

Khalsa 6th@
ATAM



A Level Biology Transition work



This transition work book are designed to give you an introduction and prepare you for advanced study in your chosen subjects. The tasks are to be completed independently over the summer and handed into your subject teachers in your first lesson. You should aim to spend a **minimum** of four hours on this transition booklet.

Reflection Sheet

Complete this document after you complete each question and mark it.

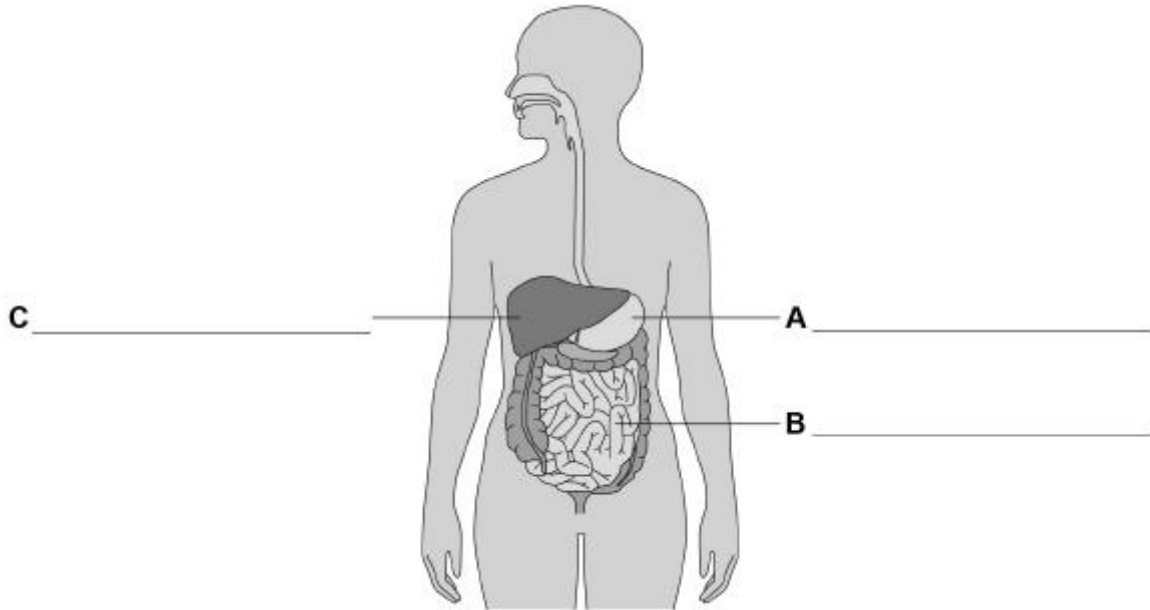
Topic	Question	Marks available	What I got	What I learnt from this question
Carbs, proteins & lipids	1	15		
	2	8		
	3	7		
Cell biology	4	4		
	5	12		
	6	8		
	7	5		
	8	6		
	9	6		
DNA, mitosis, meiosis, protein synthesis	10	11		
	11	6		
	12	7		
Antibody production	13	7		

	14	8		
Gas exchange	15	6		
	16	6		
Heart & circulation	17	9		
	18	5		
	19	13		
Vascular bundles in plants	20	7		
	21	9		
	22	9		
Natural selection	23	5		
	24	5		
Inheritance	25	12		
	26	6		
	27	12		
	28	16		

There are 237 marks of exam questions altogether. This should take you approximately 4 hours in total.

Q1.

The diagram below shows the human digestive system.



(a) Label organs **A**, **B** and **C**.

(3)

(b) Complete the sentences.

Choose the answers from the box.

catalyse	denatured	digest	energise
excreted	ingested	insoluble	soluble

Digestion is the process of breaking down large food molecules into smaller molecules that are _____ .

Enzymes help to break down food because they _____ chemical reactions.

If the temperature of an enzyme gets too high, the enzyme is _____ .

(3)

(c) Protease is an enzyme.

Protease breaks down protein.

What is protein broken down into?

Tick **one** box.

Amino acids

Fatty acids

Glucose

Glycerol

(1)

(d) Why is protein needed by the body?

(1)

(e) Which organ in the human digestive system produces protease?

Tick **one** box.

Gall bladder

Large intestine

Liver

Stomach

(1)

(f) Describe how you would test a sample of food to show it contains protein.

Give the reason for any safety precautions you would take.

(4)

(g) Complete the sentence.

Choose the answer from the box.

fat	fibre	minerals	vitamins
------------	--------------	-----------------	-----------------

Obesity can be caused by a diet high in _____ .

(1)

(h) Complete the sentence.

Choose the answer from the box.

skin cancer	type 1 diabetes	type 2 diabetes
--------------------	------------------------	------------------------

Obesity is a risk factor for _____ .

(1)

(Total 15 marks)

Q2.

(b) Digestive enzymes are made by different organs in the digestive system.

Complete the table below putting a tick (✓) or cross (×) in the boxes.

The first row has been done for you.

		Organ producing enzyme			
		salivary glands	stomach	pancreas	small intestine
Enzyme	amylase	✓	×	✓	✓
	lipase				
	protease				

(2)

(c) The stomach also makes hydrochloric acid.

How does the acid help digestion?

(1)

(d) Draw **one** line from each digestive enzyme to the correct breakdown product.

Digestive enzyme	Breakdown products
Amylase breaks down starch into.....	amino acids.
Lipase breaks down fats into...	bases.
Protease breaks down proteins into...	fatty acids and glycerol.
	sugars.

(3)
(Total 8 marks)

Q3. Fresh milk is a mixture of compounds including lipid, protein and about 5% lactose sugar.

Lactose must be digested by the enzyme lactase, before the products can be absorbed.

Lactase can be added to fresh milk to pre-digest the lactose. This makes 'lactose-free' milk, which is suitable for people who do not produce enough lactase of their own.

A student investigated the effect of changing pH and temperature on the digestion of lactose in milk.

The results are shown in **Tables 1** and **2**.

Table 1
Effect of pH

pH	Time taken to digest lactose in minutes
4.0	20
5.0	18
6.0	13
7.0	7
8.0	5
9.0	6

Table 2
Effect of temperature

Temperature in °C	Time taken to digest lactose in minutes
25	20
30	14
35	11
40	6
45	29
50	No digestion

(a) The label on a carton of lactose-free milk states:

'Lactase is normally produced in the stomach of mammals.'

The results in **Table 1** suggest that this statement is **not** true.

Explain how.

(2)

(b) Explain, as fully as you can, the results shown in **Table 2**.

(3)

(c) Bile is produced in the liver and is released into the small intestine.

Bile helps the digestion of lipid in the milk.

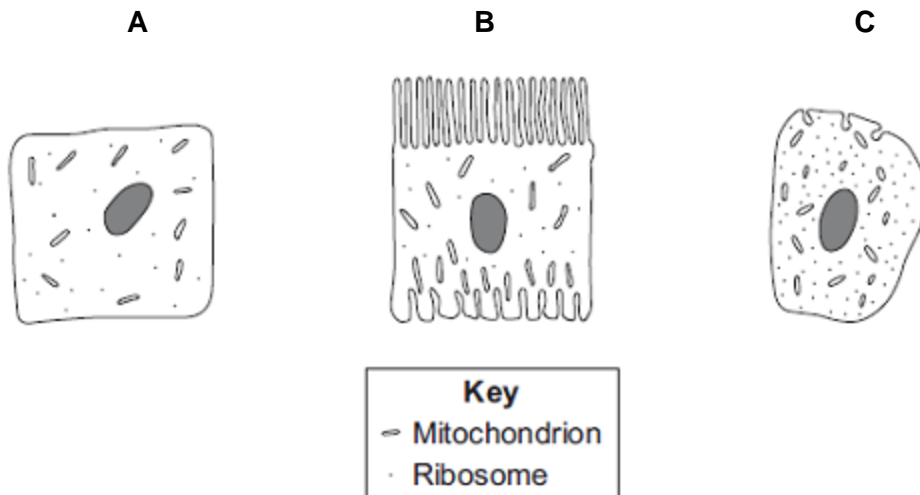
Describe how.

(2)

(Total 7 marks)

Q4.

Diagrams **A**, **B** and **C** show cells from different parts of the human body, all drawn to the same scale.



(a) Which cell, **A**, **B** or **C**, appears to be best adapted to increase diffusion into or out of the cell?

Give **one** reason for your choice.

(1)

- (b) (i) Cell **C** is found in the salivary glands.

Name the enzyme produced by the salivary glands.

(1)

- (ii) Use information from the diagram to explain how cell **C** is adapted for producing this enzyme.

(2)

(Total 4 marks)

Q5.

A student carried out an investigation using chicken eggs.

This is the method used.

1. Place 5 eggs in acid for 24 hours to dissolve the egg shell.
2. Measure and record the mass of each egg.
3. Place each egg into a separate beaker containing 200 cm³ of distilled water.
4. After 20 minutes, remove the eggs from the beakers and dry them gently with a paper towel.
5. Measure and record the mass of each egg.

Table 1 shows the results.

Table 1

Egg	Mass of egg without shell in grams	Mass of egg after 20 minutes in grams
1	73.5	77.0
2	70.3	73.9
3	72.4	75.7
4	71.6	73.1
5	70.5	73.8

(a) Another student suggested that the result for egg 4 was anomalous.

Do you agree with the student?

Give a reason for your answer.

(1)

(b) Calculate the percentage change in mass of egg 3.

Percentage change in mass = _____

(2)

(c) Explain why the masses of the eggs increased.

(3)

(d) Explain how the student could modify the investigation to determine the concentration of the solution inside each egg.

(3)

Chicken egg shells contain calcium. Calcium ions are moved from the shell into the cytoplasm of the egg.

Table 2 shows information about the concentration of calcium ions.

Table 2

Location	Concentration of calcium ions in arbitrary units
Egg shell	0.6
Egg cytoplasm	2.1

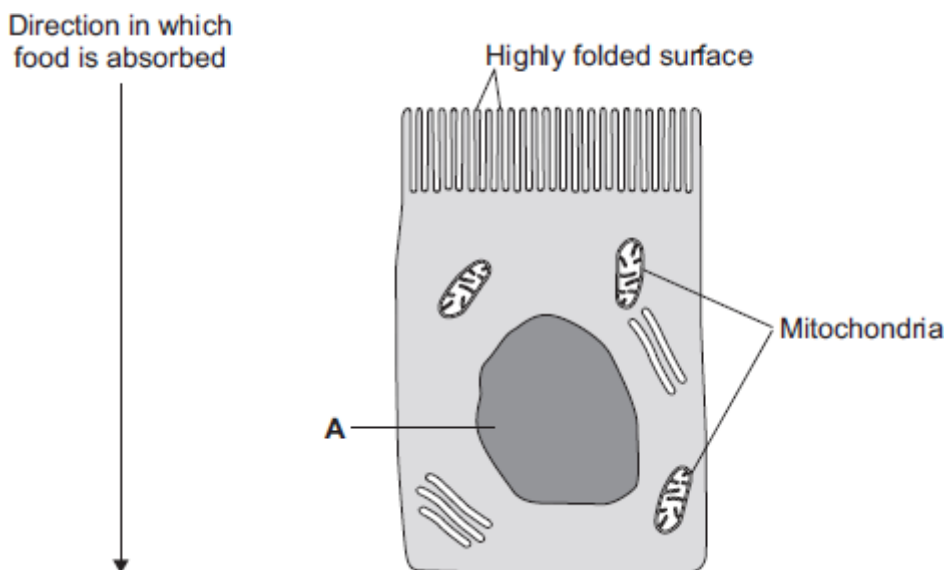
(e) Explain how calcium ions are moved from the shell into the cytoplasm of the egg.

