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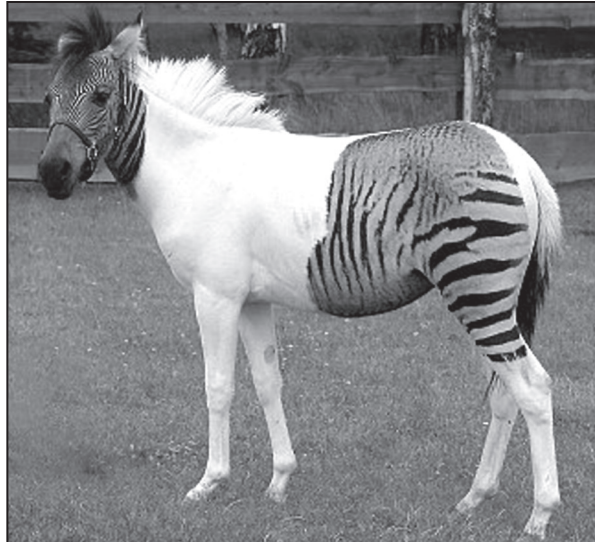
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Answer **all** questions in the spaces provided.

1 The photograph shows a zorse.



A zorse is a cross between a male zebra and a female horse.
The zorse has characteristics of both parents.

1 (a) The zorse was produced by *sexual reproduction*.

1 (a) (i) What is *sexual reproduction*?

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(1 mark)

1 (a) (ii) The zorse has characteristics of a zebra and a horse.

Why?

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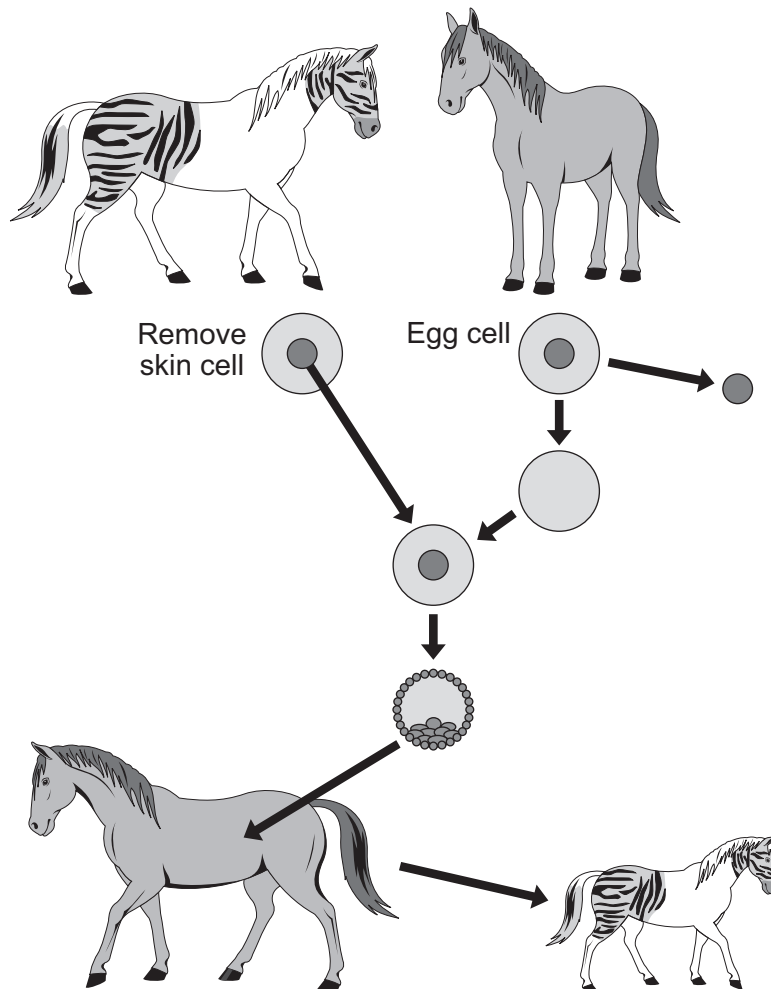
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Question 1 continues on the next page

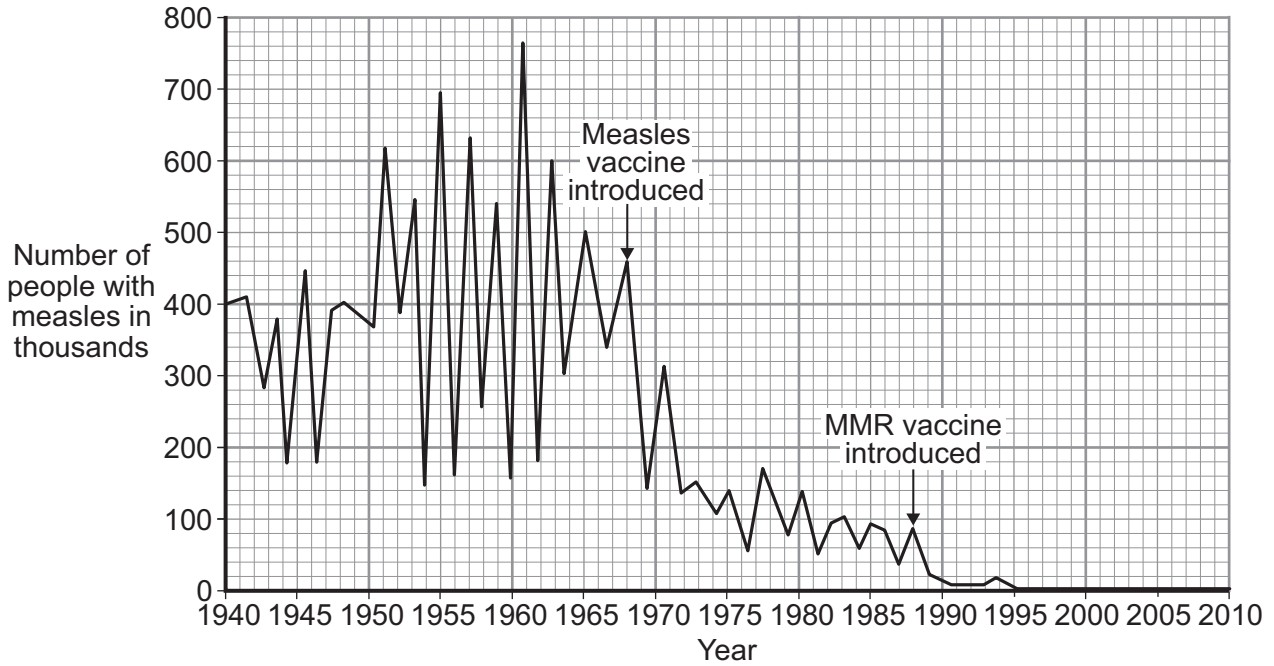
Turn over ►

- 1 (b) Zorses are **not** able to breed.
Scientists could produce more zorses from this zorse by adult cell cloning.

The diagram shows how the scientists might clone a zorse.



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



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

Use data from the graph.

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(3 marks)

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

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

1 2
(2 marks)

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.

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(3 marks)

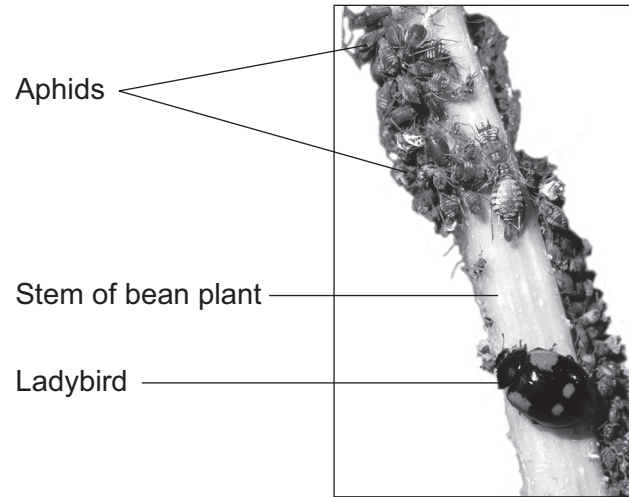
8

Turn over for the next question

Turn over ►

3 Students investigated a food chain in a garden.

The students found 650 aphids feeding on one bean plant.
Five ladybirds were feeding on the aphids.



3 (a) (i) Draw a pyramid of biomass for this food chain.
Label the pyramid.

(2 marks)

3 (a) (ii) The biomass in the five ladybirds is less than the biomass in the bean plant.

Give **two** reasons why.

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(2 marks)

3 (b) The carbon in dead bean plants is returned to the atmosphere via the carbon cycle.

Describe this part of the carbon cycle.

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(4 marks)

8

Turn over for the next question

Turn over ►

4 The human body produces many hormones.

4 (a) (i) What is a *hormone*?

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(1 mark)

4 (a) (ii) Name an organ that produces a hormone.

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(1 mark)

4 (a) (iii) How are hormones transported to their target organs?

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(1 mark)

4 (b) Describe how the hormones FSH, oestrogen and LH are involved in the control of the menstrual cycle.

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(3 marks)

6

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



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.

5 (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?

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(1 mark)

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

Suggest why.

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(4 marks)

5

Turn over ►

6 Drugs must be trialled before the drugs can be used on patients.

6 (a) (i) Before the clinical trials, drugs are tested in the laboratory.
The laboratory trials are **not** trials on people.

What is the drug tested on in these laboratory trials?

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(1 mark)

6 (a) (ii) Drugs must be trialled before the drugs can be used on patients.

Give **three** reasons why.

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(3 marks)

6 (b) Read the information about cholesterol and ways of treating high cholesterol levels.

