Total for question = 12 marks)

Q3.

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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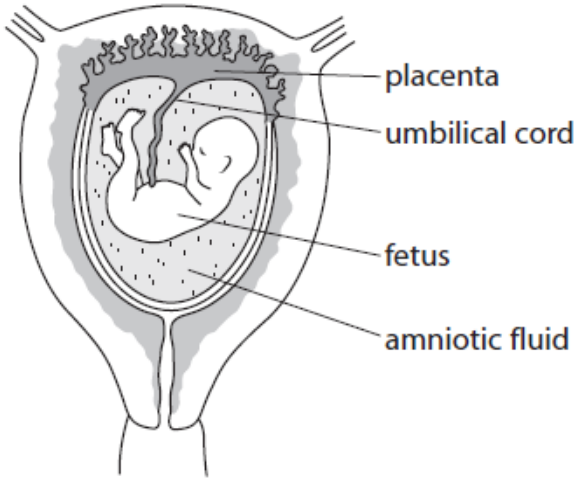
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(Total for question = 10 marks)

Q4.

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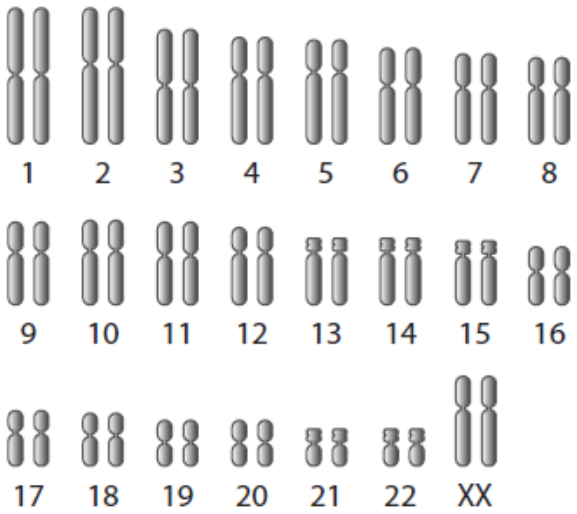
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(b) The amniotic fluid contains cells from the fetus.

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)

1 .....

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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.

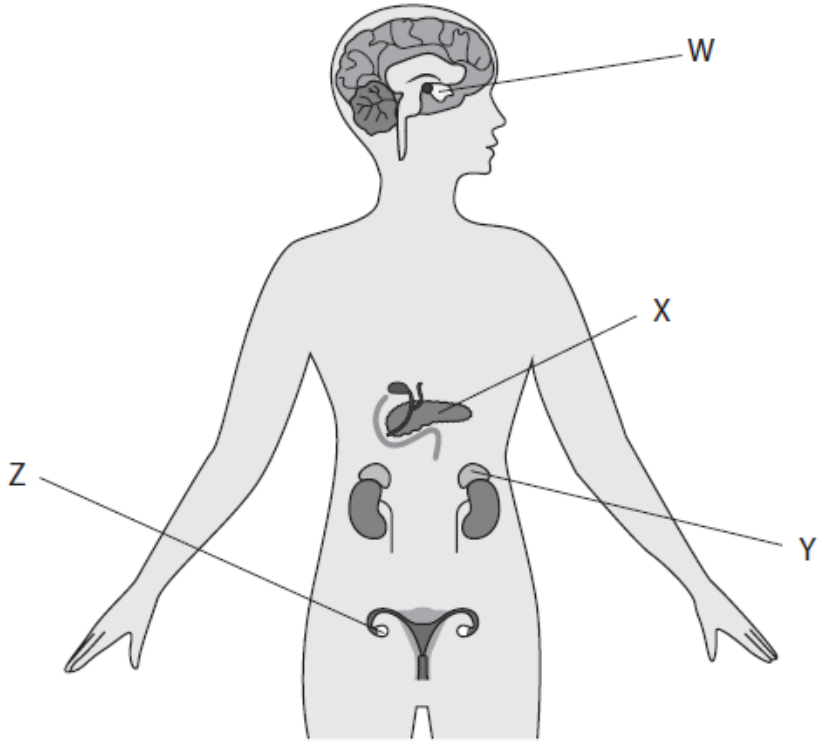
(3)

mass = ... mg per day

(Total for question = 14 marks)

Q5.

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)

Q6.

Farmers sometimes use biological control to reduce the damage to their crops caused by pests such as insects.

(a) Which of these is an advantage of using biological control over chemical control?

(1)

☒ **A** it lasts a short time

☒ **B** it leads to bioaccumulation

☒ **C** it is specific

☒ **D** it is quicker

(b) Aphids are tiny insects that have very sharp mouthparts. They push these mouthparts into the phloem found in stems. They then feed on the phloem contents.



(Source: © Scenics & Science / Alamy Stock Photo)

(i) Name two substances the aphids obtain from the phloem.

(2)

1 .....

2 .....

(ii) Explain how aphids feeding from the phloem of crop plants can lead to a reduction in yield.

(4)

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(c) Silverflies and hoverflies are two species of insects whose larvae feed on aphids.

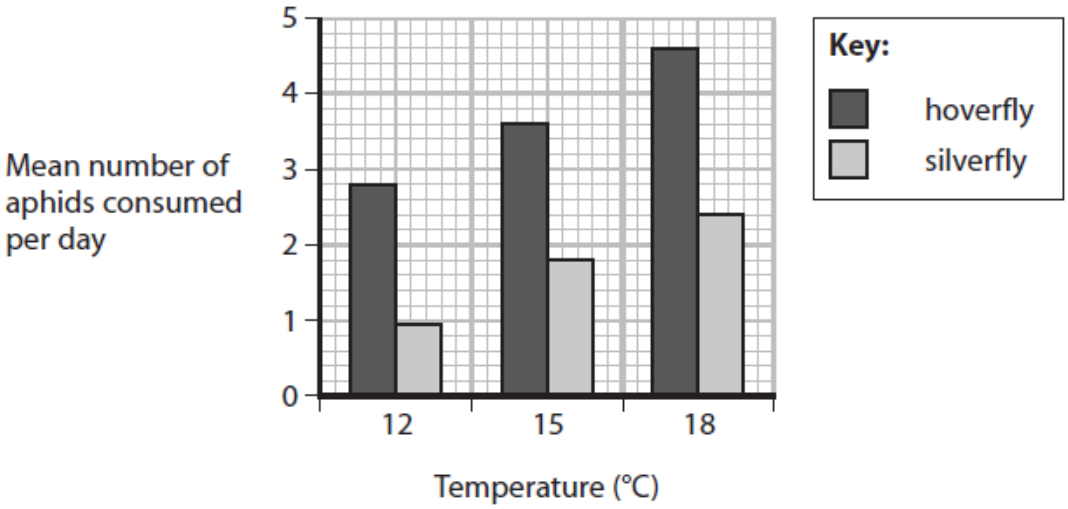
Scientists investigate the feeding behaviour of these species in a laboratory experiment.

This is the scientists' method.

- place a single silverfly in a container
- place a single hoverfly in a separate container
- keep the containers at 12 °C
- put 30 aphids in each container
- count the number of aphids consumed each day for several days
- determine the mean number of aphids consumed per day

The scientists repeat the method at two higher temperatures.

The graph shows the scientists' results.



The scientists conclude that the hoverfly is the most effective biological control agent for aphids.

Discuss the scientists' conclusion, referring to information in the graph and the scientists' method in your answer.