(3)

(Total 12 marks)

Q6.

The image below shows an epithelial cell from the lining of the small intestine.



(a) (i) In the image above, the part of the cell labelled **A** contains chromosomes.

What is the name of part **A**?

(1)

(ii) How are most soluble food molecules absorbed into the epithelial cells of the small intestine?

Draw a ring around the correct answer.

diffusion osmosis respiration

(1)

(b) Suggest how the highly folded cell surface helps the epithelial cell to absorb soluble food.

(1)

(c) Epithelial cells also carry out active transport.

(i) Name **one** food molecule absorbed into epithelial cells by active transport.

(1)

(ii) Why is it necessary to absorb some food molecules by active transport?

(1)

(ii) Suggest why epithelial cells have many mitochondria.

(2)

(d) Some plants also carry out active transport.

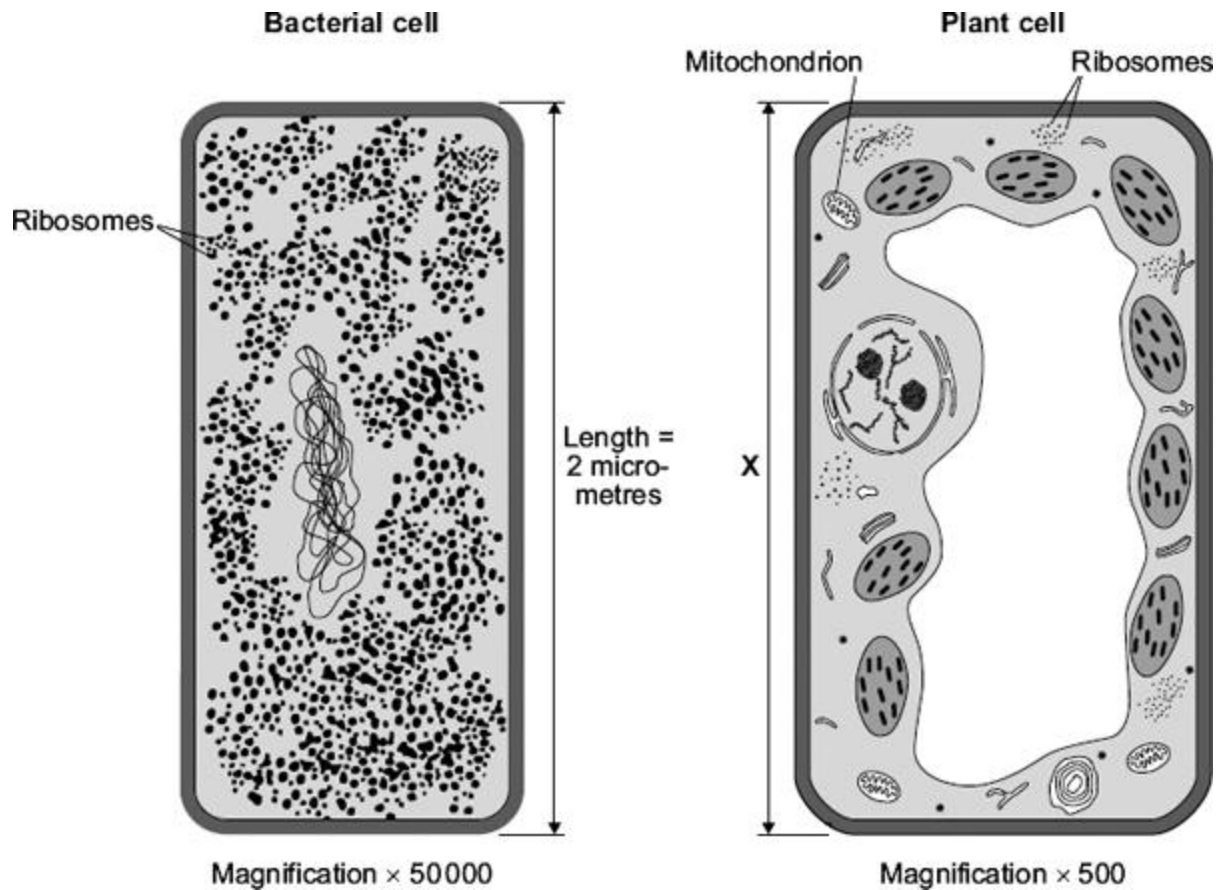
Give **one** substance that plants absorb by active transport.

(1)

(Total 8 marks)

Q7.

The diagram shows two cells, a bacterial cell and a plant cell.



- (a) (i) Both the bacterial cell and the plant cell contain ribosomes.

What is the function of a ribosome?

(1)

- (ii) The plant cell contains mitochondria but the bacterial cell does **not** contain mitochondria.

Give **one** other way in which the plant cell is different from the bacterial cell.

(1)

- (b) (i) Both cells are drawn the same length, but the magnification of each cell is different.

The real length of the bacterial cell is 2 micrometres.

Calculate the real length, **X**, of the plant cell. Give your answer in micrometres.

Show clearly how you work out your answer.

X = _____ micrometres (2)

(ii) Most mitochondria are about 3 micrometres in length.

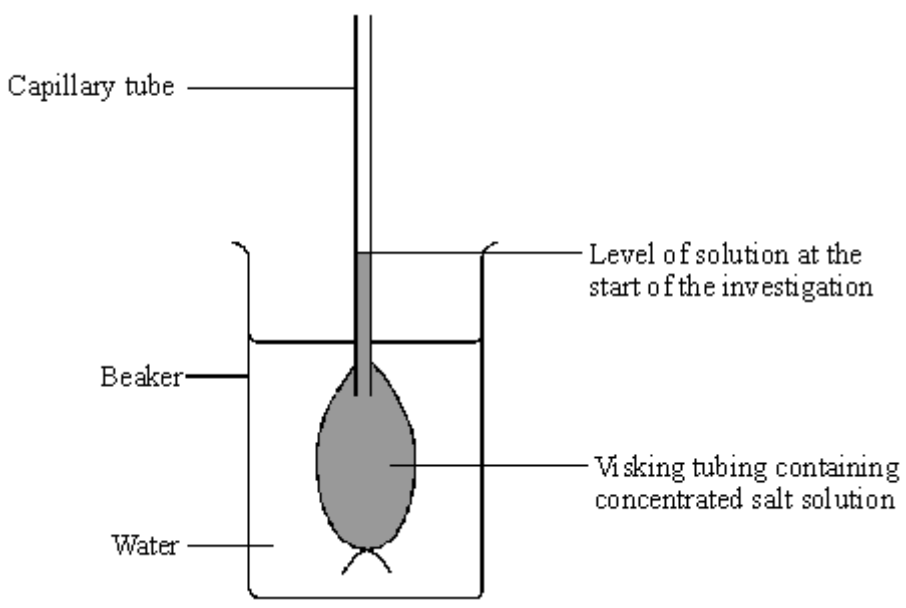
The plant cell contains mitochondria but the bacterial cell does **not** contain mitochondria.

Use your answer to part (b)(i) and the information in the diagram to suggest why.

(1)
(Total 5 marks)

Q8.

Some students set up the equipment below to investigate osmosis.



(a) What is osmosis?

(3)

(b) (i) What will happen to the water level in the capillary tube during the investigation because of osmosis?

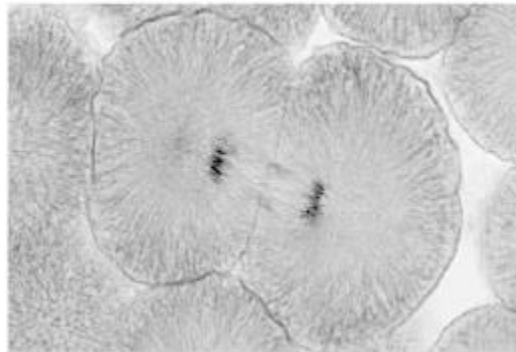
(Total 6 marks)

Q10.

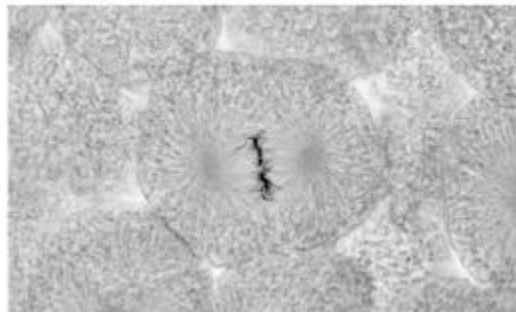
Figure 1 shows photographs of some animal cells at different stages during the cell cycle.

Figure 1

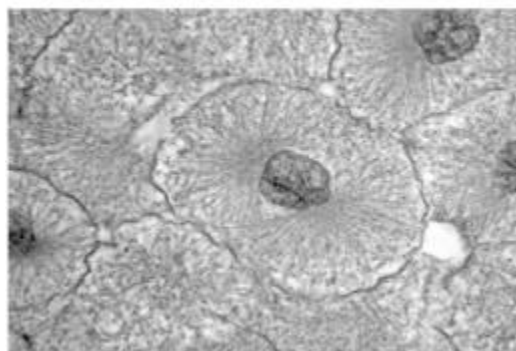
A



B



C



A © Ed Reschke/Photolibary/Getty Images
B © Ed Reschke/Oxford Scientific/Getty Images
C © Ed Reschke/Photolibary/Getty Images

(a) Which photograph in **Figure 1** shows a cell that is **not** going through mitosis?

Tick **one** box.

A B C

(1)

(b) Describe what is happening in photograph **A**.

(2)

(c) A student wanted to find out more about the cell cycle.

The student made a slide of an onion root tip.

She counted the number of cells in each stage of the cell cycle in one field of view.

The table below shows the results.

	Stages in the cell cycle					Total
	Non-dividing cells	Stage 1	Stage 2	Stage 3	Stage 4	
Number of cells	20	9	4	2	1	36

Each stage of the cell cycle takes a different amount of time.

Which stage is the fastest in the cell cycle?

Give a reason for your answer.

Stage _____

Reason _____

(2)

(d) The cell cycle in an onion root tip cell takes 16 hours.

Calculate the length of time **Stage 2** lasts in a typical cell.

Give your answer to 2 significant figures.