Diet and inherited factors affect the level of cholesterol in a person's blood.
Too much cholesterol may cause deposits of fat to build up in blood vessels and reduce the flow of blood. This may cause the person to have a heart attack.
Some drugs can lower the amount of cholesterol in the blood.

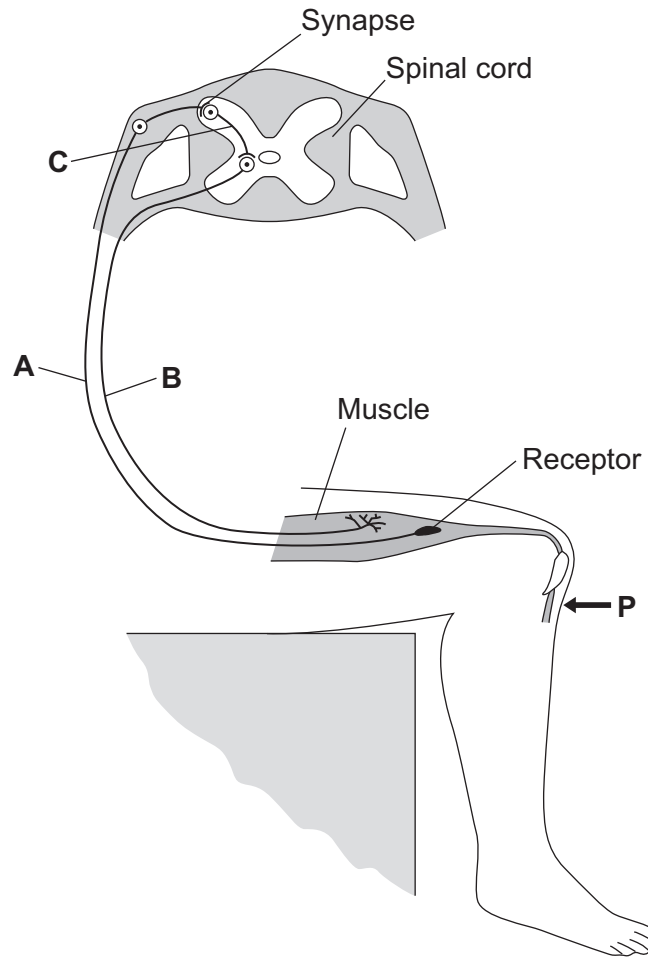
The body needs cholesterol. Cells use cholesterol to make new cell membranes and some hormones. The liver makes cholesterol for the body.

Some drugs can help people with high cholesterol levels.

Statins block the enzyme in the liver that is used to produce cholesterol.
People will normally have to take statins for the rest of their lives. Statins can lead to muscle damage and kidney problems. Using some statins for a long time has caused high numbers of deaths.

Cholesterol blockers reduce the absorption of cholesterol from the intestine into the blood.
Cholesterol blockers can sometimes cause problems if the person is using other drugs.

7 The diagram shows the nervous pathway used to coordinate the knee-jerk reflex. When the person is hit at point **P**, the lower leg is suddenly raised.



7 (a) Name neurones **A**, **B** and **C**.

A

B

C

(3 marks)

7 (b) The receptor in the muscle in the leg is sensitive to a stimulus.

Suggest the stimulus.

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(1 mark)

7 (c) Describe what happens at the synapse during this reflex.

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(3 marks)

7

Turn over for the next question

Turn over ►

8 Squirrels live in woodland.

Table 1 shows:

- the total area of England, Scotland and Wales
- the area of different types of woodland in these countries.

Table 1

Country	Total area of country in thousands of km ²	Area of woodland in thousands of km ²		
		Coniferous woodland	Broadleaf woodland	Total
England	130	3.6	7.8	11.4
Scotland	79	10.4	3.0	13.4
Wales	21	1.9	0.9	2.8

8 (a) Look at the data for the three countries. Estimate which country has the greatest proportion of its area suitable as a habitat for squirrels.

Support your answer with relevant figures.

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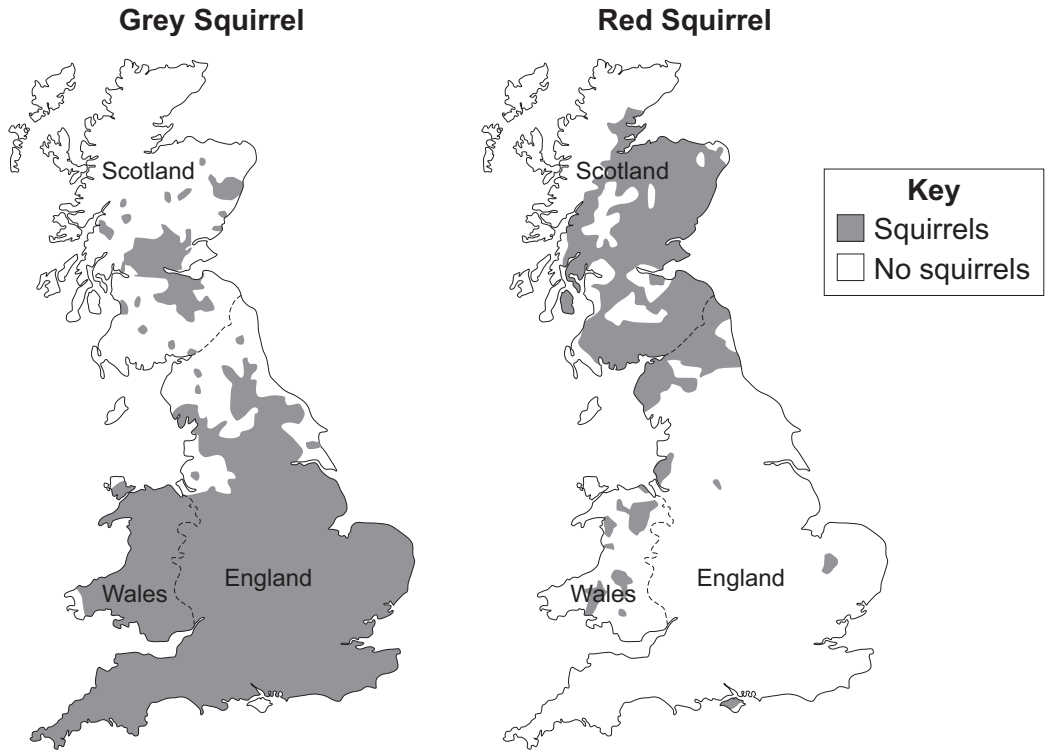
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(2 marks)

8 (b) The maps show the distribution of grey squirrels and red squirrels in England, Scotland and Wales.



Scientists suggested that the distribution of grey squirrels and red squirrels is linked to the type of trees in woodlands.

8 (b) (i) The information for England and Scotland supports this suggestion.

How?

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(1 mark)

8 (b) (ii) Give **one** piece of evidence that contradicts this suggestion.

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(1 mark)

Question 8 continues on the next page

Turn over ►

8 (c) Red squirrels are native to the UK.
Grey squirrels were introduced to the UK from the USA over 100 years ago.

Table 2 gives information about the two types of squirrel.

Table 2

	Grey squirrel	Red squirrel
Population in UK	2.5 million	140 000
Main food types	Seeds, nuts, tree bark, birds' eggs, young birds	Cones from coniferous trees, nuts, tree bark, berries
Health	Can become immune to parapox virus	Cannot become immune to parapox virus
Reproduction	Up to 9 young, twice a year	Up to 6 young, twice a year
Survival rate of young in mixed populations	41%	14%
Length of life	2 – 4 years	Up to 7 years

In most parts of the UK the population of grey squirrels is increasing, but the population of red squirrels is decreasing.

Suggest why.

Use information from **Table 2**.

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(3 marks)

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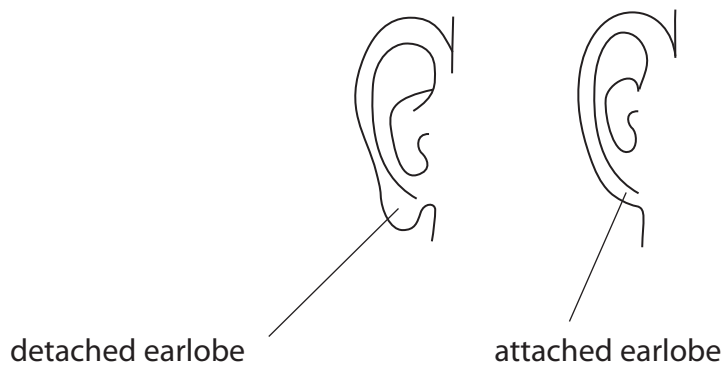
END OF QUESTIONS

Answer ALL questions.

Some questions must be answered with a cross in a box ☒. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.

Inheritance

- 1 (a) The earlobes of an individual are detached or attached. This is determined by the alleles inherited from their parents.



An individual with attached earlobes must have inherited two recessive alleles from each of their parents and will have the genotype **ee**.

- (i) State the genetic term used to describe an individual with the genotype **ee** for attached earlobes.

(1)

- (ii) A female with the genotype **ee** has attached earlobes and a male with the genotype **Ee** has detached earlobes.

Complete the Punnett square to show the gametes and genotypes of the offspring for this female and male.

(2)

	female gametes	
male gametes		

- (iii) State the probability of the offspring having detached earlobes.

(1)

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- (iv) What is the percentage probability of a homozygous dominant mother and homozygous recessive father producing a child with attached earlobes?

Put a cross (☒) in the box next to your answer.

(1)

- A** 0%
- B** 25%
- C** 75%
- D** 100%

(b) Cystic fibrosis is a genetic disorder that is caused by the inheritance of two recessive alleles.

Describe the symptoms of cystic fibrosis.