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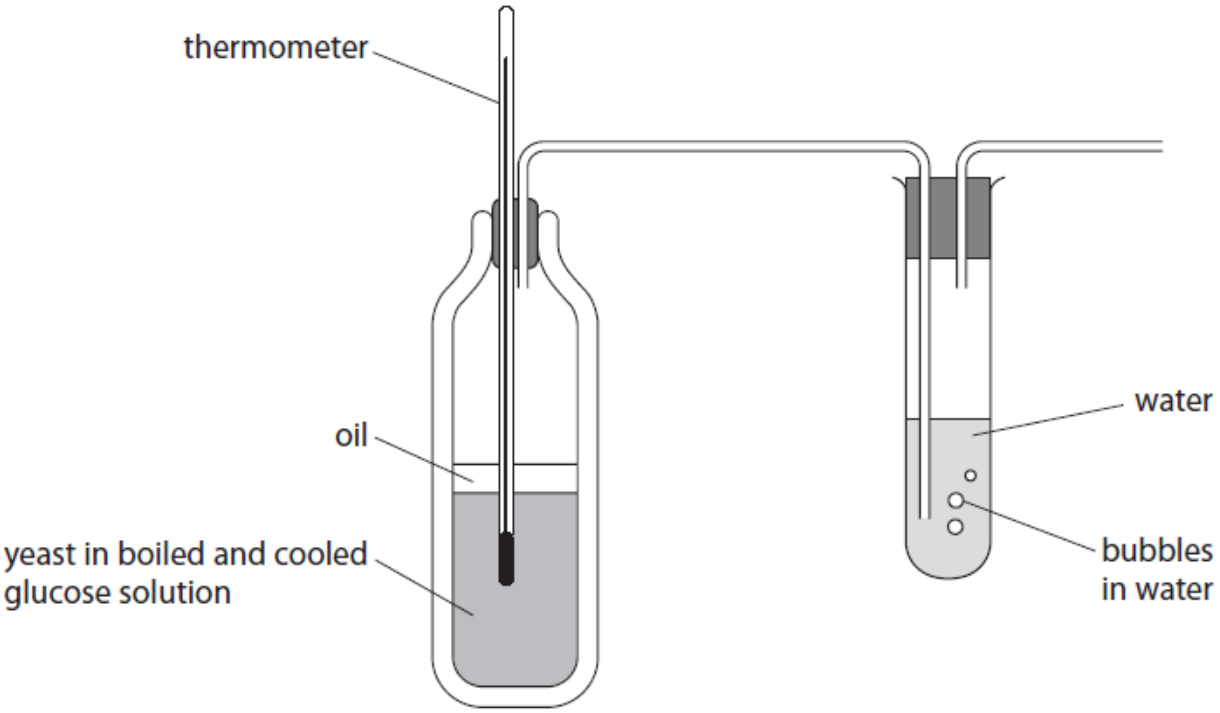
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(Total for question = 12 marks)

Q7.

Answer the question 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 ☒.

A student uses this apparatus to investigate anaerobic respiration by yeast.



(a) Explain why the student boils and cools the glucose solution before the yeast is added.

(2)

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(b) The student measures the rate of anaerobic respiration by counting the number of bubbles produced per minute.

Explain how she could modify her apparatus to obtain a more accurate measurement of the rate of anaerobic respiration.

(2)

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(c) (i) The student wants to compare the rate of anaerobic respiration with the rate of aerobic respiration by yeast.

How should the student modify the apparatus in order to measure the rate of aerobic respiration?

(1)

- ☒ **A** remove liquid oil to allow oxygen diffusion
- ☒ **B** remove liquid oil to allow carbon dioxide diffusion
- ☒ **C** add more liquid oil to prevent oxygen diffusion
- ☒ **D** add more liquid oil to prevent carbon dioxide diffusion

(ii) The student found that more bubbles were produced during aerobic respiration than during anaerobic respiration.

Sketch a bar chart to show these results.

(2)

(Total for question = 7 marks)

Q8.

(a) Fish do not have lungs. They use gills for gas exchange.

Fish gills have similar adaptations to the alveoli in lungs.

Suggest how fish gills are adapted for gas exchange.

(3)

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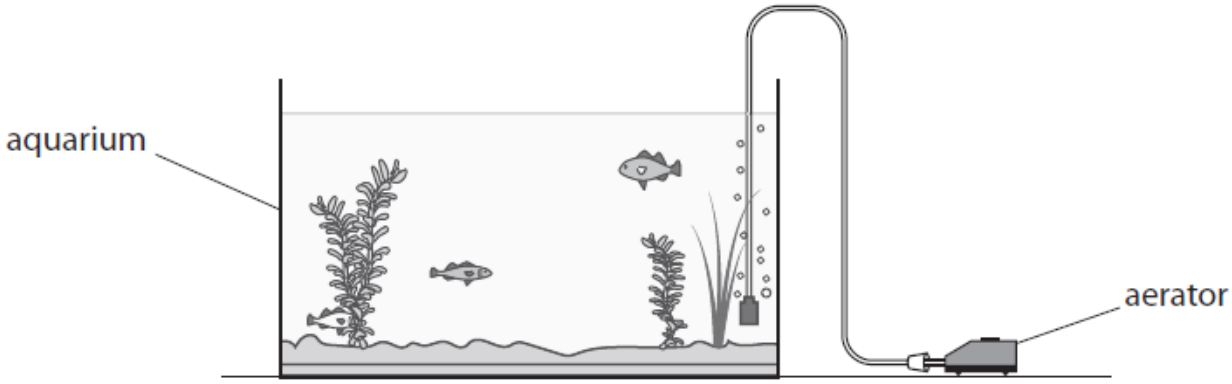
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(b) A person keeps small fish in a glass container called an aquarium.

The diagram shows an aquarium.

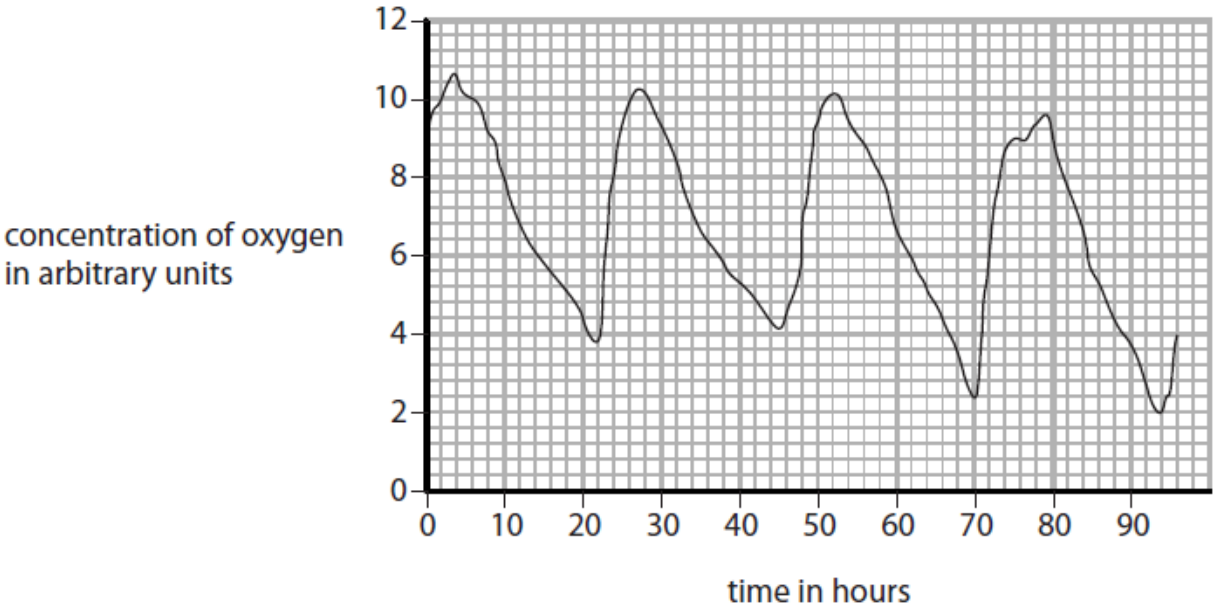


He follows these steps to try and keep his fish healthy.

- place the aquarium near a window
- use the aerator for one hour each day
- set the aerator to pump large bubbles of air rather than small bubbles
- feed the fish several times a day with large amounts of food
- change the water in the aquarium every four days

He measures the changes in oxygen concentration in the aquarium water over a period of four days.

The graph shows these changes in oxygen concentration.



The person claims he keeps his fish in good conditions.

Evaluate this claim.

(6)

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(Total for question = 9 marks)

Q9.

Aerobic respiration is a process in living organisms.

(a) Which of these is the balanced chemical symbol equation for aerobic respiration?