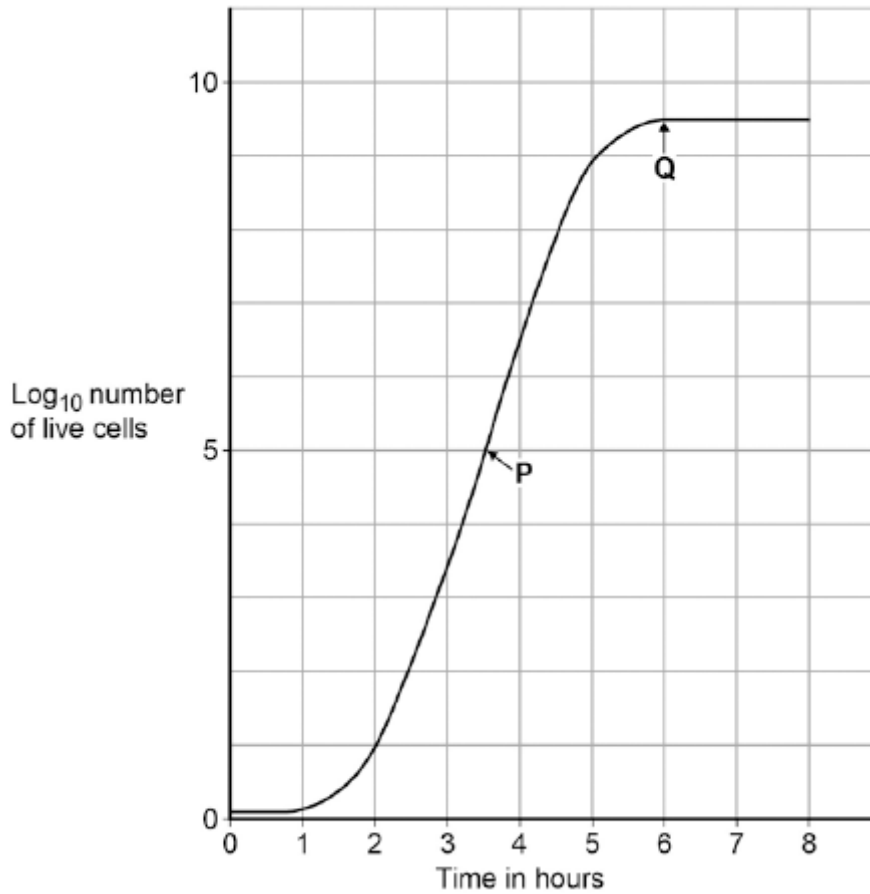
Time in **Stage 2** = _____ minutes

(3)

(e) Bacteria such as *Escherichia coli* undergo cell division similar to mitosis.

Figure 2 shows a growth curve for *E. coli* grown in a nutrient broth.

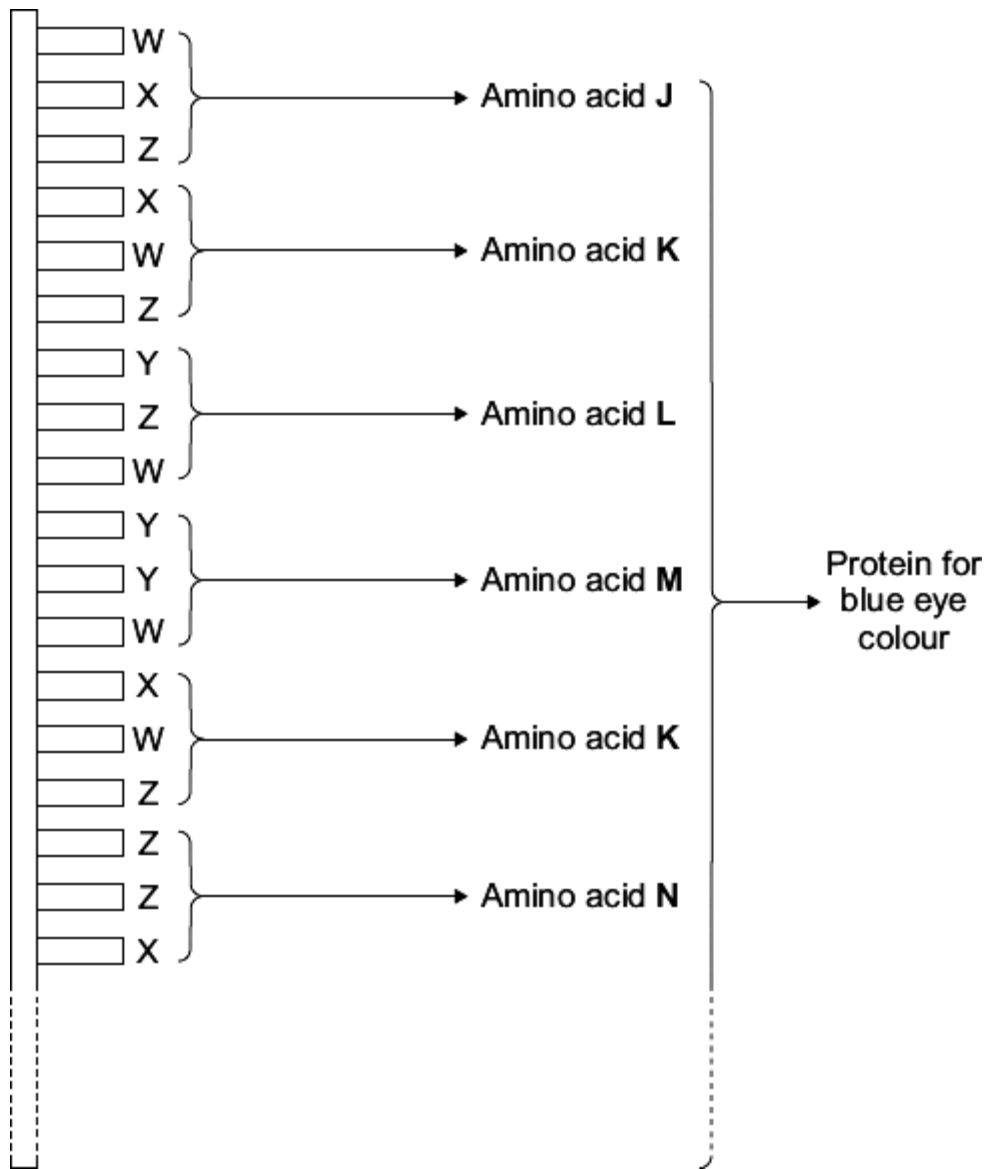
Figure 2



What type of cell division causes the change in number of *E. coli* cells at **P**?

(1)

(f) Suggest why the number of cells levels out at **Q**.



(a) What word is used to describe 'a small section of a DNA molecule that controls the synthesis of a protein'?

(1)

(b) In the cell, where are proteins synthesised?

(1)

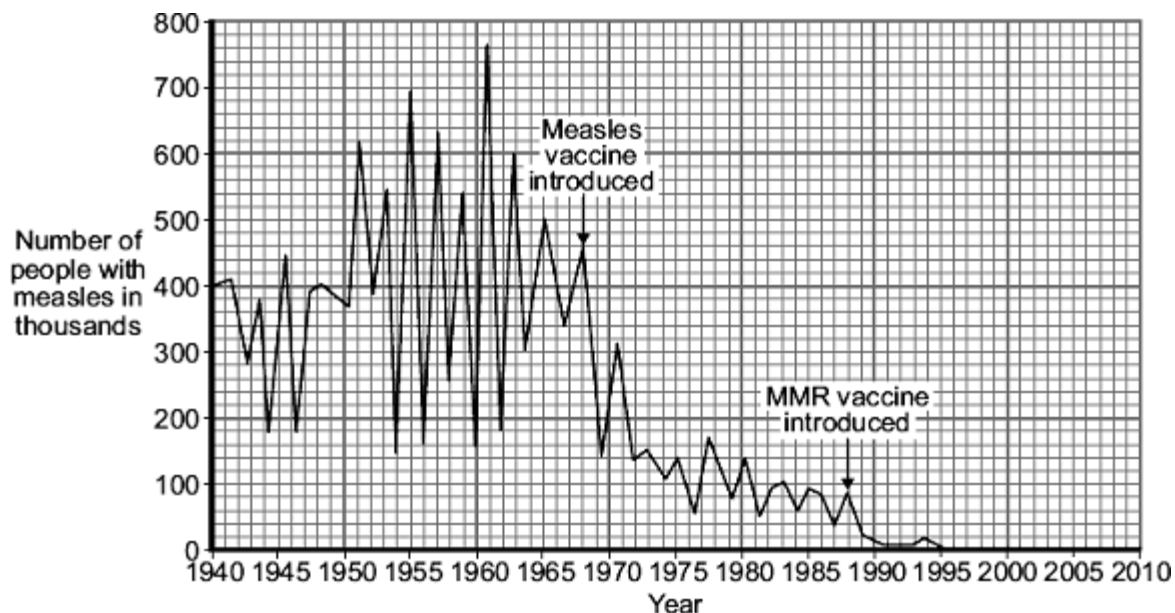
(c) Describe how the protein for blue eye colour is synthesised.

To gain full marks you must use information from the diagram.

(5)
(Total 7 marks)

Q14.

The graph shows the number of people with measles in the UK between 1940 and 2010.



© Health Protection Agency

- (a) Compare how effective introducing the measles vaccine was with introducing the MMR vaccine.

Use data from the graph.

(3)

- (b) The MMR vaccine was introduced in 1988.

Other than measles, which **two** diseases does the MMR vaccine protect against?

1. _____

2. _____

(2)

- (c) To immunise someone against measles, a small quantity of the inactive measles pathogen is injected into the body.

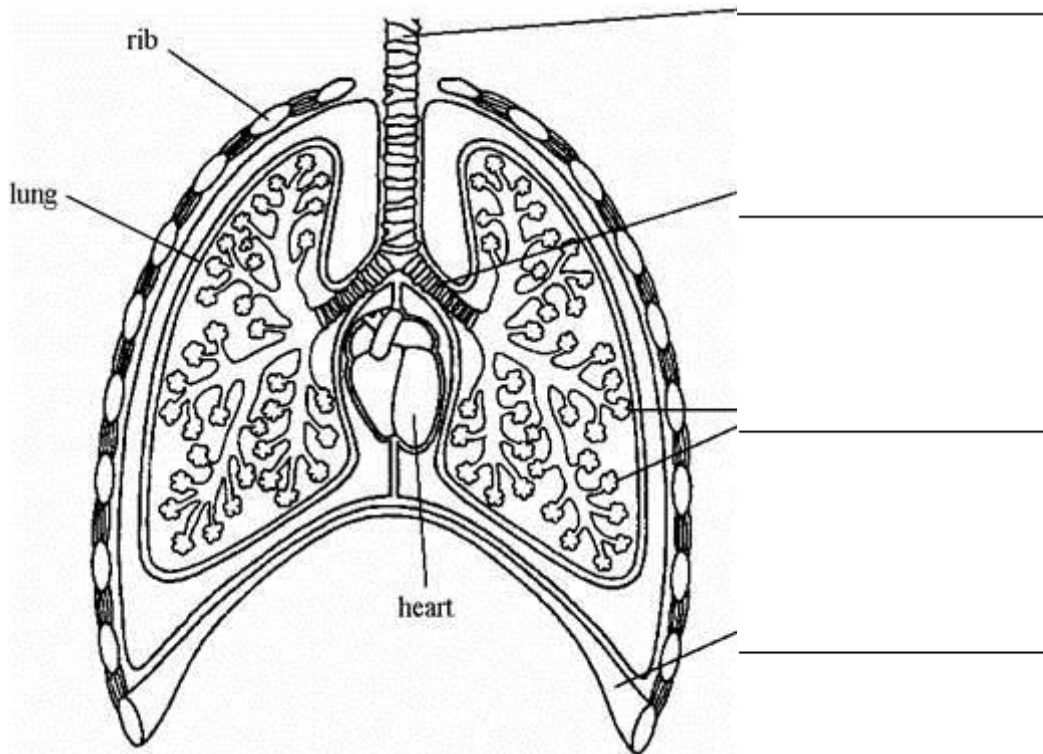
Describe what happens in the body after immunisation to stop a person catching measles in the future.

(3)

(Total 8 marks)

Q15.

The diagram shows part of the breathing system in a human.