(3)

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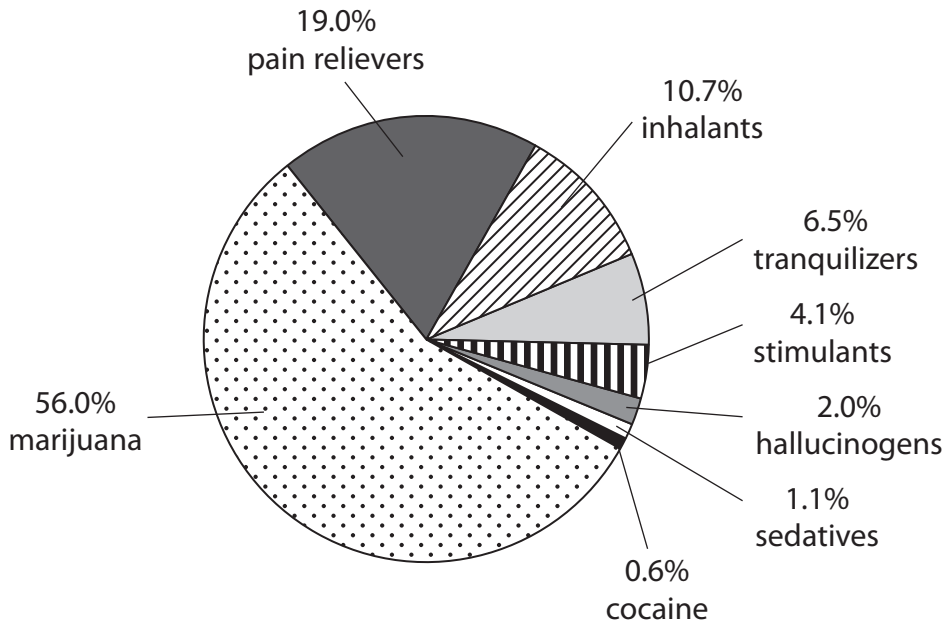
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(Total for Question 1 = 8 marks)

Drugs

2 In the USA, 2.7 million people admitted using illegal drugs.

The pie chart shows the percentage of these people using different illegal drugs.



(a) (i) Calculate the number of people who admitted using marijuana illegally. (2)

answer = million people

(ii) Suggest **one** reason why the information in the pie chart may not be reliable. (1)

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(b) Marijuana is often smoked with tobacco.

Suggest why combining tobacco with marijuana makes it more difficult to give up smoking marijuana.

(2)

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(c) (i) Which of these drugs is a stimulant?

Put a cross (☒) in the box next to your answer.

(1)

- A alcohol
- B caffeine
- C LSD
- D morphine

(ii) Explain how stimulants affect reaction times.

(2)

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(Total for Question 2 = 8 marks)

Blood glucose

3 Humans regulate the glucose concentration of their blood.

A scientist recorded the blood glucose concentration of an individual over a seven-hour period.

The results are shown in the table.

time of day	blood glucose concentration / mg per 100 cm ³
06.00	76
07.00	77
08.00	124
09.00	91
10.00	83
11.00	81
12.00	79
13.00	130

(a) (i) Describe the trend in blood glucose concentration for this seven-hour period.

(2)

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(ii) Suggest reasons for the changes in blood glucose concentration.

(2)

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(iii) Complete the sentence by putting a cross (☒) in the box next to your answer.

Excess blood glucose is converted into (1)

- A glucagon in the liver
- B glucagon in the pancreas
- C glycogen in the liver
- D glycogen in the pancreas

(b) (i) Scientists have discovered that a high body mass index (BMI) is a risk factor that may cause Type 2 diabetes.

Calculate the BMI for a female who has a mass of 67.5 kg and a height of 1.50 m.

$$\text{BMI} = \frac{\text{mass in kg}}{(\text{height in metres})^2}$$

(2)

answer =

(ii) Explain how a Type 2 diabetic can regulate their blood glucose concentration. (3)

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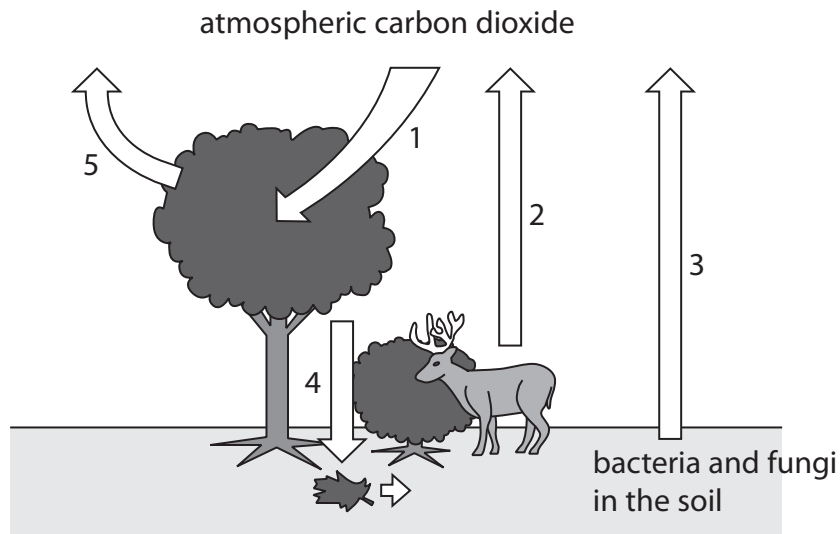
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(Total for Question 3 = 10 marks)

Environment cycling

4 (a) The diagram shows the processes involved in the carbon cycle. Each process is numbered.



(i) What is the name of process 1?

Put a cross (☒) in the box next to your answer.

(1)

- A decomposition
- B denitrification
- C photosynthesis
- D respiration

(ii) Describe the numbered processes that return carbon dioxide back into the atmosphere.

(3)

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(b) The human population is increasing.

Explain how this could change the concentration of carbon dioxide in the atmosphere.

(2)

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(c) Air quality can be monitored using indicator species.

Name an indicator species used to monitor air quality.

(1)

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(d) The overuse of fertilisers can cause eutrophication.

Explain the effects of eutrophication that may lead to the death of aquatic animals.

(3)

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(Total for Question 4 = 10 marks)

Temperature regulation

- 5 (a) (i) Conditions in the human body must be regulated to maintain a stable internal environment.

Name the process that maintains a stable internal environment.

(1)

- (ii) Complete the sentence by putting a cross (☒) in the box next to your answer.

The temperature that enzymes work most effectively in the human body is

(1)

A 31 °C

B 33 °C

C 35 °C

D 37 °C

- (b) Receptor cells in the skin detect temperature changes in the external environment.

Explain how this information is transmitted to the brain.

(4)

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**(c)* In the UK, the external temperature can drop below 0 °C.

Explain how the human body maintains a stable internal temperature when the external temperature is 0 °C.

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(Total for Question 5 = 12 marks)

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Controlling infections

6 (a) Athlete's foot fungus is a pathogen.

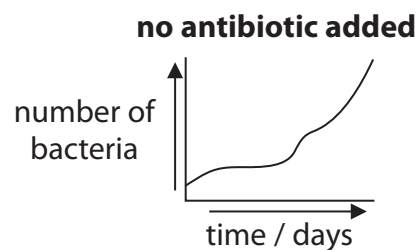
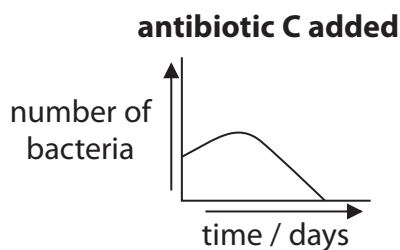
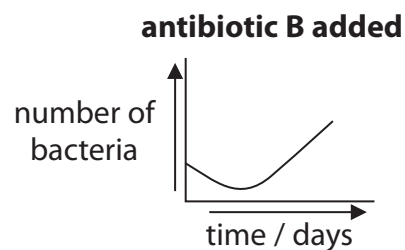
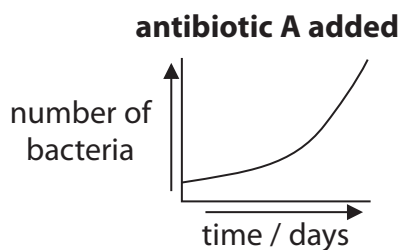
(i) Describe how athlete's foot fungus is spread.

(1)

(ii) State the type of medication that can be used to treat this pathogen.

(1)

(b) The graphs show the effect of three different antibiotics on bacterial growth.



(i) Which of these is most effective at reducing the number of bacteria?

Put a cross (☒) in the box next to your answer.

(1)

- A** antibiotic A
- B** antibiotic B
- C** antibiotic C
- D** no antibiotic

(ii) Explain how chemical defence mechanisms in the body reduce the chance of infection.