(1)

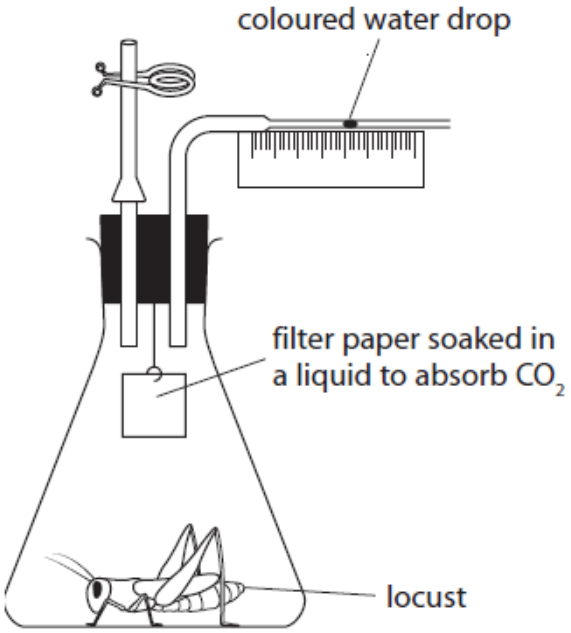
☒ **A** $C_6H_{12}O_6 + 6O_2 \longrightarrow 6CO_2$

☒ **B** $C_6H_{12}O_6 \longrightarrow 2C_2H_5OH + 2CO_2$

☒ **C** $C_6H_{12}O_6 + 6CO_2 \longrightarrow 6O_2 + 6H_2O$

☒ **D** $C_6H_{12}O_6 + 6O_2 \longrightarrow 6CO_2 + 6H_2O$

(b) A student uses this apparatus to investigate aerobic respiration in a locust.



(i) The coloured water drop moves during the investigation.

Explain why the coloured water drop moves during the investigation.

(2)

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(ii) The student compares the aerobic respiration of male and female locusts.

He uses three male locusts and three female locusts.

He uses locusts of the same age and the same species.

Explain three other variables that the student needs to control.

(6)

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(c) The table shows the student's results.

	Distance moved by coloured water drop in mm	
	male	female
trial 1	5.0	5.4
trial 2	4.9	5.2
trial 3	2.0	5.2
mean	5.0	

(i) Complete the table by giving the missing mean value.

(1)

(ii) Comment on the reliability of the data in the table.

(3)

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(Total for question = 13 marks)

Q10.

Aerobic respiration uses oxygen and produces ATP.

(a) Complete the word equation for aerobic respiration.

(2)

oxygen + ... → ..... + ... + ATP

(b) A scientist investigates the rates of aerobic respiration of some animals.

The scientist calculates the rate of respiration per gram of each animal.

The results are shown in the table.

Animal	Rate of aerobic respiration per gram of animal in arbitrary units
frog	150
human	200
mouse	1500

Explain why a mouse uses more oxygen per gram than a human.

(3)

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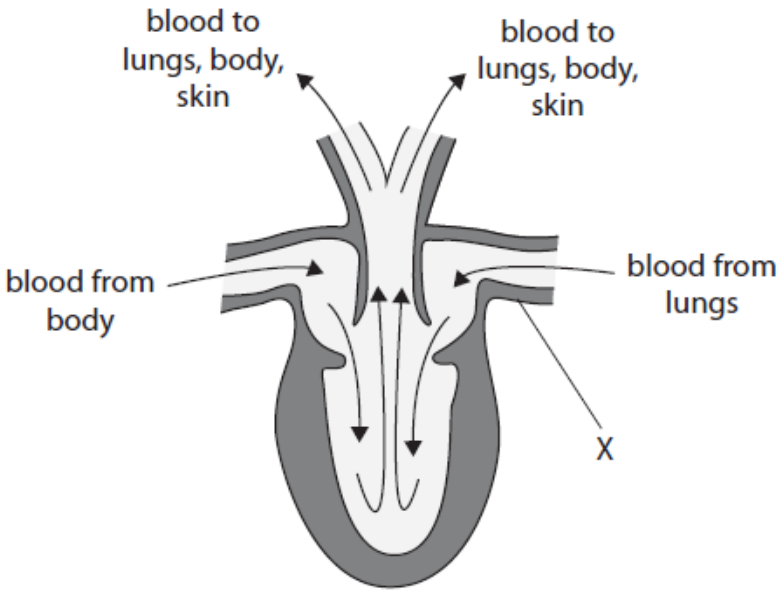
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(c) The structure of a frog heart is different from the structure of a human heart.

The diagram shows a section of a frog heart with arrows showing the direction of blood flow.



(i) What is the name of the blood vessel labelled X?

(1)

☒ **A** aorta

☒ **B** pulmonary artery

☒ **C** pulmonary vein

☒ **D** vena cava

(ii) Give one difference between the structure of the frog heart and a human heart.

(1)

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(iii) Humans can run for long periods of time. Frogs can only move for short periods of time.

Explain how the structure of the heart of a frog means that it is unable to move for long periods of time.

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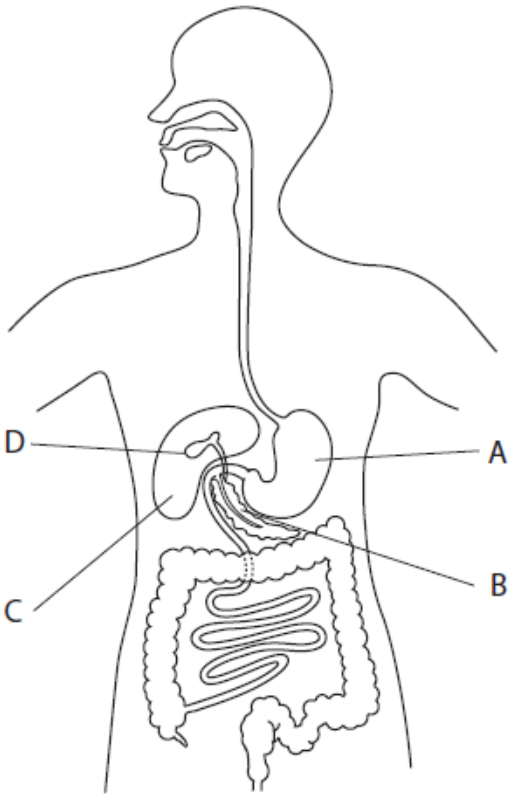
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(Total for question = 12 marks)

Q11.

The diagram shows the human alimentary canal.



(a) (i) Explain how food passes down the oesophagus.

(2)

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(ii) Which labelled structure produces bile?

(1)

☒ **A**

☒ **B**

☒ **C**

☒ **D**

(iii) Describe the role of bile in digestion.

(3)

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(b) Lipase inhibitors are chemicals that bind to lipase enzymes.

To test the effect of a lipase inhibitor, equal masses of full fat milk are placed into two test tubes.

Lipase inhibitor is added to one test tube.

Lipase is added to both test tubes and the pH of each solution is measured every five minutes.

The results are shown in the table.

Time in minutes	pH of solution	
	without lipase inhibitor	with lipase inhibitor
0	8.0	8.0
5	7.6	7.8
10	7.2	7.8
15	6.3	7.7
20	5.8	7.5

(i) Calculate the mean rate of pH change per minute of the solution without lipase inhibitor.

(2)

mean rate of pH change = ... per minute

(ii) Explain the difference in the changes of pH of the solutions in the two test tubes during the 20-minute period.

(2)

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(iii) Doctors use this method to investigate the use of lipase inhibitor as a treatment for obesity.

- give three volunteers a tablet containing the lipase inhibitor
- give another three volunteers a tablet with no lipase inhibitor
- give all the volunteers 100 cm^3 of olive oil to drink
- measure the lipid concentrations in the blood of the volunteers after three hours

Some of the volunteers reported abdominal pains three hours after drinking the olive oil.

The table shows the doctors' results.

Tablet contents	Blood lipid concentration in mg per dm^3		Abdominal pains
	at start	after 3 hours	
inhibitor	35	38	yes
inhibitor	37	42	no
inhibitor	37	43	yes
no inhibitor	35	62	no
no inhibitor	37	64	no
no inhibitor	35	45	yes

Discuss the use of the lipase inhibitor as a treatment for obesity.

Use the data from the table to support your answer.

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(Total for question = 15 marks)

Q12.

Alkaptonuria is an inherited condition caused by the presence of recessive alleles.

(a) State what is meant by a recessive allele.

(1)

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(b) Alkaptonuria is first diagnosed in children when it is noticed that they produce very dark urine that turns black when exposed to air.

A woman and a man do not have alkaptonuria. They have a child who has the condition.

The woman and the man are expecting a second child.