- (a) Use words from the list to label the parts on the drawing.

alveoli bronchiole bronchus diaphragm trachea (windpipe)

(4)

(b) Where in the lungs does oxygen enter the blood?

(1)

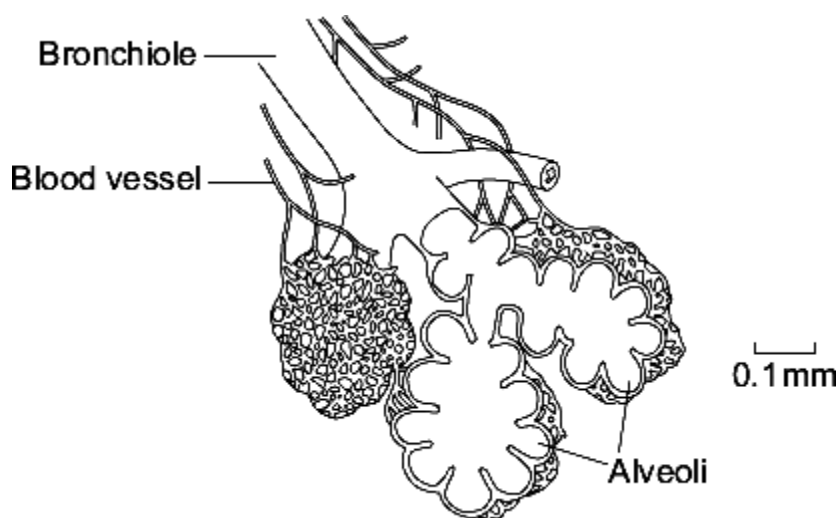
(c) Which process in cells produces carbon dioxide?

(1)

(Total 6 marks)

Q16.

The human lung has about 80 million alveoli.
The diagram shows some alveoli in a human lung.



(a) Give **three** features of the alveoli that allow large amounts of oxygen to enter the blood.

1. _____

2. _____

3. _____

(3)

(b) (i) Name the process by which oxygen passes from the air into the blood.

(1)

(ii) Breathing allows large amounts of oxygen to enter the blood.

Explain how breathing does this.

(2)
(Total 6 marks)

Q17.

The heart is part of the circulatory system.

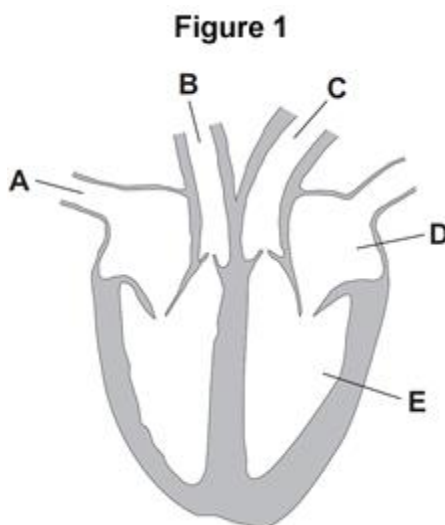
- (a) (i) Name **one** substance transported by the blood in the circulatory system.

(1)

- (ii) What is the main type of tissue in the heart wall?

(1)

- (b) **Figure 1** shows the human heart.



- (i) Which blood vessel, **A**, **B** or **C**, takes blood to the lungs?

(1)

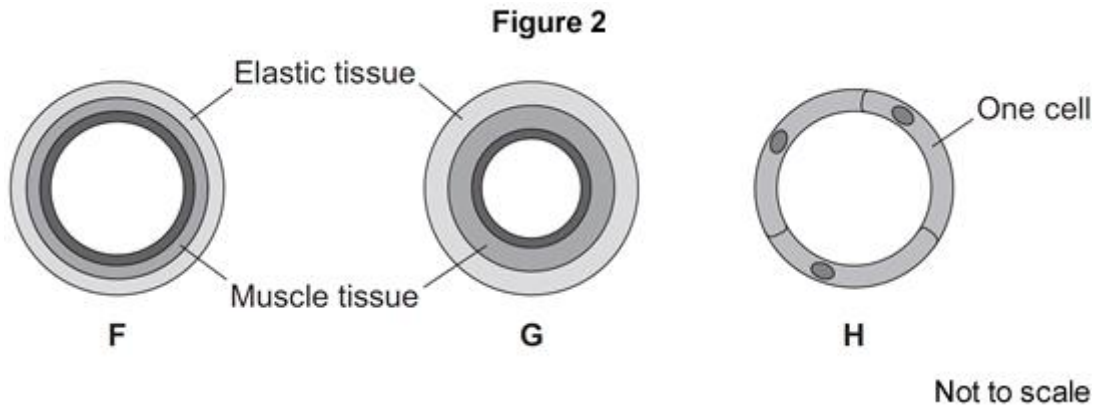
- (ii) Name parts **D** and **E** shown in **Figure 1**.

D _____

E _____

(2)

- (c) **Figure 2** shows three types of blood vessel, **F**, **G** and **H**.



(i) What type of blood vessel is **F**?

Tick (✓) **one** box.

an artery

a capillary

a vein

(1)

(ii) A man needs to have a stent fitted to prevent a heart attack.

In which type of blood vessel would the stent be placed?

Tick (✓) **one** box.

an artery

a capillary

a vein

(1)

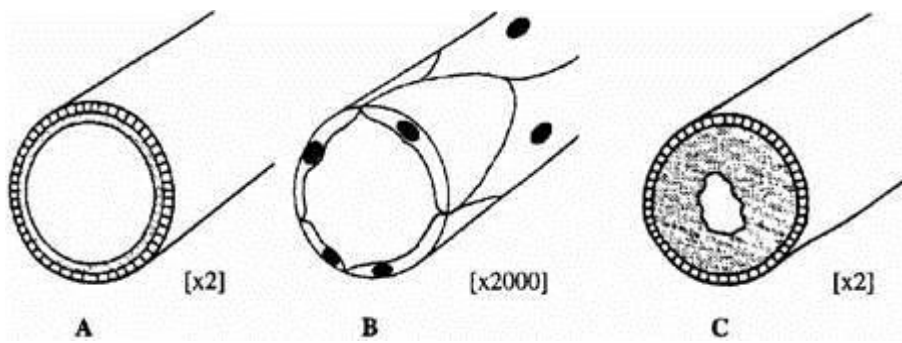
(iii) Explain how a stent helps to prevent a heart attack.

(2)

(Total 9 marks)

Q18.

The drawings show the structure of three types of blood vessel, **A**, **B** and **C**. They are drawn to the scales indicated.



(a) Name the **three** types of blood vessel.

A _____

B _____

C _____

(3)

(b) Describe the job of blood vessel **B**.

(2)

(Total 5 marks)

Q19.

The circulatory system is composed of the blood, blood vessels and the heart.

(a) Urea is transported in the blood plasma.

Name **two** other substances transported in the blood plasma.

1. _____

2. _____

(2)

(b) Some athletes train at high altitude.

Training at high altitude increases the number of red blood cells per cm^3 of blood.

Explain why having more red blood cells per cm^3 of blood is an advantage to an athlete.

(3)

(c) Which **two** blood vessels carry deoxygenated blood?

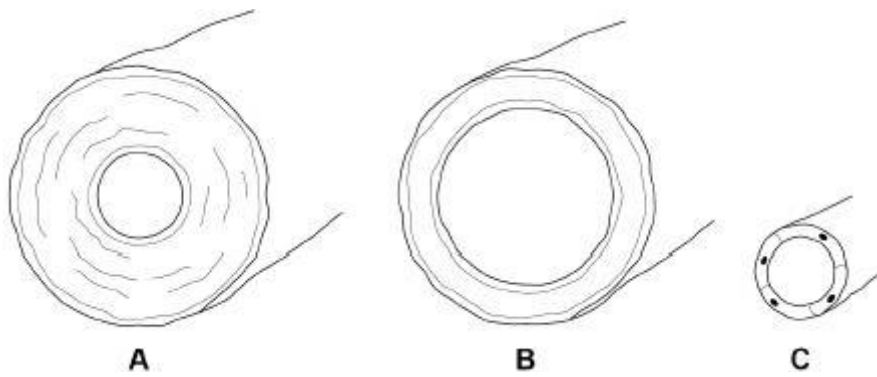
Tick **two** boxes.

- Aorta
- Coronary artery
- Pulmonary artery
- Pulmonary vein
- Vena cava

(2)

Figure 1 shows the three types of blood vessel.

Figure 1



(d) Which type of blood vessel carries blood into the right atrium?

Tick **one** box.

A	B	C
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

(1)

(e) Compare the structure of an artery with the structure of a vein.

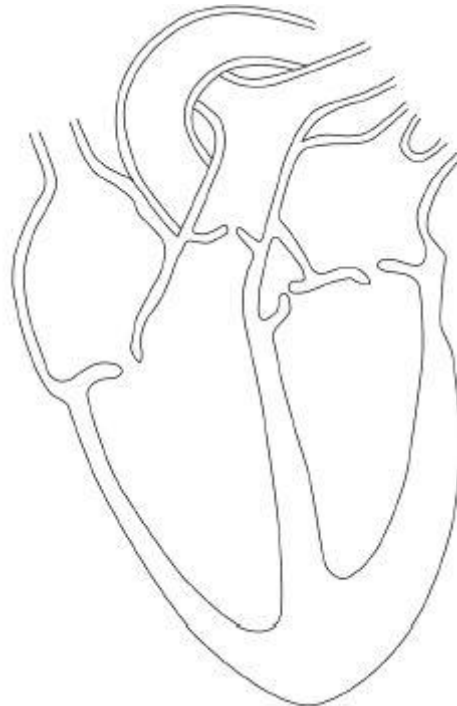
(3)

(f) Heart rate is controlled by a group of cells. This group of cells act as a pacemaker.

Figure 2 shows a section through the heart.

Draw an **X** on **Figure 2** to show the position of the pacemaker.

Figure 2



(1)

(g) A patient may be fitted with an artificial pacemaker.