(3)

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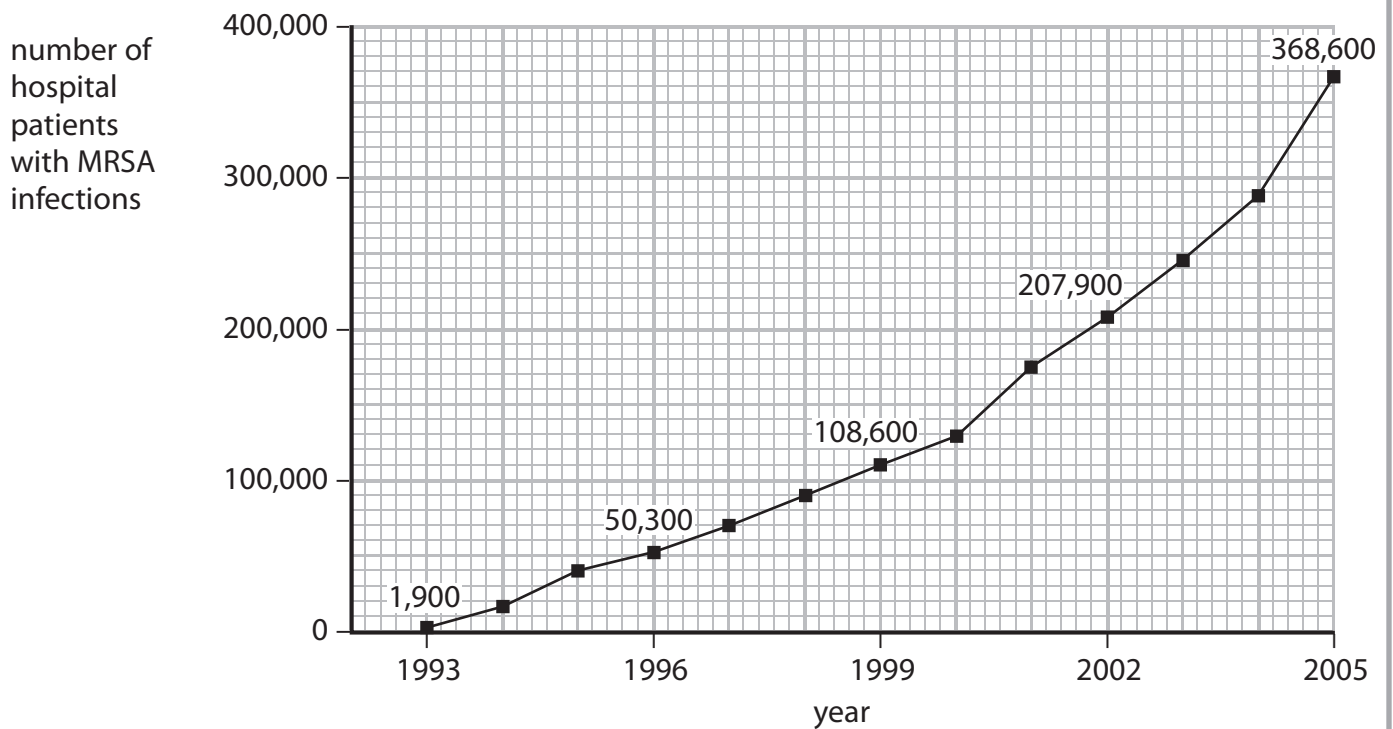
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*(c) MRSA is a bacterial infection.

The graph shows the number of cases of hospital patients with MRSA infections from 1993 to 2005.



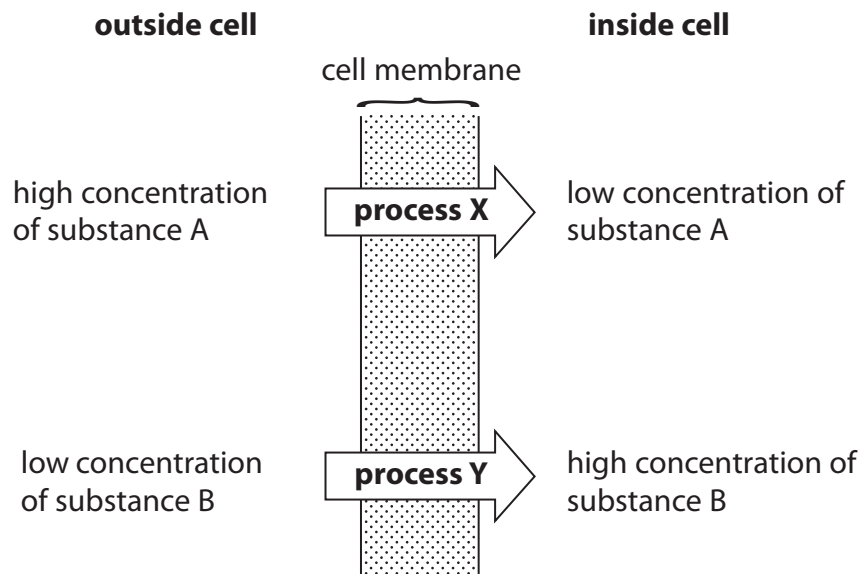
Answer ALL questions

Some questions must be answered with a cross in a box ☒.
If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.

Cell transport mechanisms

- 1 (a) Substances in the soil are taken up by plant root hair cells.

The diagram shows the direction of movement of two substances A and B across the cell membrane of a root hair cell.



- (i) Name **process X**.

(1)

- (ii) Name **process Y**.

(1)

- (iii) Mineral ions are taken up by the root hair cells of plants.

Name the type of vessel that transports these mineral ions through the plant.

(1)

(b) A student investigated osmosis in a courgette.

The photograph shows a courgette.

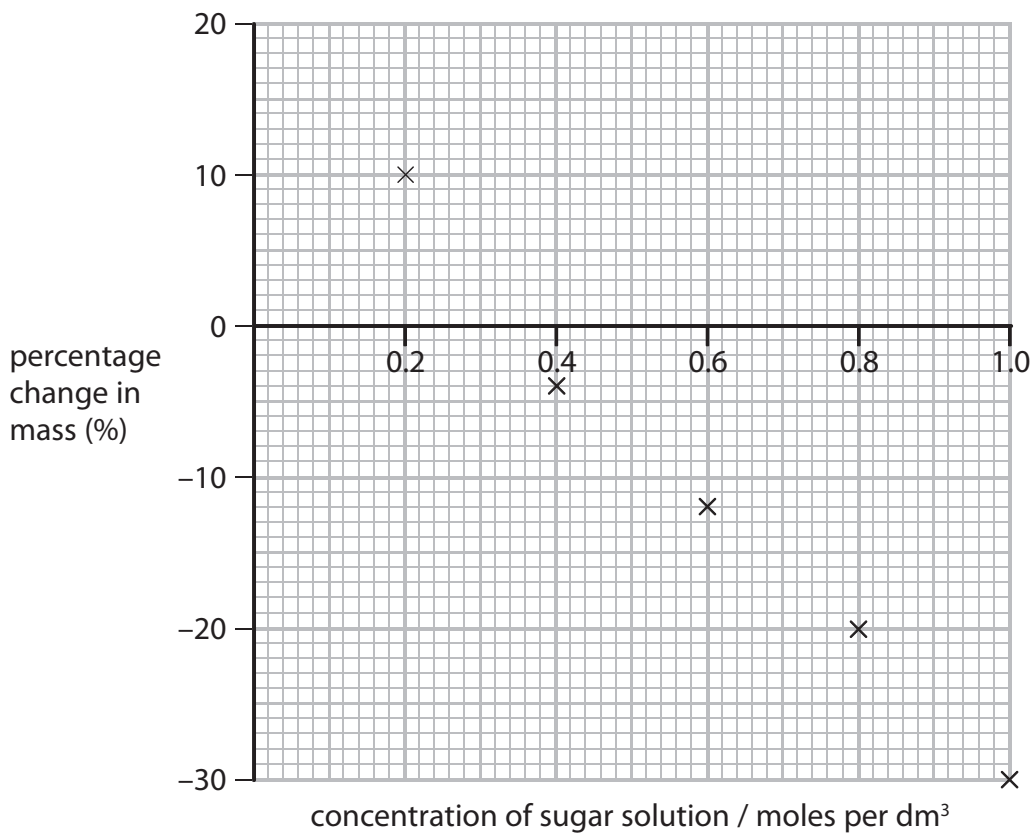


The student weighed pieces of courgette and placed them in five different concentrations of sugar solution.

After one hour she dried and reweighed the pieces of courgette.

She calculated the percentage change in mass.

The graph shows the results of this investigation.



(i) Draw a line of best fit on the graph.

(1)

(ii) Use your line of best fit to estimate the concentration of sugar solution that would result in no change in mass.

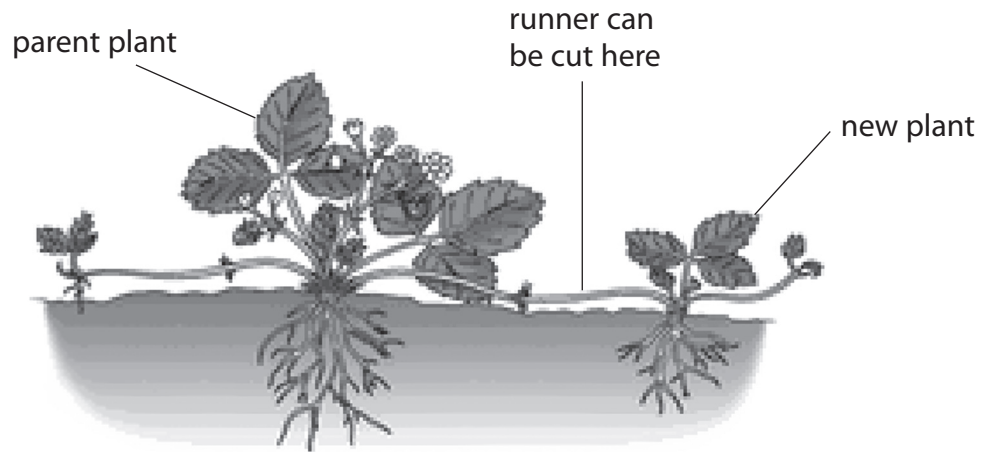
(1)

estimate = moles per dm³

Producing new strawberry plants

- 2 Strawberry plants grow runners and new strawberry plants develop along the runners. The new plants are genetically identical to the parent plant.

The diagram shows the parent plant with new plants attached to runners.



- (a) (i) Name the type of cell division that results in the production of these new plants. (1)

- (ii) Farmers cut the runners and sell the new plants.