(i) Draw a genetic diagram to show the genotypes of the woman and the man, the gametes they produce and the possible phenotypes and genotypes of the second child.

(4)

(ii) Calculate the probability that the second child is male and does not have the condition.

(1)

probability = ...

(c) Alkaptonuria is caused by the body being unable to break down the amino acids tyrosine and phenylalanine.

This leads to a build-up of a toxin that causes damage to joints and tendons and can also lead to heart valve damage in later life.

A new drug treatment is being tested that can slow the damage to the joints and tendons.

Scientists selected 40 adults who all had alkaptonuria. They placed each patient into one of two groups. One group was given the drug treatment and the other group acted as a control.

The scientists then compared the symptoms of the patients in each group after three years.

(i) Describe what is meant by the control group.

(1)

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(ii) The table compares the control group with the drug treatment group.

It shows the numbers starting and completing the trial and those showing harmful effects.

It also compares improvements in two symptoms of alkaptonuria.

	Control group	Drug group
number of patients starting trial	20	20
number of patients completing trial	17	16
number of patients showing adverse effects	0	2
number of patients that died	0	1
decrease in time taken to stand up and walk 3 m in seconds	0.54	1.33
increase in distance in metres walked in 6 minutes	6.7	51.5

Evaluate whether the new drug should be recommended as an effective treatment for alkaptonuria.

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(d) Other scientists have suggested that eating fewer proteins that contain tyrosine and phenylalanine would reduce the symptoms of alkaptonuria.

Suggest why eating fewer of these proteins may be difficult.

(2)

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(Total for question = 14 marks)

Q13.

Fur colour in rats is controlled by a gene with two alleles.

One allele codes for black fur colour. The other allele codes for agouti fur colour.

Several female rats with agouti coloured fur are mated with several male rats with black coloured fur.

All of the offspring have agouti coloured fur.

(a) (i) Explain which allele is dominant.

(2)

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(ii) A male and female rat from these offspring are then mated together in a second cross.

Some of the offspring of this second cross have agouti coloured fur and some have black coloured fur.

Draw a genetic diagram to show this second cross. Include the genotypes of the parents, the gametes they produce, and the genotypes and the phenotypes of the offspring.

(4)

(iii) Calculate the probability of any one offspring from this second cross being male with agouti coloured fur.

(2)

probability = ...

(b) Scientists observed that genes that control fur colour in rats can affect rat behaviour, such as how tame they are.

Other genes that control the size of the adrenal glands and the production of neurotransmitters also affect rat behaviour.

Scientists also noticed that coat colour is associated with differences in anatomy and physiology, such as the size of the adrenal glands and the production of neurotransmitters.

(i) State the name of the type of genetic control where many genes control one phenotype.

(1)

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(ii) Explain why the size of the adrenal glands and the production of neurotransmitters would affect rat behaviour.

(3)

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(c) Some rats with white fur also have pink eyes.

These rats have pink eyes because they do not have pigment in their irises.

This means that their irises let light pass through, unlike the coloured irises found in other rats.

Explain how this difference in the iris affects vision in the rats with pink eyes.

(3)

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(Total for question = 15 marks)

Q14.

Fur colour in mice is controlled by a single gene that has two alleles.

Mice can have grey fur or white fur.

In a first cross, a female white mouse is mated with a male grey mouse.

They have eight offspring, each with grey fur.

(a) Which allele is dominant?

(1)

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(b) One of the female offspring from this first cross is mated with a male white mouse in a second cross.

(i) Draw a genetic diagram to show the genotypes of the parents, the gametes they produce and the expected genotypes and phenotypes of the offspring from this second cross.

(4)

(ii) This second cross produces six offspring.

Four are male and two are female.

Give a reason why the ratio of male to female mice in the offspring is not 1 : 1

(1)

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(iii) The parents of the second cross mate again and produce another set of offspring.

Calculate the probability that one of these offspring will be male and have white fur.

(2)

probability = ...

(c) Scientists have found that mice with white fur may be more likely to develop some bacterial infections.

The mouse immune system is similar to the human immune system.

Describe how the immune system of a mouse responds when exposed to a bacterial infection.

(3)

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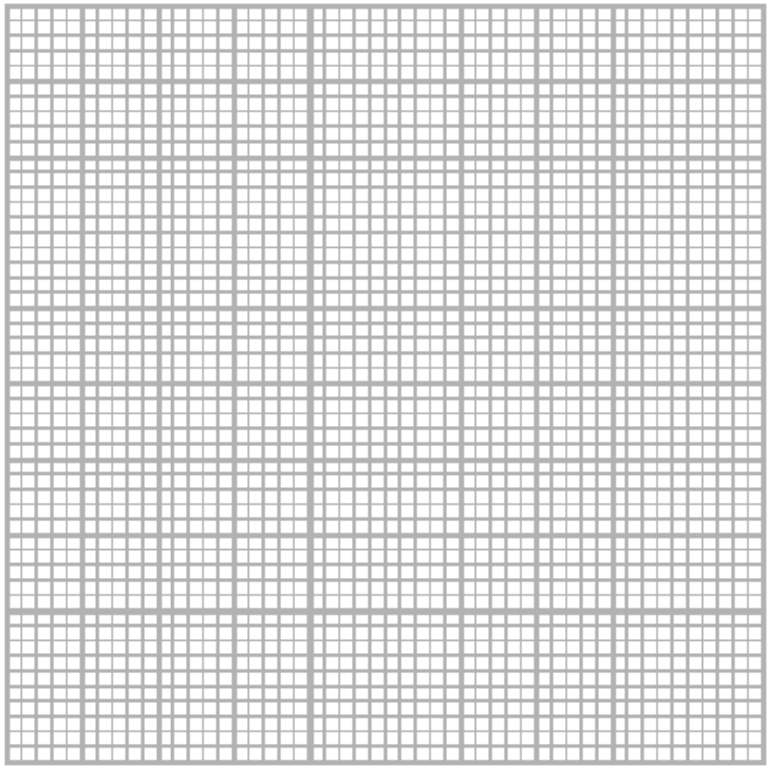
Q15.

The data in the table shows how the mean maximum lung volume changes with age for males and females.

Age / years	Mean maximum lung volume / dm^3	
	males	females
7	2.10	2.05
16	4.50	3.70
25	5.20	3.80
50	4.80	3.40
70	3.90	2.80

(a) (i) Plot a bar graph to show this data.

(5)



(ii) Calculate the increase in mean maximum lung volume for males between the ages of 7 and 25.

(1)

increase = ... dm^3

(iii) Explain why the mean maximum lung volume for males and females is similar at age 7 but is different at age 25.

(3)

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(b) The data shows the mean maximum lung volume at each age.

(i) Which of the following would improve the reliability of these mean values?

(1)

☒ **A** using a larger range of ages

☒ **B** measuring more people at each age

☒ **C** measuring lung volume in cm^3

☒ **D** measuring lung volumes in other mammals

(ii) Variation in maximum lung volume exists between males at each age.

Suggest **two** factors that could cause this variation.

(2)

1 .....

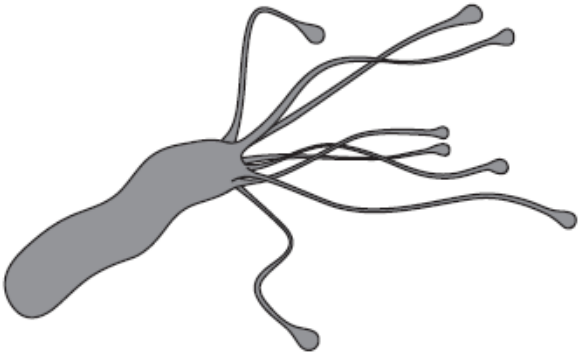
2 .....

(Total for question = 12 marks)

Q16.

The bacterium *H. pylori* causes stomach ulcers.

(a) The diagram shows this bacterium.



(i) Which of these is found in this bacterium?

(1)

☒ **A** cellulose

☒ **B** chitin

☒ **C** cytoplasm

☒ **D** nucleus

(ii) The bacterium has evolved to release an enzyme called urease.

The action of the bacterium neutralises the acid in the stomach.

What is the pH changed to?

(1)

☒ **A** 1

☒ **B** 2

☒ **C** 7

☒ **D** 12

(iii) Use the theory of evolution by natural selection to explain how *H. pylori* bacteria could have evolved to produce urease.