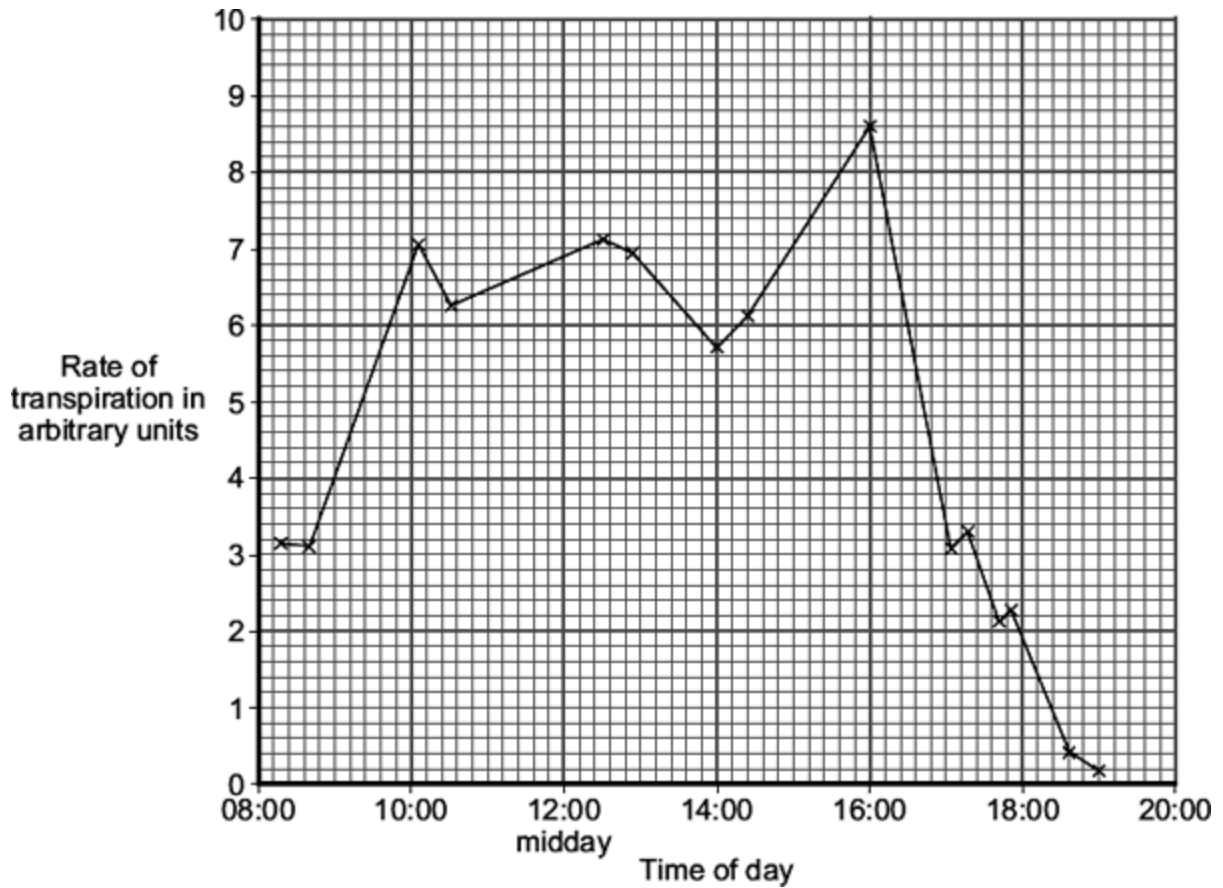
What condition may be treated using an artificial pacemaker?

(1)

(Total 13 marks)

Q20.

The graph shows the rate of transpiration from a plant at different times of the day.



Transpiration occurs mainly in the leaves of a plant.

(a) (i) What is *transpiration*?

(2)

(ii) Through which part of a leaf does most transpiration occur?

(1)

(b) In this investigation, the rate of transpiration decreases between 16:00 hours and 19:00 hours.

(i) Calculate the average rate of decrease per hour in the rate of transpiration over this time.

Show clearly how you work out your answer.

Rate = _____ arbitrary units per hour

(2)

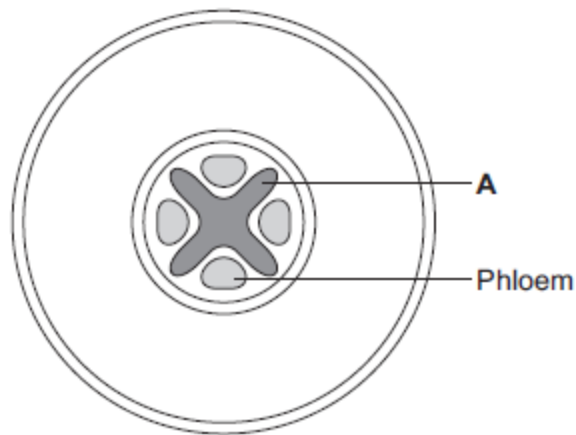
- (ii) Suggest **one** explanation for the decrease in the rate of transpiration between 16:00 hours and 19:00 hours.

(2)

(Total 7 marks)

Q21.

The diagram below shows a cross-section of a plant root. The transport tissues are labelled.



- (a) (i) What is tissue **A**?

Draw a ring around the correct answer.

cuticle **epidermis** **xylem**

(1)

- (ii) Name **two** substances transported by tissue **A**.

1. _____

2. _____

(2)

- (b) Phloem is involved in a process called translocation.

- (i) What is translocation?

(1)

(ii) Explain why translocation is important to plants.

(2)

(c) Plants must use active transport to move some substances from the soil into root hair cells.

(i) Active transport needs energy.

Which part of the cell releases most of this energy?

Tick (✓) **one** box.

mitochondria

nucleus

ribosome

(1)

(ii) Explain why active transport is necessary in root hair cells.

(2)

(Total 9 marks)

Q22.

The leaves of most plants have stomata.

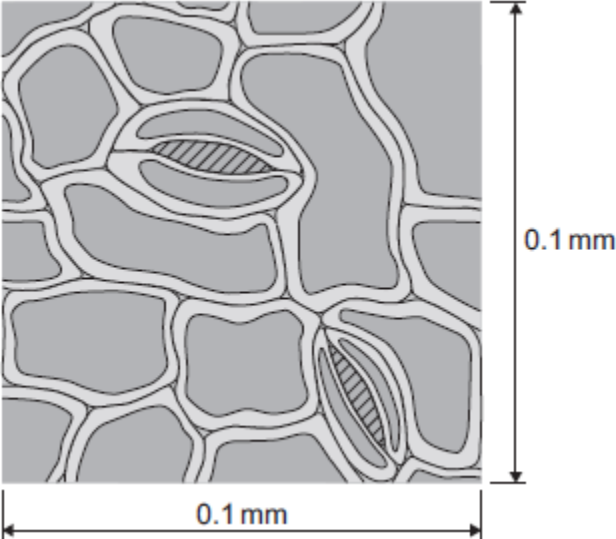
(a) (i) Name the cells which control the size of the stomata.

(1)

(ii) Give **one** function of stomata.

(1)

(b) The image below shows part of the surface of a leaf.



The length and width of this piece of leaf surface are both 0.1 mm.

(i) Calculate the number of stomata per mm² of this leaf surface.

_____ per mm²

(2)

(ii) A different plant species has 400 stomata per mm² of leaf surface.

Having a large number of stomata per mm² of leaf surface can be a disadvantage to a plant.

Give **one** disadvantage.

(1)

(c) A student investigated the loss of water from plant leaves.

The student did the following:

- Step 1: took ten leaves from a plant

- Step 2: weighed all ten leaves
- Step 3: hung the leaves up in a classroom for 4 days
- Step 4: weighed all ten leaves again
- Step 5: calculated the mass of water lost by the leaves
- Step 6: repeated steps 1 to 5 with grease spread on the upper surfaces of the leaves
- Step 7: repeated steps 1 to 5 with grease spread on both the upper and lower surfaces of the leaves.

All the leaves were taken from the same type of plant.

The table below shows the student's results.

Treatment of leaves	Mass of water the leaves lost in g
No grease was used on the leaves	0.98
Grease on upper surfaces of the leaves	0.86
Grease on upper and lower surfaces of the leaves	0.01

- (i) What mass of water was lost in 4 days through the upper surfaces of the leaves?

Mass = _____ g

(1)

- (ii) Very little water was lost when the lower surfaces of the leaves were covered in grease.

Explain why.

(3)

(Total 9 marks)

Q23.

The vole is a small, mouse-like animal. Voles found on some cold islands to the north of Scotland are much larger than voles found in warmer areas such as southern France. Explain how natural selection may have caused the northern voles to be larger in size.

(Total 5 marks)

Q24.

The Blue-moon butterfly lives on a small island called Samoa, in the Pacific Ocean.



By Eموke Dénes [CC-BY-SA-2.5], via Wikimedia Commons

In 2006 Blue-moon butterflies almost became extinct.

Wolbachia bacteria killed males before they could hatch from eggs. Only females were resistant to the bacteria.

In 2006 the number of male Blue-moon butterflies had decreased to only 1 per cent of the population. Two years later, the number of males was equal to the number of females.

- (a) Scientists believe that a change in a gene suddenly occurred to make some males resistant to the bacteria.

What scientific term describes a change in a gene?

(1)

- (b) The numbers of male Blue-moon butterflies in the population increased quickly after the new form of the gene had appeared.

Suggest why.

(4)

(Total 5 marks)

Q25.

Chromosomes carry genetic information.

Chromosomes are found in nearly all human cells.

- (a) How many chromosomes are there in most human body cells?

Tick **one** box.

23

24

46

48

(1)

(b) How many chromosomes are there in a human gamete cell?

(1)

(c) Complete the sentences.

Choose the answers from the box.

sexual reproduction	binary fission	egg	fertilisation	meiosis
mitosis	ovary	sperm	testis	uterus

The female gamete is called the _____.

The male gamete is called the _____.

The female gamete is produced in the _____.

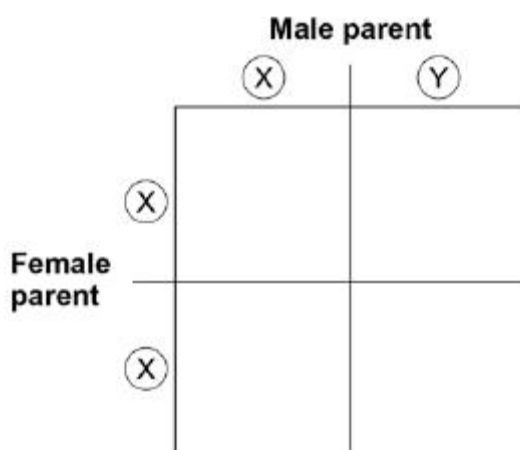
Gametes are produced by a type of cell division
called _____.

Male and female gametes join together in a process
called _____.

(5)

In humans, the sex chromosomes are called **X** and **Y**.

The diagram shows the inheritance of sex chromosomes.

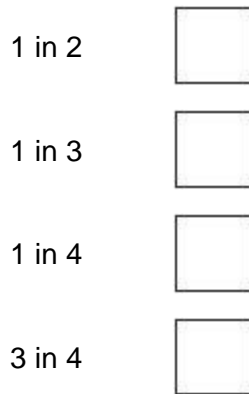


(d) Complete the diagram above to show the sex chromosomes inherited by the offspring.

(2)

(e) What is the chance that a child produced by these parents will be female?

Tick **one** box.



(1)

(f) The parents shown in the diagram above have five children.

Give **two** reasons why these children all look different from each other.

1. _____

2. _____

(2)

(Total 12 marks)

Q26.

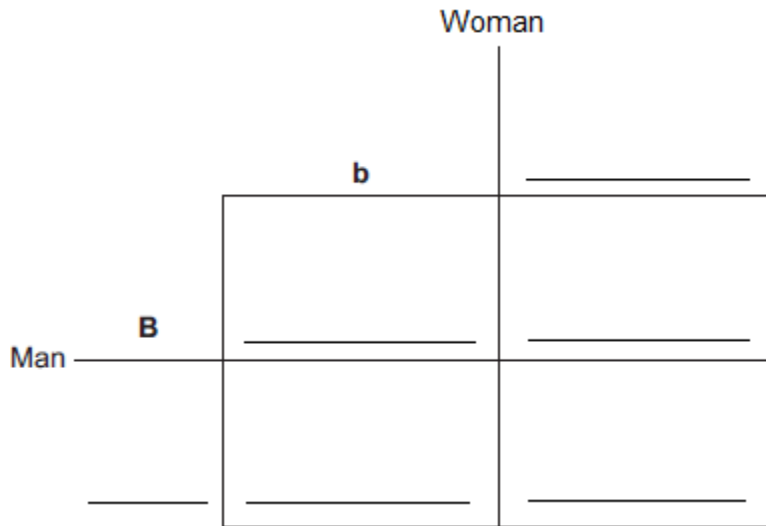
Eye colour is controlled by genes.