Suggest advantages of producing new strawberry plants in this way. (2)

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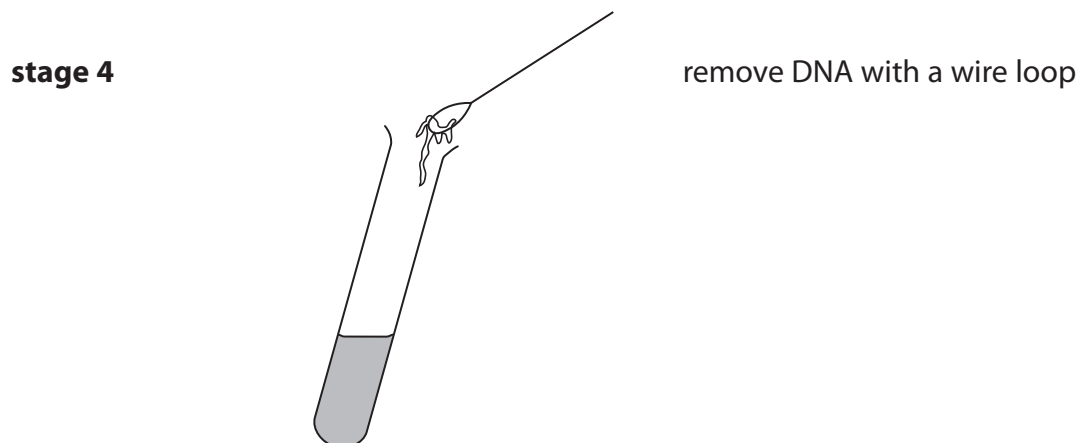
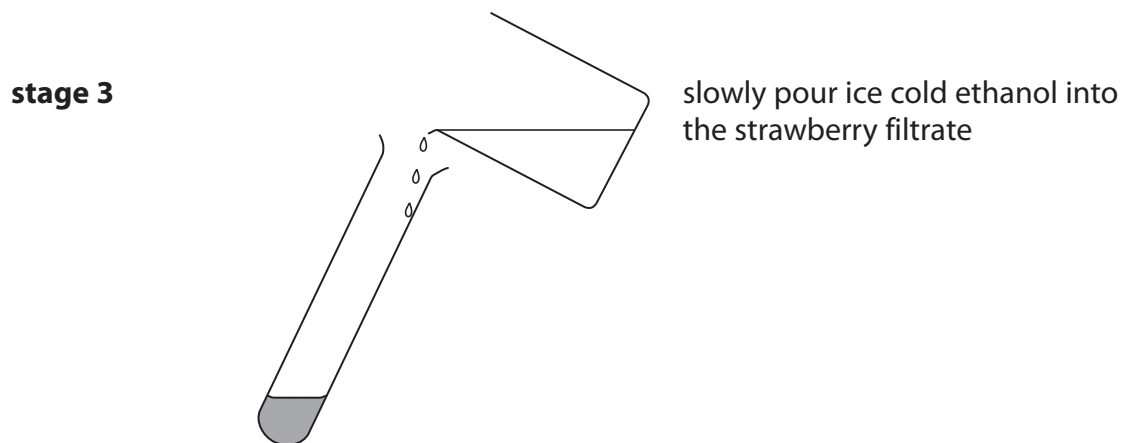
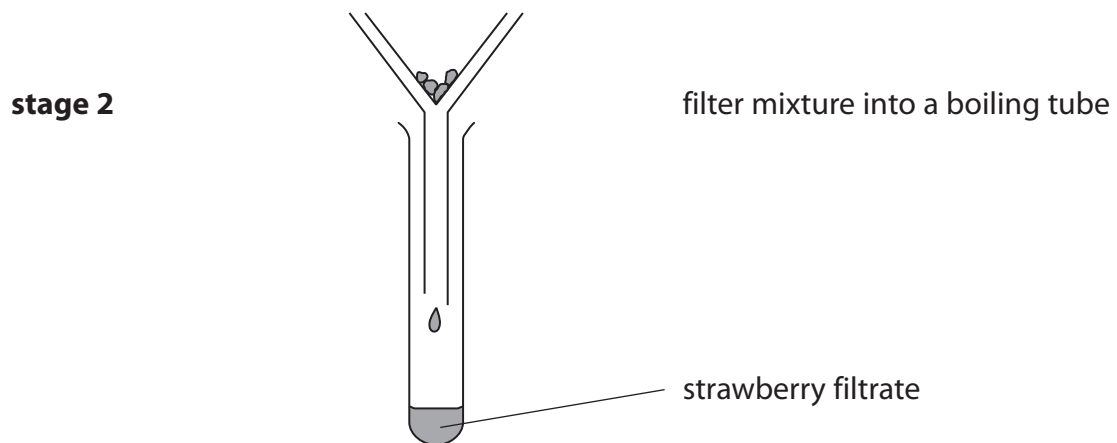
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(b) Some students extracted DNA from strawberries.
The diagram shows the method used.



Suggest the purpose of stages 1 and 3 in the DNA extraction.

(2)

stage 1

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stage 3

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(c) A short section of DNA from a strawberry is shown in the diagram.



(i) How many codons are shown in this section of DNA?

Put a cross (☒) in the box next to your answer.

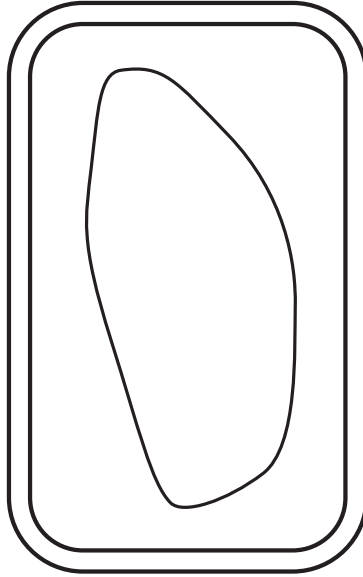
(1)

- A** 2
- B** 3
- C** 4
- D** 12

(ii) This DNA is found in a structure within a cell of a strawberry plant.

On the diagram of a plant cell, draw and name the structure containing DNA.

(2)



(Total for Question 2 = 8 marks)

Probiotic bacteria

3 The digestive system is made up of a number of different organs.

(a) Define the term **organ**.

(1)

(b) (i) How many of the statements are correct?

- The low pH of the stomach kills bacteria.
- The low pH of the stomach provides optimum conditions for pepsin activity.
- The pH of the stomach is low so that acid digests protein.

Put a cross (☒) in the box next to your answer.

(1)

- A** none
- B** 1
- C** 2
- D** 3

(ii) Complete the sentence by putting a cross (☒) in the box next to your answer.

Protein is broken down to form

(1)

- A** amino acids
- B** fatty acids
- C** glucose
- D** glycerol

(c) Explain how the structure of villi allows efficient absorption of the soluble products of protein digestion.

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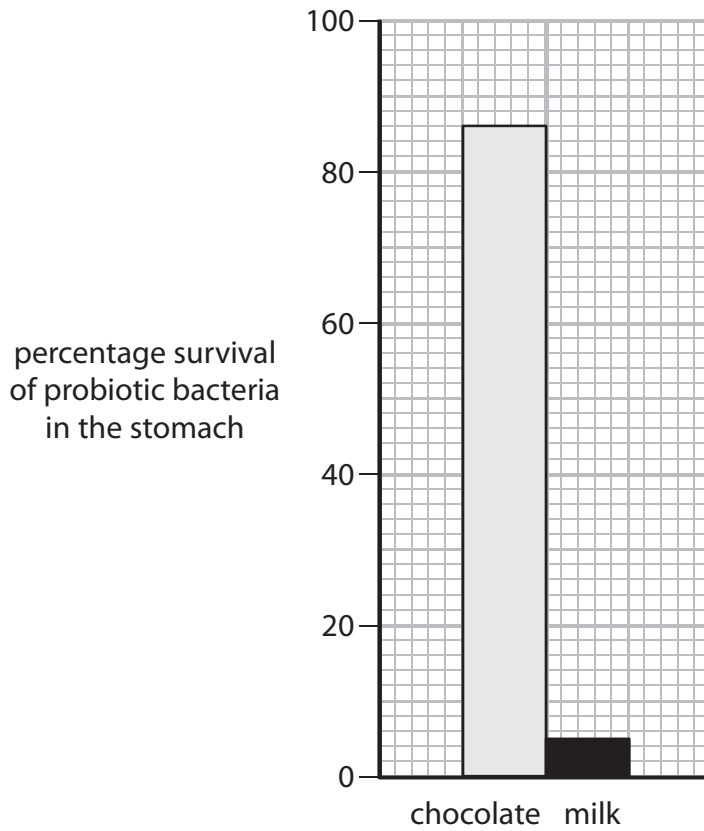
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- (d) Probiotic bacteria are thought to be beneficial to health.
Probiotic bacteria can be consumed in chocolate and milk.

The graph shows the percentage survival of probiotic bacteria in the stomach.



- (i) The total number of live bacteria in the chocolate was five million.

Calculate the number of live bacteria from the chocolate that survived in the stomach.

(2)

answer =

- (ii) Suggest a reason for the survival differences of probiotic bacteria in chocolate compared with probiotic bacteria in milk.

(1)

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(Total for Question 3 = 10 marks)

Fitness Training

4 The volume of blood that the heart pumps with every beat is known as the stroke volume.

Stroke volume can be used to indicate fitness level.

The table gives information about the stroke volume, heart rate and cardiac output of an athlete at rest and during exercise.

athlete	stroke volume / dm ³	heart rate / beats per minute	cardiac output / dm ³ min ⁻¹
at rest	0.1	53	5.3
during exercise		182	30.4

(a) Calculate the stroke volume of the athlete during exercise.

(2)

answer =dm³

(b) Explain why it is important that the cardiac output of the athlete increases during exercise.