(4)

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(b) Probiotics are live microorganisms that can have health benefits when consumed.

Scientists investigate the ability of probiotics and cranberry juice to reduce the growth of *H. pylori*.

The scientists give various treatments to a group of people who have *H. pylori*.

The treatments are given daily for three weeks.

The scientists measure the mean percentage reduction of *H. pylori* for each treatment.

The table shows the scientists' results.

Treatment	Mean percentage (%) reduction in *H. pylori*
probiotics	14.9
cranberry juice	16.9
probiotics and cranberry juice	22.9
control	1.5

Give two conclusions from these results.

(2)

1 .....

2 .....

(Total for question = 8 marks)

Q17.

(a) The table gives some examples of biological processes.

Complete the table by giving the name of each process.

The first one has been done for you.

(3)

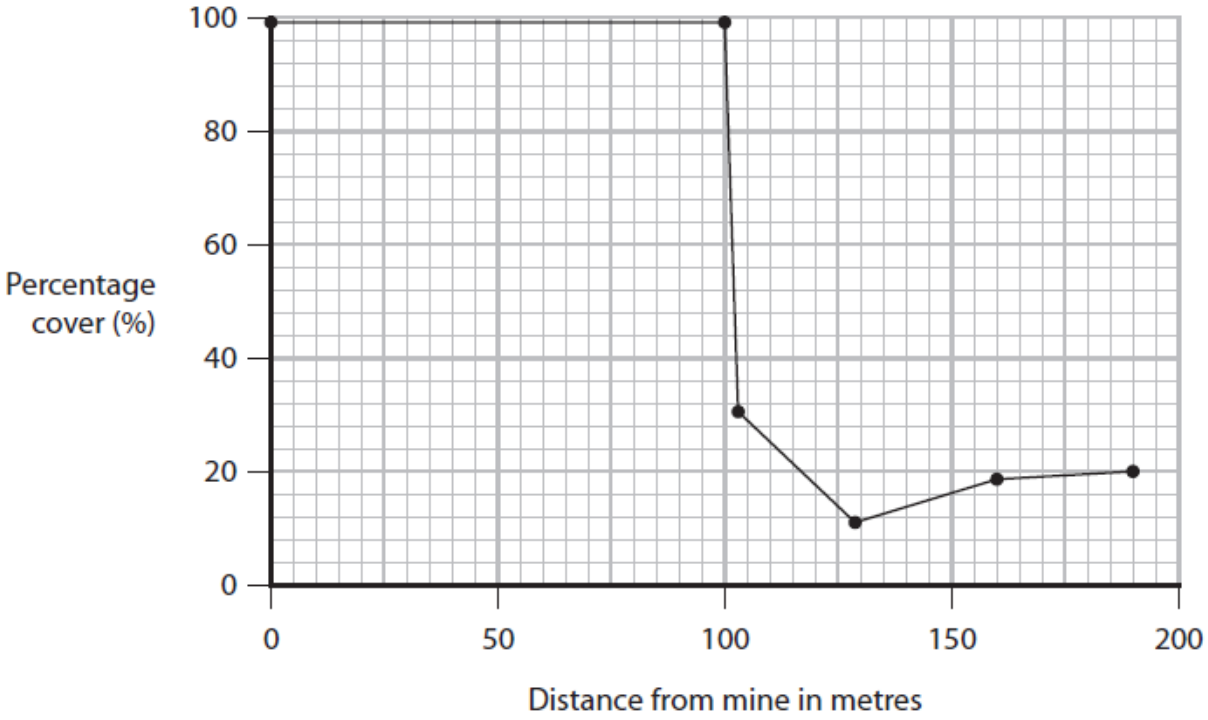
Example of process	Name of process
plants with a short growing season survive drought	natural selection
growth of algae in rivers polluted by fertiliser	
pollen transferred from one plant to another by an insect	
absorption of nitrate ions from soil using ATP	

(b) Zinc is poisonous to many plants and can affect natural selection.

A scientist investigates the ability of one grass species to survive at different distances from a zinc mine.

The scientist uses a sampling method to measure the percentage cover of this grass species at different distances from the zinc mine.

The graph shows the scientist's results.



(i) The zinc concentration in soil is higher near the zinc mine than it is further from the zinc mine.

Explain how natural selection could be responsible for the results shown in the graph between 0 and 100 metres.

(4)

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(ii) Describe a method the scientist could use to compare the population size of the grass species at 50 metres and 100 metres from the mine.

(4)

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(Total for question = 11 marks)

Q18.

Plants use some of the biomass that they produce as a source of energy.

(a) Name the process that releases energy in plant cells.

(1)

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(b) The productivity of plants in different ecosystems can be compared by calculating their net primary productivity.

Net primary productivity is the difference between the biomass produced and the biomass used.

The table shows the net primary productivity of different ecosystems in one year. This is measured in grams of biomass produced by one square metre of ground.

Ecosystem	Mean net primary productivity in one year in g per m^2
desert	80
temperate grassland	600
cultivated farmland	625
temperate deciduous forest	1250
tropical rainforest	2200

A temperate ecosystem has no extremes of temperature.

(i) Describe a method that a scientist could use to determine the mean net primary productivity of temperate grassland in a year.

(3)

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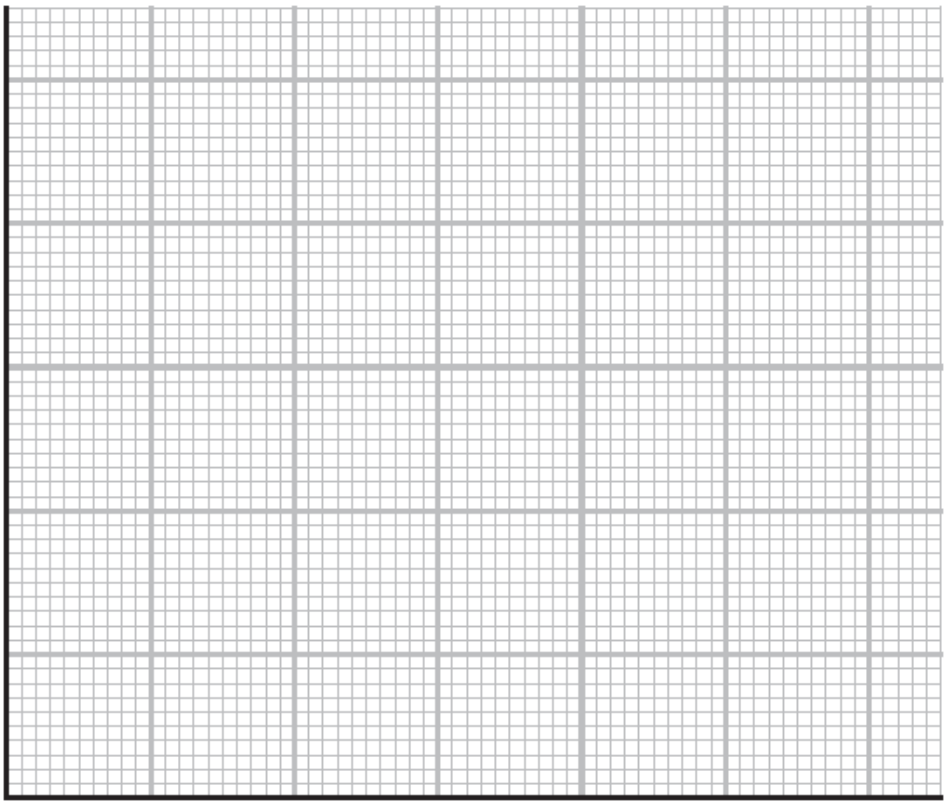
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(ii) Draw a bar chart to show the mean net primary productivity in g per m^2 for each ecosystem in one year.

(5)



(iii) Comment on the differences between the mean net primary productivity in the ecosystems.

(5)

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(Total for question = 14 marks)

Q19.

A study investigates the effect of training on athletic performance.

In the study, the number of capillaries in the muscle tissue of a person is measured before and after a six-week period of training.

(a) The table shows the results.

Mean number of capillaries per mm^2	
before training	after training
437	460

(i) Explain how training may affect the athletic performance of this person. Use information from the table to support your answer.