The dominant allele of the gene (**B**) produces brown eyes. The recessive allele (**b**) produces blue eyes.

A homozygous blue-eyed woman married a homozygous brown-eyed man.

All of their three children had brown eyes.

(a) (i) Complete the genetic diagram.



(2)

(ii) Give the reason why all of the children had brown eyes.

(1)

(b) The couple's brown-eyed son and his brown-eyed partner had five children. Two of the children had blue eyes and three of the children had brown eyes.

Use a genetic diagram to show how two of their children came to have blue eyes.

(3)

(Total 6 marks)

Q27.

Figure 1 shows an image of a small section of DNA.

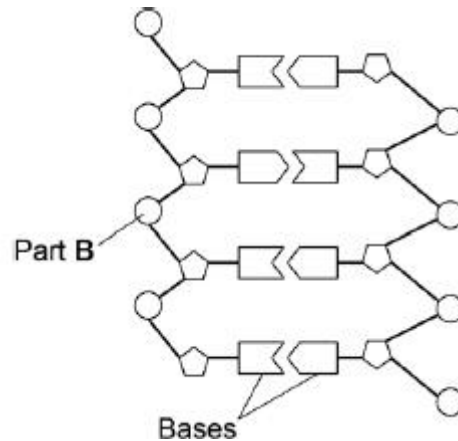
Figure 2 shows the structure of a small section of DNA.

Figure 1



© Svisio/iStock/Thinkstock

Figure 2



(a) What is **Part B**?

(1)

(b) In **Figure 1** the structure of DNA shows four different bases.

There are four different bases and they always pair up in the same pairs.

Which bases pair up together?

(1)

(c) Syndrome H is an inherited condition.

People with syndrome H do **not** produce the enzyme IDUA.

Figure 3 shows part of the gene coding for the enzyme IDUA.

Figure 3



Strand **K** shows a mutation in the DNA which has caused syndrome H.

The enzyme IDUA helps to break down a carbohydrate in the human body.

The enzyme IDUA produced from Strand **K** will not work.

Explain how the mutation could cause the enzyme **not** to work.

(5)

(d) A recessive allele causes syndrome H.
A heterozygous woman and a homozygous recessive man want to have a child.
Draw a Punnett square diagram to determine the probability of the child having syndrome H.
Identify any children with syndrome H.
Use the following symbols:
A = dominant allele
a = recessive allele

Probability = _____ %

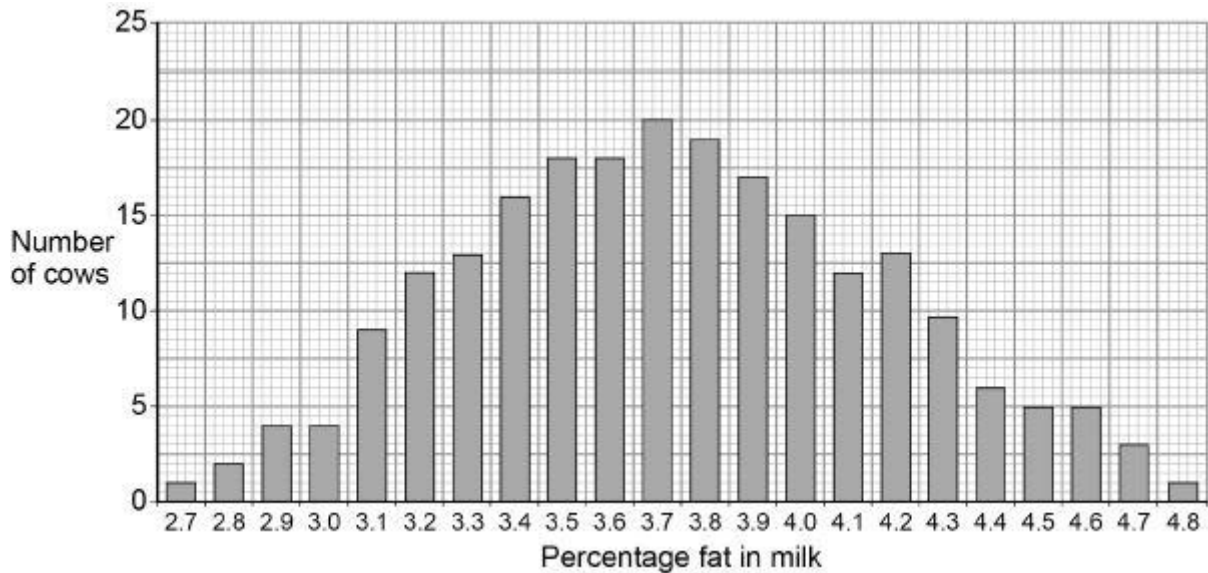
(5)

(Total 12 marks)

Q28.

Scientists want to breed cows that produce milk with a low concentration of fat.
Figure 1 shows information about the milk in one group of cows.
The cows were all the same type.

Figure 1



(a) In **Figure 1** the mean percentage of fat in the milk is equal to the modal value.

Give the mean percentage of fat in the milk of these cows.

Mean percentage = _____

(1)

(b) A student suggested:

‘The percentage of fat in milk is controlled by one dominant allele and one recessive allele.’

How many different phenotypes would this produce?

Tick **one** box.

2	<input type="checkbox"/>
---	--------------------------

3	<input type="checkbox"/>
---	--------------------------

22	<input type="checkbox"/>
----	--------------------------

46	<input type="checkbox"/>
----	--------------------------

(1)

(c) Give the evidence from **Figure 1** which shows the percentage of fat in the milk is controlled by several genes.

(1)

(d) One of the genes codes for an enzyme used in fat metabolism.

A mutation in this gene causes a reduction in milk fat.

The mutation changes one amino acid in the enzyme molecule.

Explain how a change in one amino acid in an enzyme molecule could stop the enzyme working.

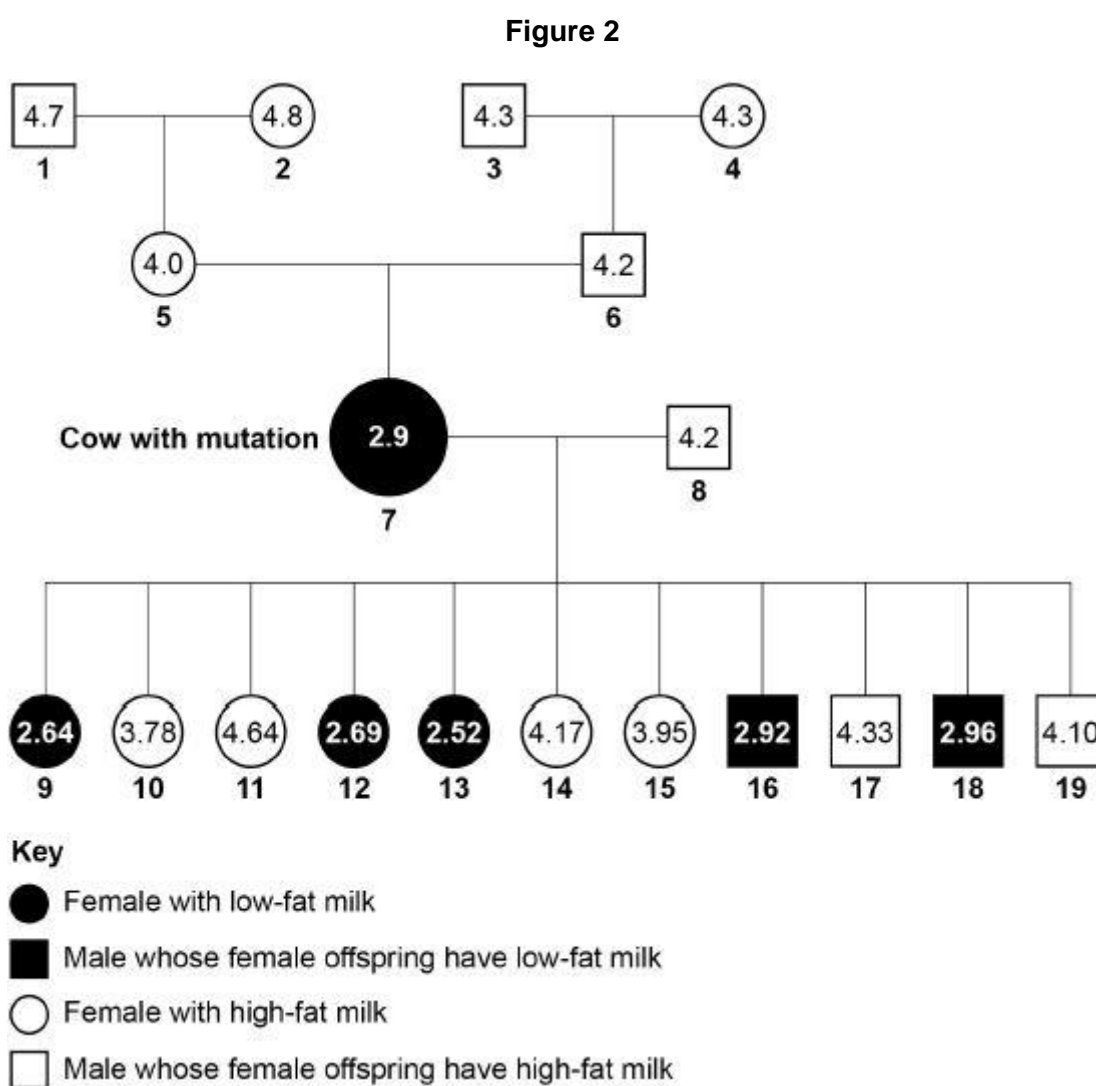
(3)

The scientists found one cow with a mutation.

The cow's milk contained only 2.9% fat.

Figure 2 shows the percentage of fat in the milk of cattle related to the cow with the mutation.

The values for male cattle are the mean values of their female offspring.



(e) Animal 8 is homozygous.

The mutation in animal 7 produced a dominant allele for making low-fat milk.

Give evidence from **Figure 2** that animal 7 is heterozygous.

(1)

(f) Animals **7** and **8** produced 11 offspring. These offspring were produced by in vitro fertilisation (IVF).

The embryos from IVF were transferred into 11 other cows.

Suggest why IVF and embryo transfer were used rather than allowing animals **7** and **8** to mate naturally.

(1)

(g) Draw a Punnett square diagram to show a cross between animals **7** and **8**.

Identify which offspring produce low-fat milk and which offspring produce high-fat milk.

Use the following symbols:

D = dominant allele for making low-fat milk

d = recessive allele for making high-fat milk

(4)

(h) The scientists want to produce a type of cattle that makes large volumes of low-fat milk.

The scientists will selectively breed some of the animals shown in **Figure 2**.

Describe how the scientists would do this.

(4)
(Total 16 marks)

Mark schemes

Q1.