(3)

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(c) Describe how the circulatory system transports substances around the body.

(2)

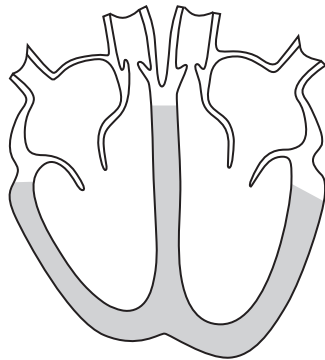
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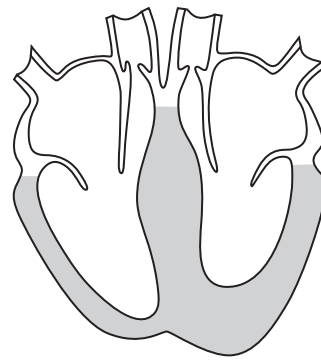
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(d) The diagrams below show a healthy heart and a heart with a condition known as hypertrophic cardiomyopathy (HCM).



healthy heart



hypertrophic cardiomyopathy

A symptom of HCM is that contraction of the heart muscle is more difficult.

Suggest the effects HCM may have on an athlete during competitive sport.

(2)

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(e) Some athletes, such as sprinters, use energy from anaerobic respiration.

Complete the sentence by putting a cross (☒) in the box next to your answer.

(1)

Anaerobic respiration produces

- A carbon dioxide
- B glucose
- C lactic acid
- D oxygen

(Total for Question 4 = 10 marks)

Cloning

5 In May 2011, the Food Standards Agency stated that meat and milk produced from cloned animals should be allowed to go on sale to the public.

(a) (i) Describe the risks associated with cloning mammals.

(3)

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*(ii) A cloned animal contains genetic information that is identical to its parent.

Describe the stages in the production of a cloned mammal.

(6)

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(b) (i) Fertilisation takes place during sexual reproduction to produce genetically different offspring.

Complete the sentence by putting a cross (☒) in the box next to your answer.

Fertilisation occurs when

(1)

- A** diploid gametes combine to produce a diploid zygote
- B** diploid gametes combine to produce a haploid zygote
- C** haploid gametes combine to produce a diploid zygote
- D** haploid gametes combine to produce a haploid zygote

(ii) Genetically different organisms contain different DNA codes that produce different proteins.

Describe the process that takes place in the nucleus during the first stage of protein synthesis.

(2)

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(Total for Question 5 = 12 marks)

Cells

6 There are many different types of cell in the human body.

(a) Complete the sentence by putting a cross (☒) in the box next to your answer.

An embryonic stem cell can

(1)

- A differentiate into any type of cell
- B differentiate into only one type of cell
- C only be obtained from embryos
- D only produce haploid cells

(b) Describe how the structure of a red blood cell is related to its function.

(3)

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(c) Describe the function of platelets.

(2)

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.....

Practice 4

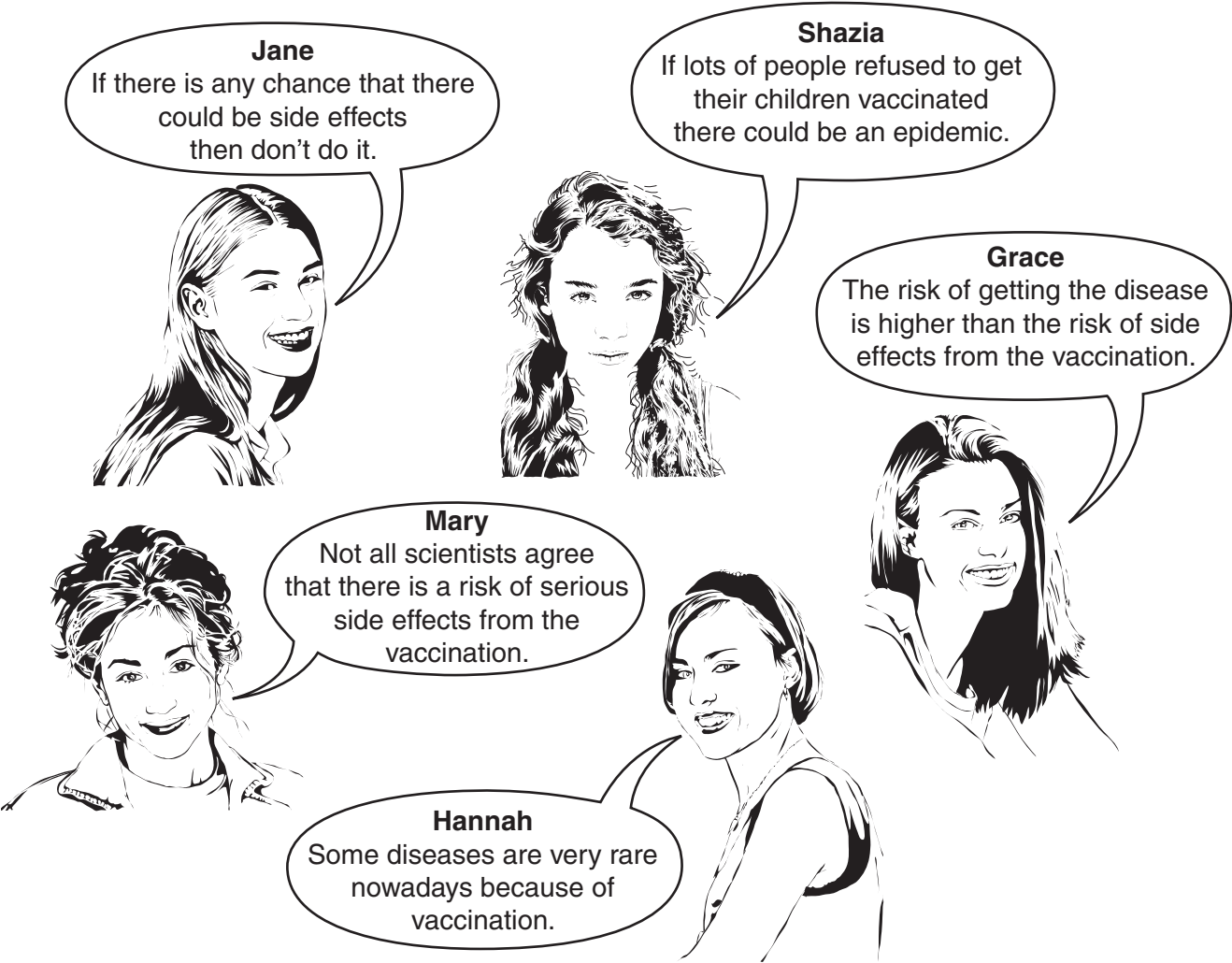
Answer **all** the questions.

1 Saleema has a three month old daughter called Nadia.

Nadia is due for a vaccination to protect her from certain diseases.

Saleema is worried that there may be side effects.

She asks some of her friends what they think.



(a) (i) Which friend can see a benefit to **Nadia** in having the vaccination?

answer [1]

(ii) Which **two** friends can see a benefit for **society** if Nadia has the vaccination?

answer and [2]

3

(b) Mary says that not all scientists agree that there is a risk.

What reasons might these scientists have for coming to different conclusions?

Put ticks (✓) in the boxes next to the **two** best answers.

All scientists share data with each other.

Different studies produce different results.

Not enough evidence may have been collected.

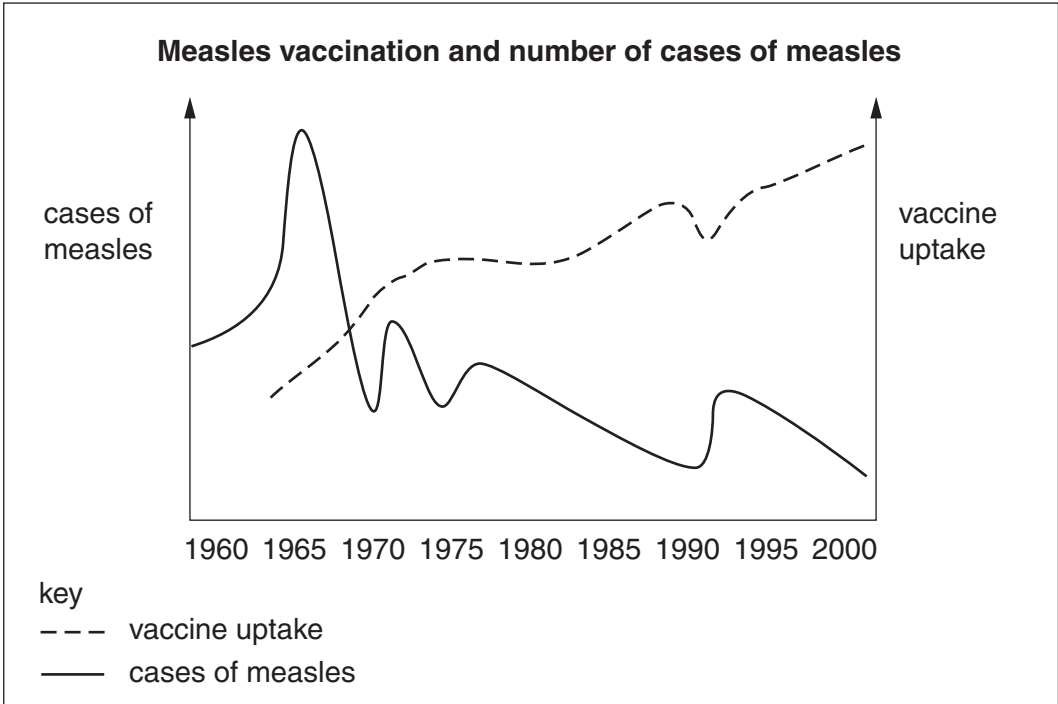
Scientists like to argue with each other.