(5)

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(ii) Give **two** ways in which the design of the study could be improved.

(2)

1 .....

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2 .....

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(b) The diameter of a capillary is 8.0 µm and the diameter of the aorta is 25.0 mm. 1000 µm = 1 mm.

(i) Calculate the ratio of the diameter of the aorta to the diameter of the capillary. Show your working

(2)

ratio = ...

(ii) Explain why the aorta has a thicker wall than the capillary.

(2)

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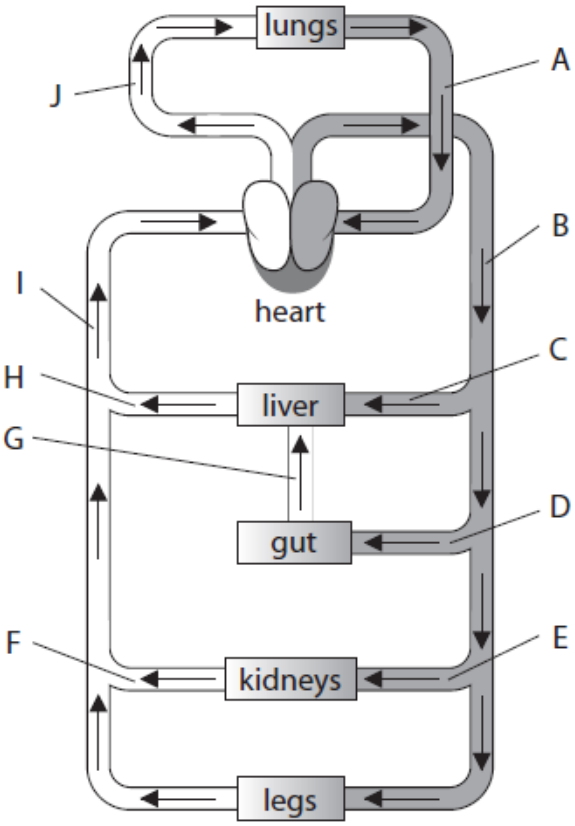
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(Total for question = 11 marks)

Q20.

The diagram shows the human circulation system with some blood vessels labelled A to J. The arrows show the direction of blood flow.



(a) The table gives some statements about the content of blood vessels in this circulation system.

(i) Complete the table by giving the letter of the blood vessel that matches each statement.

(5)

Statement	Letter
contains the least carbon dioxide	
contains the most glucose after a meal	
contains the least oxygen	
contains the least urea	
contains blood at the highest pressure	

(ii) State two ways in which the structure of blood vessel A differs from the structure of blood vessel J.

(2)

1 .....

2 .....

(b) Muscles in the legs contain capillaries.

A scientist investigates how long-term training affects the number of capillaries in an athlete's leg muscles.

The scientist determines the mean number of capillaries per mm^2 in samples of leg muscle from the athlete before and after a period of training.

The table shows the scientist's results.

Muscle sample	Mean number of capillaries per mm^2
before training	313
after training	349

The scientist concludes that training improves the athletic performance.

Discuss this conclusion.

(5)

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(Total for question = 12 marks)

Q21.

Blood consists of cells and plasma.

(a) Plasma transports various substances to and from different parts of the body.

Describe the function of plasma in transporting named substances in the body.

(4)

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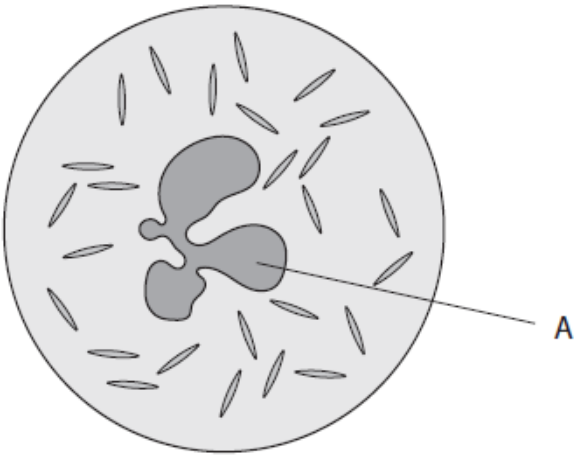
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(b) The diagram shows a white blood cell called a phagocyte.



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

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

The actual diameter of the cell is 0.013 mm.

Calculate the magnification of the cell.

(2)

magnification = ...

(ii) Name the structure labelled A in the diagram.

(1)

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(iii) Describe the function of this cell in defending the body from infection.

(2)

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(c) Other white blood cells produce proteins called antibodies.

State how you could test a sample of plasma for protein.

(1)

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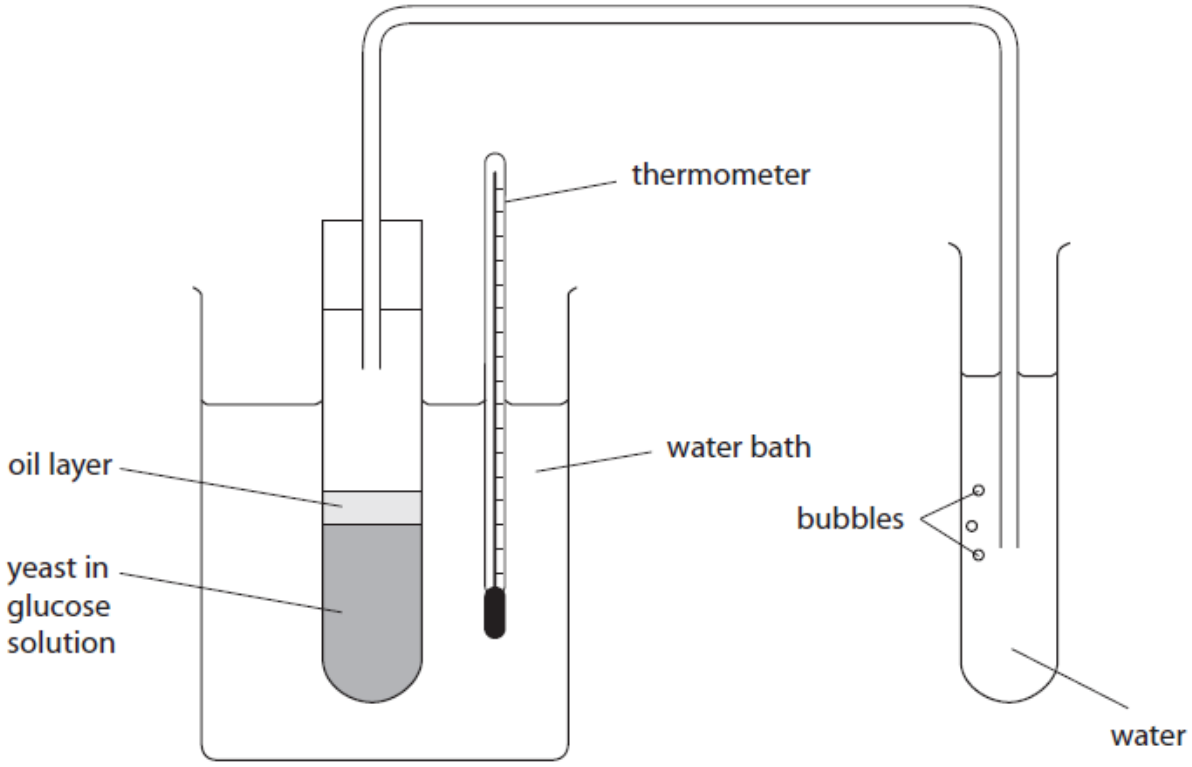
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(Total for question = 10 marks)

Q22.

A student wants to investigate the effect of temperature on the rate of anaerobic respiration by yeast.

She set up this apparatus.



(a) The oil layer prevents the entry of air into the glucose solution.

Explain why this is necessary.

(2)

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(b) The student varies the temperature of the water bath between 15 °C and 60 °C.

She measures the rate of respiration by counting the number of carbon dioxide bubbles produced per minute.

These are her results.

Temperature / °C	Number of bubbles produced in one minute				
	trial 1	trial 2	trial 3	trial 4	trial mean
15	6	7	5	5	6
20	7	8	7	9	8
35	10	12	11	14	
45	12	15	14	16	14
60	3	2	1	2	2

(i) Calculate the mean number of bubbles produced in one minute at 35 °C.