- (a) (A) stomach 1
- (B) small intestine
allow ileum
ignore intestine unqualified 1
- (C) liver 1
- (b) soluble 1
- catalyse 1
- denatured 1
- this order only*
- (c) amino acids 1
- (d) any **one** from:
 • for growth
 allow for enzymes / hormones / antibodies
 • for repair / replacement (of cells / tissues / organs)
 allow to strengthen bones
 ignore for energy 1
- (e) stomach 1
- (f) **Level 2:** Scientifically relevant facts, events or processes are identified and given in detail to form an accurate account. 3-4
- Level 1:** Facts, events or processes are identified and simply stated but their relevance is not clear. 1-2
- No relevant content** 0
- Indicative content**
- grinding up the food
 - add Biuret reagent (allow CuSO_4 and NaOH) to food (sample)
 - protein turns solution (from blue) to purple / lilac
 - wear goggles to protect eyes
 - clean up spills immediately
 - Biuret / NaOH is an irritant / corrosive / poisonous

for **level 2** a reference to Biuret, a positive result and reason for a safety precaution is required

(g) fat

1

(h) type 2 diabetes

1

[15]

Q2.

(b)

	salivary glands	stomach	pancreas	small intestine
amylase	✓	×	✓	✓
lipase	×	×	✓	✓
protease	×	✓	✓	✓

1 mark per correct row

or

if no correct row max 1 mark for any one correct column

2

(c) enzyme / protease / pepsin most effective in acid conditions / low pH

accept optimum / correct pH

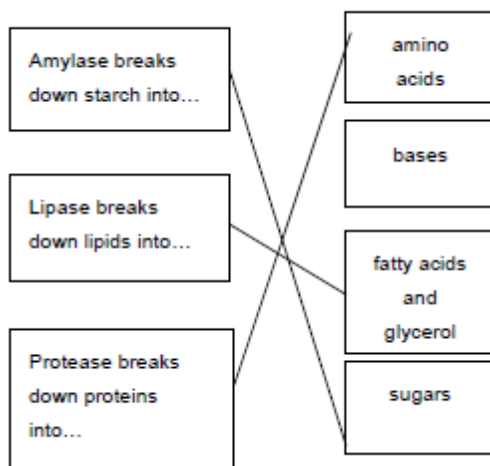
do not accept ref to incorrectly named enzymes

ignore killing bacteria

ignore acid breaks down food

1

(d) **Enzyme** **Breakdown products**



3

[8]

Q3.

- (a) stomach is acidic / has low pH

allow any pH below 7

ignore stomach is not alkaline

1

lactase works best / well in alkali / high pH / neutral / non-acidic conditions

allow any pH of 7 and above

accept works slowly in acid conditions

*allow figures from table with a **comparison***

ignore reference to temperature

1

- (b) any **three** from:

- (below 40(°C)) increase in temperature increases rate / speed of reaction
- reference to molecules moving faster / colliding faster / harder / more collisions
- enzyme optimum / works best at 40°C
allow value(s) in range 36 – 44
ignore body temperature unless qualified
- high temperatures (above 40°C) / 45°C / 50°C enzyme denatured
*allow synonyms for denaturation, but do **not** allow 'killed'*
*denaturation at high and low temperature does **not** gain this mark*
ignore references to time / pH

3

- (c) any **two** from:

- acid neutralised or conditions made neutral / alkali
accept bile is alkaline
- (allow) emulsification / greater surface area (of lipid / fat)
allow description of emulsification eg fat broken down / broken up into droplets
*do **not** accept idea of chemical breakdown*
- lipase / enzymes (in small intestine) work more effectively / better
allow better for enzymes
ignore reference to other named enzymes

2

[7]

Q4.

- (a) **B**

*no mark for "B" alone, the mark is for B **and** the explanation.*

large(r) surface / area **or** large(r) membrane

accept reference to microvilli
ignore villi / hairs / cilia
accept reasonable descriptions of the surface eg folded membrane / surface
do **not** accept wall / cell wall

1

(b) (i) any **one** from:

- (salivary) amylase
- carbohydrase

1

(ii) many ribosomes

do **not** mix routes. If both routes given award marks for the greater.

1

ribosomes produce protein

accept amylase / enzyme / carbohydrase is made of protein

or

(allow)

many mitochondria (1)

mitochondria provide energy to build / make protein (1)

accept ATP instead of energy

1

[4]

Q5.

(a) (yes, because) the mass change (of egg 4) is much lower than the others

allow because it / egg 4 has gained (over) 50% less mass than the others

allow it / egg 4 has gained 1.5 g and the others have all gained more than 3 g (unit required)

1

(b)
$$\frac{75.7 - 72.4}{72.4} \times 100$$

or equivalent

1

4.6 (%)

allow 4.558 / 4.56 (%)
allow any correct rounding of
4.558011049723757

1

an answer of 4.6 / 4.56 / 4.558 scores **2** marks

(c) (mass increased because) water entered by osmosis

1

from a dilute solution in the beaker to a more concentrated solution in the egg (cell)

allow from an area of high water concentration in the beaker to an area of low water concentration in the egg (cell)

allow ref to water potential

allow ref to 'strong' and 'weak' solutions

ignore along / across concentration gradient

*do **not** accept 'amount' in place of concentration*

through a partially permeable membrane

allow semi-permeable / selectively permeable membrane

1

(d) use five (or more) different concentrations of salt / sugar solution (in beakers)

allow any number of concentrations provided it is more than four

1

(by) plotting percentage change (in mass / volume) on / using a graph

1

determine the concentration where the curve / line crosses the zero percentage change (in mass / volume)

1

(e) (ions are moved) from an area of low concentration to high concentration

allow against the concentration gradient

allow in terms of solution

*do **not** accept molecules*

1

(by) active transport

1

(which) requires using energy

*do **not** accept idea of energy being created*

1

[12]

Q6.

(a) (i) nucleus

1

(ii) diffusion

1

(b) increases / larger surface area (for diffusion)

ignore large surface area to volume ratio

1

(c) (i) sugar / glucose

accept amino acids / other named monosaccharides

1

- (ii) against a concentration gradient
or
 from low to high concentration 1
- (iii) (active transport requires) energy 1
- (from) respiration 1
- (d) minerals / ions
accept named ion ignore nutrients
do not accept water 1
- [8]**

Q7.

- (a) (i) makes / produces / synthesises protein / enzyme 1
- (ii) plant cell has nucleus / vacuole / chloroplasts / chlorophyll
or plant cell is much larger
'It' = plant cell
allow correct reference to DNA or chromosomes
allow plant cell has fewer ribosomes
allow cellulose (cell wall) 1
- (b) (i) 200
correct answer with or without working gains 2 marks

$$\frac{2 \times 50,000}{500}$$
if answer incorrect, allow 1 mark for $\frac{100,000}{500}$ **or**
or 100 2
- (ii) bacterial cell is too small / bacterial cell about same size as a mitochondrion / 'no room'
ignore references to respiration 1
- [5]**

Q8.

- (a) movement of water [1]
 from high concentration (of water) to low concentration (of water)
or
 from (an area of) dilute solution to an area of concentrated solution [1]
 through a differentially **or** partially **or** selectively **or** semi permeable membrane [1]

- (b) (i) it will rise 1
- (ii) water enters visking tubing [1]
- because the concentration of water outside is greater than the concentration inside
- or**
- because the concentration of salt **or** solute is greater inside the tubing than outside [1]
- or**
- to equalise concentration water has to enter visking tubing [2] 2

[6]

Q9.

Marks awarded for this answer will be determined by the Quality of Written Communication (QWC) as well as the standard of the scientific response. Examiners should also apply a 'best-fit' approach to the marking.

0 marks

No relevant content.

Level 1 (1 – 2 marks)

An example is given of a named substance

or

a process

or

there is an idea of why diffusion is important eg definition.

Level 2 (3 – 4 marks)

At least one example of a substance is given

and

correctly linked to a process in either animals or plants.

Level 3 (5 – 6 marks)

There is a description of a process occurring in either animals or plants that is correctly linked to a substance

and

a process occurring in the other type of organism that is correctly linked to a substance.

examples of points made in the response**Importance of diffusion:**

- to take in substances for use in cell processes
- products from cell processes removed

Examples of processes and substances:

- for gas exchange / respiration: O₂ in / CO₂ out
- for gas exchange / photosynthesis: CO₂ in / O₂ out
- food molecules absorbed: glucose, amino acids, etc
- water absorption in the large intestine

- water lost from leaves / transpiration
- water absorption by roots
- mineral ions absorbed by roots

extra information

Description of processes might include:

- movement of particles / molecules / ions through a partially permeable membrane
- (movement of substance) down a concentration gradient
- osmosis: turgor / support / stomatal movements

[6]

Q10.

- (a) C 1
- (b) cytoplasm **and** cell membrane dividing
accept cytokinesis for 1 mark 1
- to form two identical daughter cells 1
- (c) stage 4 1
- only one cell seen in this stage 1
- (d) $(4 / 36) \times 16 \times 60$ 1
- 107 / 106.7 1
- 110 (minutes)
allow 110 (minutes) with no working shown for 3 marks 1
- (e) binary fission
do **not** accept mitosis 1
- (f) shortage of nutrients / oxygen 1
- so cells die
or
death rate = rate of cell division 1

[11]

Q11.

one mark for each of the following comparisons to a maximum of **6**

candidates **must** make a clear comparison

meiosis	mitosis
sexual	asexual
gametes	growth
ovary or testes or gonads	all other cells
half number of chromosomes	same number of chromosomes
haploid or 23 chromosomes	diploid or 46 chromosomes
reassortment or variation possible or not identical	no reassortment or no variation or identical
4 cells produced	2 cells produced
2 divisions	1 division

[6]

Q12.

- (a) gene / allele 1
- (b) (in / on) ribosome(s) 1
- (c) any **three** from:
- amino acids make up a protein
 - (protein is) particular combination / sequence (of amino acids)
 - bases form a code
 - the bases work in threes or description
accept bases work in triplet
 - (code / three bases) for one amino acid
accept eg (bases) WXZ for amino acid J for 2 marks
- 3
- (d) (i) different / wrong amino acid (coded for) **or** different / wrong shape
ignore reference to amino acid 'made'
ignore change unqualified
ignore different protein 1
- (ii) different / example of different eye colour
allow protein may / would not be made / function (normally)

1

[7]

Q13.

- (a) use antibiotics; or named one to kill bacteria; (not microbes)
each for 1 mark

2

- (b) some ingest/digest bacteria (not microbes) OWTTE
some produce antibodies;
which destroy bacteria/viruses;
some produce antitoxins;
which counteract poisons released by bacteria
each for 1 mark

5

[7]

Q14.

- (a) both lead to reduction / fall (in measles cases)
can be implied

1

measles vaccine caused a big drop **or** correct use of figures

1

MMR wipes out measles **or** drops to (almost) zero **or** doesn't fall as much as measles vaccine **or** correct use of figures.

1

- (b) mump(s)

1

rubella / german measles

either order

allow phonetic spelling

1

- (c) white blood cells
allow lymphocytes / leucocytes
ignore memory cells

1

(wbc) produce antibodies

ignore antitoxins / antigens / antibiotics / engulfing

1

in future / if re-infected antibody production rapid / fast(er) / quick(er)

allow ecf from antitoxins / antigens / antibiotics

ignore engulfing

ignore reference to specificity

1

[8]

Q15.

- (a) trachea / windpipe
bronchus
alveoli
diaphragm

for 1 mark each

4

- (b) alveoli / air sacs (*reject capillaries*)

for one mark

1

- (c) respiration

for one mark

1

[6]

Q16.

- (a) large surface / large area

1

thin / short distance (from air to blood) / one cell thick / two cells thick

1

good blood supply / many capillaries / capillary network / many blood vessels

ignore moist surface

1

- (b) (i) diffusion

ignore gaseous exchange

1

- (ii) brings (more) oxygen / air into the lungs / alveoli

1

keeps O₂ level high in alveoli

or

maintains concentration difference (between alveoli and blood) / keeps O₂ concentration in alveoli > O₂ concentration in blood gains **2** marks

1

[6]

Q17.