[2]

[Turn over

(c) Saleema tells her doctor she is worried.

He shows her this information.



Use the information to answer these questions.

(i) What general trends are shown?

Put ticks (✓) in the boxes next to the **two** correct statements.

- There is a positive correlation between vaccine uptake and the number of cases of measles.
- As vaccine uptake increases, the number of cases of measles falls.
- There is a negative correlation between vaccine uptake and the number of cases of measles.
- There is no correlation between vaccine uptake and the number of cases of measles.
- As vaccine uptake falls, the number of cases of measles falls.

[2]

(ii) In 1994, there was an increase in the number of cases of measles.

Use the graph to suggest a reason why.

Put a tick (✓) in the correct box.

More children became susceptible to measles.

The measles virus became more infectious.

Fewer children were vaccinated.

[1]

(d) Look at these statements. Some support vaccination, and some do not.

- A There is a 1:500 risk of death from measles. There is a 1:5000 risk of serious side effects from the vaccination.
- B There is a 1:20 risk of deafness from measles. There is a 1:20 risk of temporary soreness at the injection site.
- C Epidemics can start if a high percentage of the population is vaccinated.
- D It is impossible to eliminate all side effects from vaccination.
- E There is a 1:100 risk of increased temperature from vaccination. There is a 1:20 risk of a swelling appearing at the injection site.

Which **two** statements support vaccination?

answer and [2]

[Total: 10]

[Turn over

2 Alex works for a pharmaceutical company trying to make new antibiotics.

Antibiotics are used to treat infections caused by some microorganisms.

(a) Why do scientists need to find new types of antibiotics?

Put a tick (✓) in the box next to the best answer.

Antibiotics can be killed.

Not all microorganisms can be controlled with antibiotics.

Microorganisms can become resistant to antibiotics.

[1]

(b) The statements **A**, **B**, **C**, **D** and **E** explain how bacteria become resistant to an antibiotic.

They are in the wrong order.

A The bacteria without the mutation are killed by the antibiotic.

B Most of the bacteria are now resistant to the antibiotic.

C Next time the same antibiotic is used, the bacteria are not affected.

D The resistant bacteria have reduced competition for resources and multiply rapidly.

E A mutation in a gene makes some bacteria more resistant to the antibiotic.

Put the statements in the correct order by writing **A**, **B**, **C**, **D** or **E** in each box.

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[3]

[Total: 4]

3 Theresa and Matthew have identical twin boys.

Identical twins are clones.

(a) Put ticks (✓) in the boxes next to the statements that **best** describe clones.

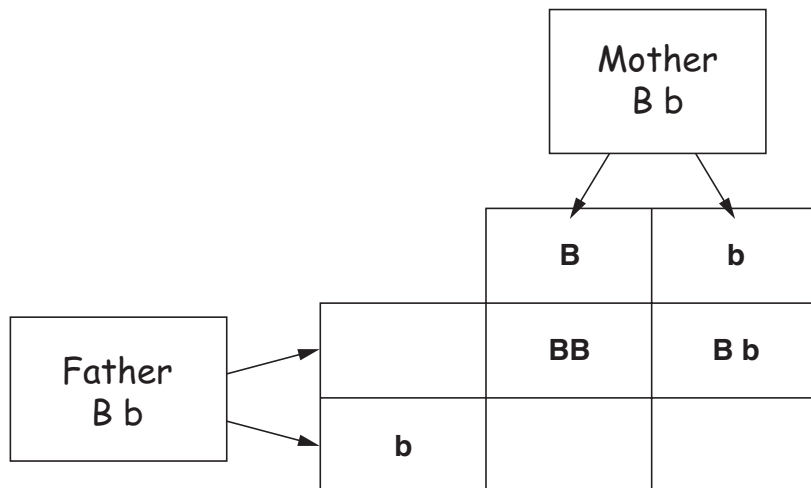
- Clones cannot be produced by natural means.
- Clones cannot be produced by asexual reproduction.
- Differences between clones are due to genetic factors.
- Differences between clones are due to environmental factors.
- Clones can be produced by transferring a nucleus from a cell into an empty egg cell.

[2]

(b) The twins have an older brother called Steven. There are differences between him and the twins.

Steven has blue eyes. The twins and both of their parents have brown eyes.

(i) Complete the genetic diagram below to show how Steven inherited blue eyes. **B** is the allele for brown eyes, and **b** is the allele for blue eyes.



[2]

(ii) Put a ring around the combination that Steven inherited.

[1]

[Turn over

(c) Theresa and Matthew want another son.

(i) Which chromosome has the gene for producing a male child?

answer [1]

(ii) It is possible to select the sex of an embryo before it is implanted.

Some people think that embryo selection should not be done.

Sort the following statements into arguments **for** embryo selection and arguments **against** embryo selection.

Put a tick (✓) in the correct box for each statement.

statement	argument for	argument against
We can make a more balanced family by selecting the sex of a child.		
Embryo selection could result in an imbalance of males and females in the population.		
Scientists should not be allowed to play God.		
Embryo selection could reduce the number of children with genetic disorders.		
Many embryos would be discarded if embryo selection were allowed.		

[3]

[Total: 9]

4 Andrew's employer asks him to attend a health screening session.

The nurse doing the screening asks him if there are any inherited disorders in his family history and offers him a genetic test.

(a) Andrew may **not** wish his employer to be given the results of this test.

Put ticks (✓) in the boxes next to the **two** most likely reasons why.

The test may give a false positive result for a disorder.

His employer could provide him with counselling.

His employer may not promote him.

His job at work will be protected by the disability discrimination act.

He does not want his doctor to be given the results of the test.

[2]

(b) Andrew's father and grandfather died of a form of cancer that can be inherited. This cancer is caused by a faulty gene. Andrew has not been tested for the faulty gene but does attend the hospital for regular check ups.

Andrew is trying to decide if he should have genetic screening for the faulty gene.

Put a (ring) around each of the letters **A, B, C, D** or **E** which **support** Andrew being screened for the faulty gene.

A If he does not have the gene then he will not need regular check ups.

B If he does have the gene then he may not be able to get life insurance.

C If he does not have the gene then he cannot pass it on to his children.

D If he does have the gene then he may become depressed.

E If he does have the gene then the cancer can be detected at an early stage.

[3]

[Total: 5]

[Turn over

5 Read this passage about a discovery made by a conservation group.

New rodent is ‘living fossil’

- 1. A squirrel-like rodent discovered in Laos is the sole survivor of a group that otherwise died out 11 million years ago, according to fossil data.
- 2. The animal made headlines in 2005 when it was hailed as the only new family of living mammals to be found in 30 years.
- 3. But scientists now believe it is a ‘living fossil’, a relic of a group of prehistoric rodents once widespread in South East Asia and Japan.
- 4. They went back through the fossil evidence and found that the rodent’s skull, teeth, lower jaw-bone and other skeletal characteristics looked the same as those in rodent fossils found in rocks thought to be 11 million years old.
- 5. Dr Dawson said efforts to conserve this animal should be given the highest priority.
- 6. ‘We don’t know what its status is – whether there are a lot of them around or just a few,’ she said.

Extract from BBC News at <http://news.bbc.co.uk>, 09 March 2006

(a) Which three statements, 1, 2, 3, 4, 5 or 6, contain data?

answer [2]

(b) Which statement **best** explains why scientists had thought that this rodent was extinct?

Put a tick (✓) in the correct box.

- The rodent had never been observed in the wild.
- Fossils of this rodent are only found in 11 million year old rock.
- New species of animals are always being discovered.

[1]

(c) New species of animals evolve over time.

Choose the **three** statements, **A, B, C, D, E, F** or **G**, that **best** explain why this happens.

- A** because the environment changes
- B** because most mutations in genes do not benefit the individual animal
- C** because mutations in genes cause changes in characteristics
- D** because animals can live together if they eat different foods
- E** because better adapted individual animals survive to breed
- F** because animal species do not show variation
- G** because some individual animals may develop characteristics during their lifetimes that make them better at finding food than others

answer [3]

(d) Conservationists are now studying the rodent and its habitat.

They want to make sure it does not become extinct.

Which changes could cause the rodent to become extinct?

Put ticks (✓) in the boxes next to the **three** correct statements.

- More trees grow giving new shelter.
- The rodent faces increased competition for its prey.
- The environmental conditions begin to change.
- The rodent is susceptible to a new disease.
- The number of humans living in the area decreases.
- An asteroid passes close by the Earth.

[3]

[Total: 9]

[Turn over

6 Our bodies need communication systems to respond to changes in our surroundings.

Some of these responses are controlled by nerves.

Some are controlled by hormones.

(a) Here is a list of responses.

- A knee jerk reaction when the knee cap is tapped
- B controlling the glucose level in the blood after a meal
- C keeping the water level in the body correct
- D touching a hot surface and pulling away
- E jumping out of the way of a moving car
- F blinking when a bright light is shone in our eyes

Choose **two** responses that:

(i) are controlled by nerves.

answer and [2]

(ii) are controlled by hormones.

answer and [2]

(b) The internal environment of our bodies must be maintained.

What is the name of this process?

answer [1]

[Total: 5]

END OF QUESTION PAPER

Practice 5

2

Answer **all** the questions.

1 This question is about keeping things inside the body the same.

(a) Name the process which means **maintenance of a constant internal environment**.

..... [1]

(b) Which conditions inside the body need to be kept constant?

Put ticks (✓) in the boxes next to the **three** correct answers.

- blood oxygen levels
- skin pigmentation
- water content of the body
- salt content of the body

[1]

(c) The internal environment is often controlled by **negative feedback**.

Which **two** statements describe negative feedback?

Put ticks (✓) in the boxes next to the **two** best answers.