(2)

mean number of bubbles in one minute = ...

(ii) Calculate the percentage change in the mean number of bubbles produced in one minute as the temperature increases from 15 °C to 45 °C.

(2)

percentage change = ... %

(iii) Explain the change in the rate of respiration by yeast as the temperature increases from 45 °C to 60 °C.

(3)

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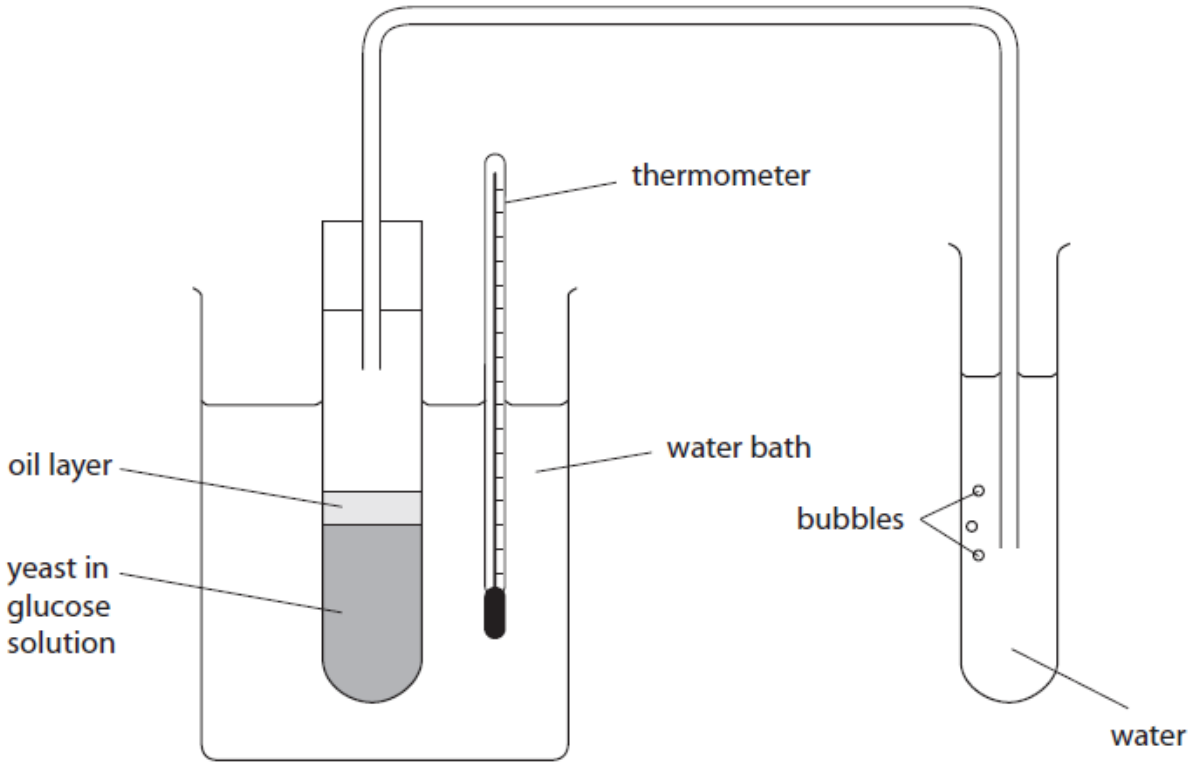
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(Total for question = 9 marks)

Q23.

A student wants to investigate the effect of temperature on the rate of anaerobic respiration by yeast.

She set up this apparatus.



(a) The oil layer prevents the entry of air into the glucose solution.

Explain why this is necessary.

(2)

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(b) The student varies the temperature of the water bath between 15 °C and 60 °C.

She measures the rate of respiration by counting the number of carbon dioxide bubbles produced per minute.

These are her results.

Temperature / °C	Number of bubbles produced in one minute				
	trial 1	trial 2	trial 3	trial 4	trial mean
15	6	7	5	5	6
20	7	8	7	9	8
35	10	12	11	14	
45	12	15	14	16	14
60	3	2	1	2	2

(i) Calculate the mean number of bubbles produced in one minute at 35 °C.

(2)

mean number of bubbles in one minute = ...

(ii) Calculate the percentage change in the mean number of bubbles produced in one minute as the temperature increases from 15 °C to 45 °C.

(2)

percentage change = ... %

(iii) Explain the change in the rate of respiration by yeast as the temperature increases from 45 °C to 60 °C.

(3)

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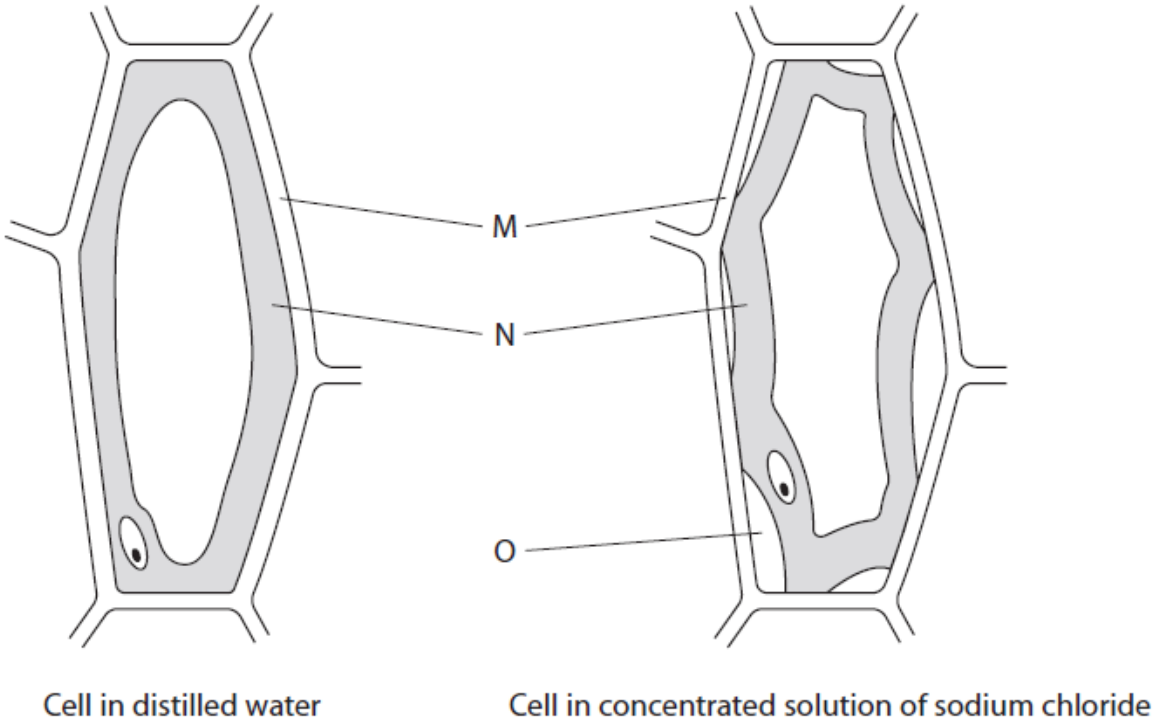
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(Total for question = 9 marks)

Q24.

The diagram shows a plant cell in distilled water and a plant cell in a concentrated solution of sodium chloride.



(a) (i) Which structure is labelled M?

(1)

☒ **A** cell membrane

☒ **B** cell wall

☒ **C** nucleus

☒ **D** vacuole

(ii) Which structure is labelled N?

(1)

☒ **A** cell membrane

☒ **B** cell wall

☒ **C** cytoplasm

☒ **D** vacuole

(b) (i) Give the name of the liquid found in the gap labelled O in the cell in the concentrated solution of sodium chloride.

(1)

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(ii) Explain the differences in the appearance of the cell in distilled water and the cell in the concentrated solution of sodium chloride.

(4)

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(c) Describe an experiment you could do to show how different concentrations of sodium chloride solution affect the appearance of plant cells.