- (a) (i) any **one** from:

- glucose
- oxygen
- carbon dioxide
- urea
- water

allow hormones

allow named example of a product of digestion

1

- (ii) (cardiac) muscle
allow muscular 1
- (b) (i) **B** 1
- (ii) **D** atrium / atria
ignore references to left or right 1
- E** ventricle(s)
ignore references to left or right 1
- (c) (i) a vein 1
- (ii) an artery 1
- (iii) keeps artery open / wider
allow ecf from part cii 1
- (so) blood / oxygen can pass through (to the heart muscle) 1

[9]

Q18.

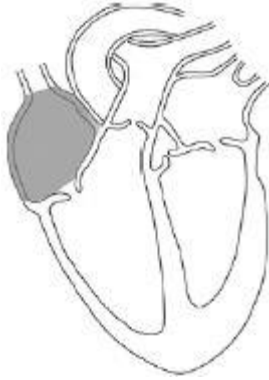
- (a) A vein / venule
B capillary
C artery / arteriole
each for 1 mark 3
- (b) *idea that* substances or named substance pass in or out / diffuses between blood and tissue
each for 1 mark
e.g. oxygen passes from blood to cells gains 2 marks 2

[5]

Q19.

- (a) any **two** from:
allow proteins / hormones / antibodies / vitamins / minerals / ions / fatty acids / glycerol
- carbon dioxide
 - water
 - glucose
 - amino acids
- ignore sugar / enzymes / nutrients / waste*
- lactic acid 2

- (b) more haemoglobin
max 2 marks if 'more' is not given 1
- (therefore) more oxygen can be carried / transported 1
- (for) more (aerobic) respiration of muscle (cells)
or
 more energy released for muscle (cells)
*allow less anaerobic respiration / lactic acid /
 oxygen debt / fatigue in muscle (cells)
 i.e. addition of 'debt'
 do **not** accept energy produced* 1
- (c) pulmonary artery 1
- vena cava 1
- (d) B 1
- (e) any **three** from:
- arteries have a **thicker** layer of muscle (tissue) **or** veins have a thinner layer of muscle (tissue)*
 - arteries have a **thicker** layer of elastic tissue **or** veins have a thinner layer of elastic tissue*
if neither marking points 1 or 2 awarded, allow arteries have a thick wall **and veins have a thin wall
or
 arteries have a **thicker** wall or veins have a **thinner** wall for 1 mark
 do **not** accept 'cell wall'*
 - arteries have a narrower lumen **or** veins have a wider lumen
allow descriptions of 'lumen'
 - arteries do not have valves **and** veins have valves
*allow **only** veins have valves*
- 3
- (f) allow an X drawn anywhere in grey shaded area below:



if a large X is drawn, award the mark if the intersection touches the grey area
 if a label line is used, award marks if the end of the label line touches the grey area
 allow label 'pacemaker'
 ignore label 'right atrium'

1

- (g) an irregular heart beat
- allow arrhythmia
 allow fibrillation
 ignore heart failure
 do **not** accept cardiovascular disease / heart murmur

1

[13]

Q20.

- (a) (i) water loss
- extra substance(s) cancel
 if transpiration stream described max 1 mark

1

as a vapour / by evaporation
 ignore stomata

1

- (ii) stomata / stoma / guard cells
- ignore epidermis

1

- (b) (i) 2.8
- correct answer with or without working gains 2 marks
 if answer incorrect:
 allow 1 mark for $(8.6 - 0.2) \div 3$ or $8.4 \div 3$

2

- (ii) warmer at 16:00 / gets cooler
- or reverse argument for 19.00

1

faster diffusion / evaporation

accept sun setting as equivalent to heat or light marking points

or

lighter at 16:00 / gets darker (1)

if no environmental factor still allow reason mark

stomata open / more open (1)

eg 'stomata close later in the day'

or

(more) windy at 16:00 / gets less windy (1)

removal of (more) water vapour / steeper gradient (1)

or

air is less humid at 16.00 (1)

allow rain at 19.00

faster diffusion or steeper gradient (1)

1

[7]

Q21.

(a) (i) xylem

1

(ii) water

1

minerals / ions / named example(s)

ignore nutrients

1

(b) (i) movement of (dissolved) sugar

allow additional substances, eg amino acids / correct named sugar (allow sucrose / glucose)

allow nutrients / substances / food molecules if sufficiently qualified

ignore food alone

1

(ii) sugars are made in the leaves

1

so they need to be moved to other parts of the plant for respiration / growth / storage

1

(c) (i) mitochondria

1

(ii) for movement of minerals / ions

Do not accept 'water'

1

against their concentration gradient

1

[9]

Q22.

(a) (i) guard (cells)

allow phonetic spelling

1

(ii) any **one** from:

ignore reference to cells

- allow carbon dioxide to enter
allow control loss / evaporation of water or control transpiration rate
- allow oxygen to leave.
allow 'gaseous exchange'

1

(b) (i) 200

*correct answer gains 2 marks with or without working
allow 1 mark for $0.1 \times 0.1 = 0.01$ (mm²)*

2

(ii) more / a lot of / increased water loss

allow plant more likely to wilt (in hot / dry conditions)

1

(c) (i) 0.12

1

(ii) the lower surface has most stomata

1

stomata are now covered / blocked (by grease)

1

so water cannot escape / evaporate from the stomata

ignore waterproof

to gain credit stomata must be mentioned at least once

1

[9]

Q23.

any **five** from:

- genetic variation exists in a population **or**
variation caused by mutation / change in gene / in DNA

- larger voles have smaller $\frac{\text{S.A.}}{\text{Vol.}}$

or have more fat

'they' accept as larger voles

- larger voles lose less heat / are better insulated or more energy stored
- larger voles survive
- larger voles breed
- larger voles pass on (beneficial) gene / allele / mutation / DNA
ignore characteristic

[5]

Q24.

(a) mutation

correct spelling only

ignore other adjectives eg random / spontaneous

1

(b)

ignore references to X / Y chromosomes

idea of mutant gene / new form / this allows hatching (of males)

1

(individual with advantage) (more) survive / (more) live / (more) don't die

allow immunity rather than resistance throughout

1

(so survivors) breed / reproduce

1

mutation / gene passed (from survivors) to offspring / next generation

allow resistance / characteristic for gene

'gene passed on' is insufficient

1

[5]

Q25.

(a) 46

1

(b) 23

allow ecf from 2.1 – ie half of answer given in 2.1

1

(c) egg

1

sperm

1

ovary

1

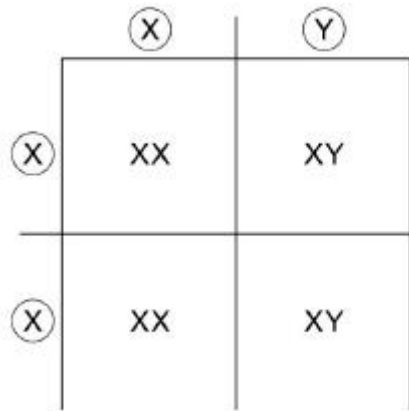
meiosis

1

fertilisation

1

*correct order only
correct spelling only*



(d)

*all 4 correct = 2 marks
2 or 3 correct = 1 mark
0 or 1 correct = 0 marks
ignore correct / incorrect identification of male and female offspring*

2

(e) 1 in 2

1

(f) any **two** from:

- multiple genes determine appearance
allow several / many genes determine appearance
- different combinations of alleles
allow description of combinations of alleles' allow genes for alleles
- different environmental effects
allow example e.g. eat different diets
- from different egg / sperm

2

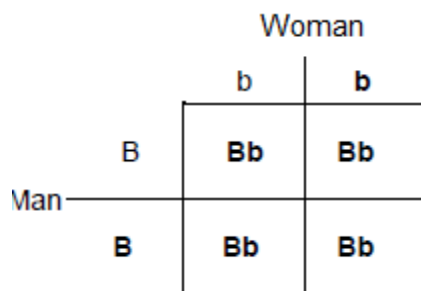
[12]

Q26.

(a) (i) correct parental genotypes (man BB and woman bb)

1

all offspring Bb



ignore 'brown' or 'brown eyes' on diagram

1

(ii) they have one B / dominant allele / heterozygous

or

B / brown allele / dominant allele is expressed even if only on one chromosome

1

(b) correct parental genotypes (both Bb)
can be shown in a diagram
can be shown as gametes

1

correct derivation of offspring genotypes from gametes
allow correct derivation from wrong gametes

1

bb identified as blue-eyed

1

[6]

Q27.

(a) phosphate

allow PO₄³⁻

1

do not allow P

(b) A / adenine and T / thymine

and

C / cytosine and G / guanine

do not allow U / uracil

1

(c) (mutation) changes from C to T DNA code

or

there is a change in the three bases / triplet from CAG to TAG

1

(mutation) changes the amino acid

1

(this could) change the protein

1

(so it) forms a different shape / changed active site

<i>accept different tertiary structure</i>	1
(therefore) the enzyme no longer fits the substrate / carbohydrate	1
(d) mother / woman's gametes correct: A a	1
father / man's gametes correct: a a	1
correct derivation of offspring <i>ecf</i>	1
identification of child with syndrome H or genotype aa	1
0.5 <i>ecf</i> <i>allow 50% / 1 / 2 / 1 in 2 / 1:1</i> <i>do not accept 1:2</i>	1
	[12]

Q28.

(a) 3.7	1
(b) 2	1
(c) (different combinations of alleles cause) many / 22 values <i>allow continuous variation</i> or in-between values or large range of values or there are not only two values <i>allow there are not only 3 values if 3 is given in part (b)</i>	1
(d) different protein made <i>allow change in shape (of enzyme) or change in 3-D structure</i> <i>ignore denature</i>	1
<u>active site</u> changed	1
so substrate does not fit / bind <i>allow description of substrate</i>	

*allow cannot form E-S complex
ignore lock and key description*

1

- (e) produces (some) offspring with high-fat milk
or
not all offspring have low-fat milk

ignore reference to alleles

1

- (f) takes less time (to obtain results)
or
more offspring at the same time

*allow other sensible suggestion – e.g. allows screening **or** allow cow 7 to continue to produce eggs **or** avoid injury to cow 7 during mating or giving birth*

1

- (g) male gametes correct: d (and d)

1

female gametes correct: D and d

1

allow 1 mark if gametes are correct but gender not identified

correct derivation of offspring genotypes from given gametes

*allow 2 × 2 **or** 2 × 1 derivation*

1

Dd identified as low-fat **and** dd identified as high-fat in offspring
if DD offspring are produced, must also identify as low-fat

1

- (h) find female with low(est) fat in milk **and** high(est) milk yield
allow choose from 7, 9, 12, 13 which has the highest yield

1

find male whose female offspring have high(est) milk yield **and** low(est) fat in milk

allow choose from 16 or 18 whose female offspring has the highest yield

1

or

find female with lowest fat in milk
or cow 13 (1)*

****or**
allow female with high(est) milk yield*

find male whose female offspring have high(est) milk yield (1)*

****or**
allow male whose female offspring have lowest*

fat in milk / male 16

cross the best (for both features) female with the best male

1

select best offspring (for both features) from each generation and repeat for several generations

1

[16]