(4)

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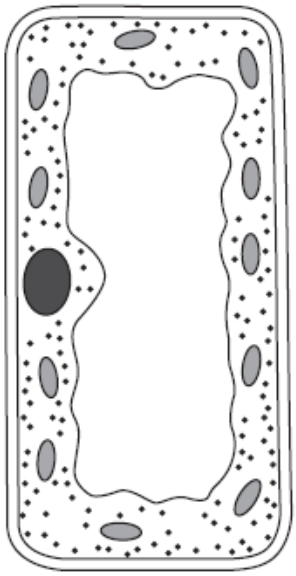
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(Total for question = 11 marks)

Q25.

The diagram shows a cell.



(a) (i) Which type of cell does the diagram show?

(1)

☐ **A** an animal

☐ **B** a bacterium

☐ **C** a fungus

☐ **D** a plant

(ii) The statements below describe conditions required for some molecules to move into this cell.

1. a concentration gradient

2. use of ATP

Which of these statements is correct for the process for osmosis?

(1)

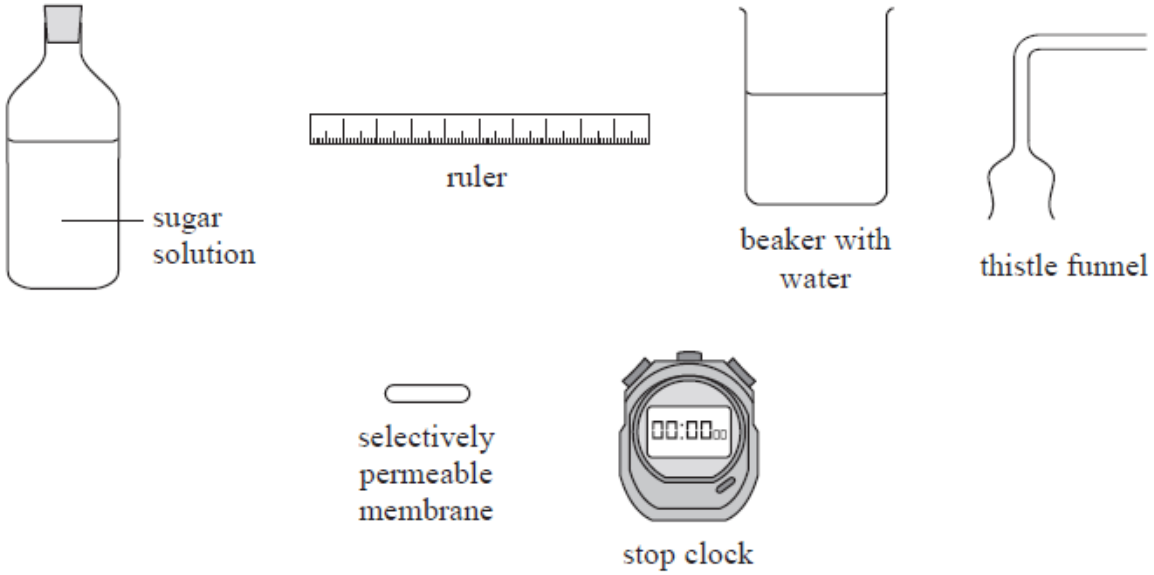
☐ **A** 1 only

☐ **B** 2 only

☐ **C** 1 and 2

☐ **D** neither 1 nor 2

(b) The diagram shows some of the apparatus used to investigate the rate of osmosis.

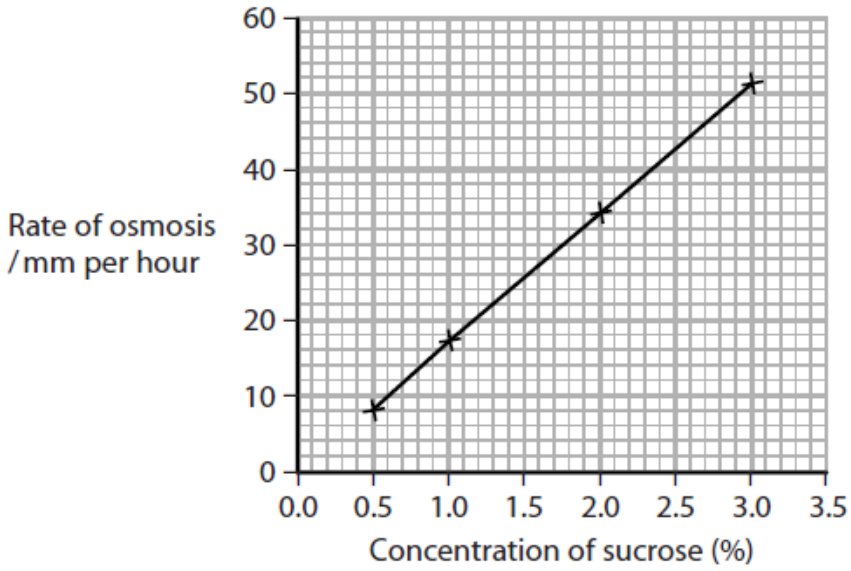


In the space below draw a labelled diagram to show how you would put this apparatus together to investigate the rate of osmosis.

(4)

(c) The apparatus is used to find out the effect of different sucrose concentrations on the rate of osmosis.

The graph below shows the results.



Calculate, using information from the graph, the rate of osmosis in mm per minute that would occur for a sucrose concentration of 2.5%. Show your working.

(2)

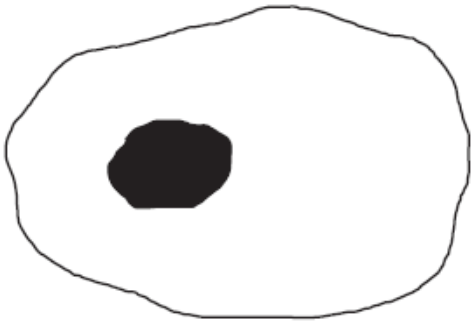
rate of osmosis = ... mm per minute

(Total for question = 8 marks)

Q26.

(a) A student uses a light microscope to look at a human cheek cell.

The student makes this drawing of the cell.



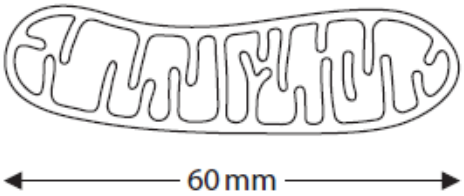
Name the organelle shown in the drawing.

(1)

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(b) Mitochondria are organelles that are too small to be seen using a light microscope.

The drawing shows a mitochondrion that has been magnified.



The actual length of this mitochondrion is 6 µm.

[1 µm = 0.001 mm]

Calculate the magnification of this drawing.

(2)

magnification = ...

(c) The table gives information about mitochondria in different human cells.

Cell	Mean number of mitochondria per cell	Mean volume of cell in µm³	Mean number of mitochondria per µm³
heart muscle	5000	15000	
sperm	75	30	2.50
egg	600000	4000000	0.15

(i) What is the mean number of mitochondria per μm^3 in a heart muscle cell?

(1)

☒ **A** 0.33

☒ **B** 3

☒ **C** 10 000

☒ **D** 75 000 000

(ii) Comment on the differences in the data for the sperm and for the egg.

(3)

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(Total for question = 7 marks)

Q27.

All living organisms have certain characteristics.

(a) Describe what is meant by the following characteristics:

(i) respiration

(2)

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(ii) control of their internal conditions

(2)

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(b) Organisms are organised into different levels.

What is the correct order of the levels?

(1)

☒ **A** organ, system, tissue, cell, organelle

☒ **B** organ, tissue, cell, system, organelle

☒ **C** organelle, cell, tissue, organ, system

☒ **D** system, cell, organelle, organ, tissue

(c) Yeast is an example of which group of organism?

(1)

☒ **A** animals

☒ **B** bacteria

☒ **C** fungi

☒ **D** protoctists

(Total for question = 6 marks)

Q28.

All living organisms have certain characteristics.

(a) Describe what is meant by the following characteristics:

(i) respiration

(2)

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.....

(ii) control of their internal conditions

(2)

.....

.....

.....

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(b) Organisms are organised into different levels.

What is the correct order of the levels?

(1)

☒ **A** organ, system, tissue, cell, organelle

☒ **B** organ, tissue, cell, system, organelle

☒ **C** organelle, cell, tissue, organ, system

☒ **D** system, cell, organelle, organ, tissue

(c) Yeast is an example of which group of organism?

(1)

☒

A animals

☒ **B** bacteria

☒ **C** fungi

☒ **D** protoctists

(Total for question = 6 marks)