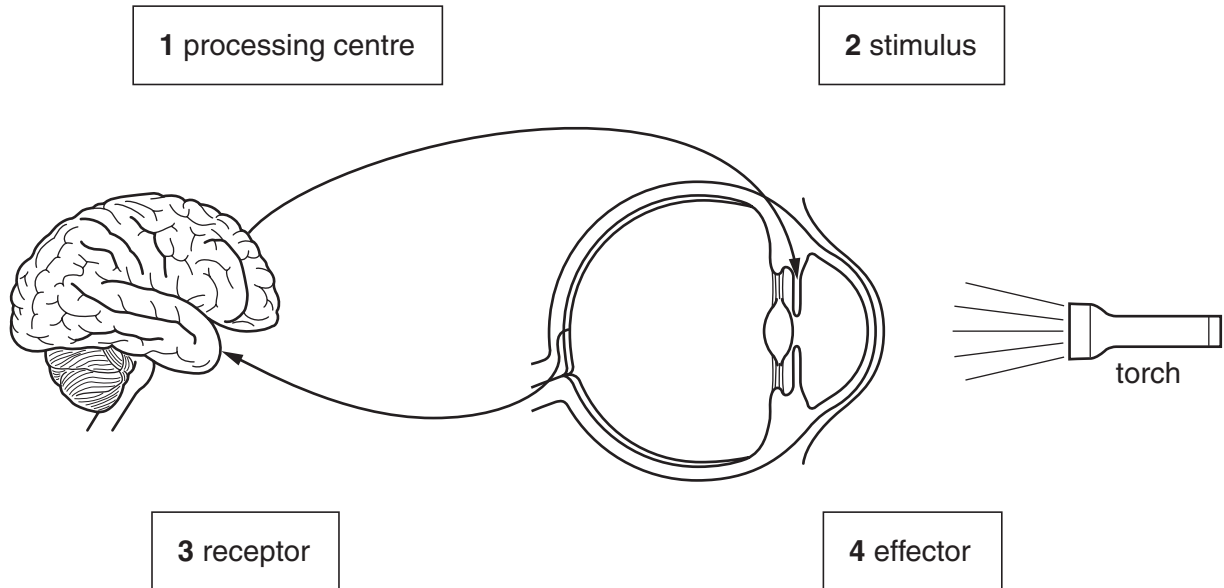
- negative feedback increases rates of chemical reactions as body temperature rises
- negative feedback works to change any steady state
- negative feedback can be used to maintain a constant level
- negative feedback between effectors and receptors reverses any changes that take place
- negative feedback decreases rates of chemical reactions as body temperature rises

[2]

3

(d) Negative feedback mechanisms are involved in controlling the amount of light entering the eye. The diagram shows negative feedback between the brain and the eye.

Draw **straight lines** to join each of the labels, **1**, **2**, **3** and **4**, to the correct part of the diagram.



[4]

[Total: 8]

[Turn over

2 This question is about processes in cells.

(a) Which statement **best** describes osmosis?

Put a tick (✓) in the correct box.

movement of molecules from a region of high concentration to a region of low concentration

movement of water molecules from a dilute to a more concentrated solution through a partially permeable membrane

movement of molecules from a region of low concentration to a region of high concentration

movement of water molecules from a concentrated to a more dilute solution through a partially permeable membrane

[1]

(b) Look at the examples of diffusion and osmosis in an animal cell.

Put a **d** in the boxes next to the examples of diffusion.

Put an **o** in the boxes next to the examples of osmosis.

carbon dioxide moving out of a cell

water moving into a cell

oxygen moving into a cell

water moving out of a cell

digested food moving into a cell

[3]

(c) Enzymes are found in cells.

Which **one** of the following must remain constant for enzymes to work at their optimum?

Put a **ring** around the correct answer.

number of cells

size of cell

temperature of cell

shape of cell

[1]

5

(d) Which conditions will increase the rate of reaction of enzymes?

Put a tick (✓) in the correct box.

fewer collisions between enzymes and other molecules

faster collisions between enzymes and other molecules

slower collisions between enzymes and other molecules

rapid changes of temperature

[1]

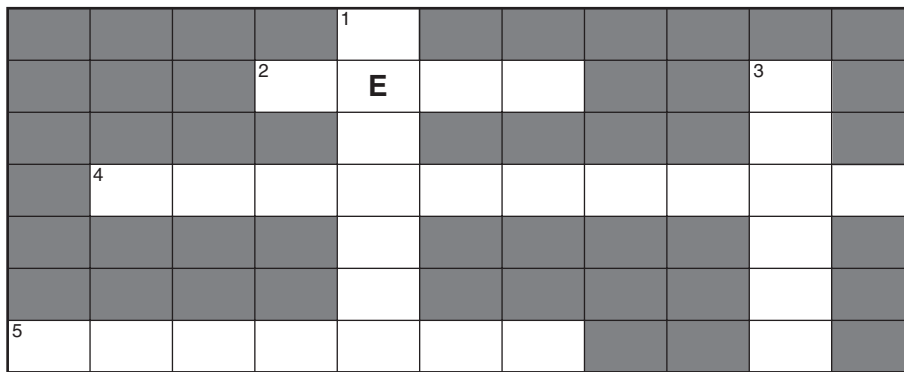
[Total: 6]

[Turn over

6

3 This question is about how organisms produce more cells.

(a) Use the clues to complete the crossword puzzle.



Across

- 2 A section of DNA that codes for one protein
- 4 A long strand of DNA found in the nucleus of a cell
- 5 A type of cell division that produces identical copies of the cell

Down

- 1 A type of cell division that produces sex cells with half the number of chromosomes
- 3 Another name for a sex cell

[5]

(b) The statements describe how organisms produce new cells. They are in the wrong order.

- A The copies of chromosomes separate.
- B The number of organelles in the cell increases.
- C The cell divides into two cells.
- D Each strand is copied to make two new strands (chromosomes).
- E The two strands of each DNA molecule separate.

Put the statements into the correct order. The first one has been done for you.

B				
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[3]

[Total: 8]

[Turn over

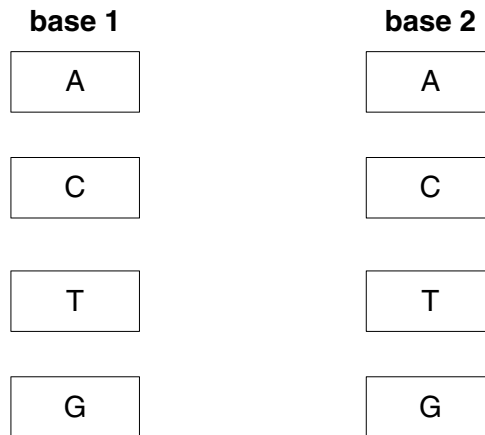
4 This question is about DNA.

(a) DNA is made from different bases.

(i) How many different types of bases are found in DNA?

answer [1]

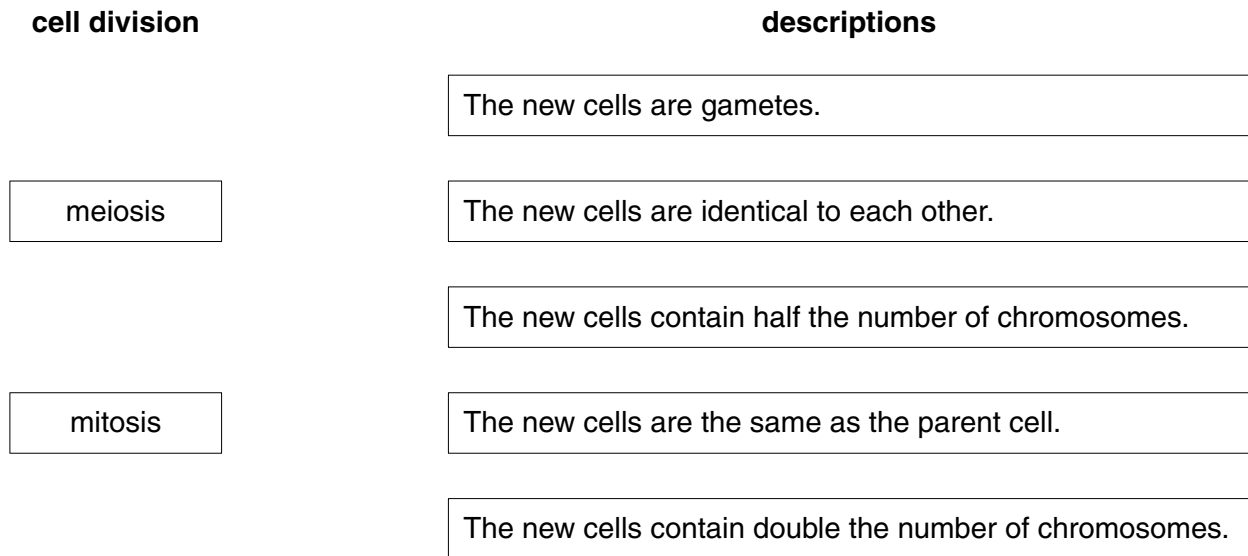
(ii) Draw **four** straight lines connecting the different bases in the left hand column with the correct bases in the right hand column to show which bases always pair up.



[1]

(b) Cells may divide by mitosis or meiosis.

Draw **two** straight lines from **each** type of **cell division** to its **two** correct **descriptions**.



[2]

(c) Which **two** of the statements best describe embryonic stem cells?

Put ticks (✓) in the boxes next to the **two** correct statements.

cells that have no inactive genes so that they can form cells of all tissue types

cells that are found in stems

cells that have the potential to replace damaged tissue

cells that have developed to become highly specialised

cells that do not change once they have been produced

[2]

[Total: 6]

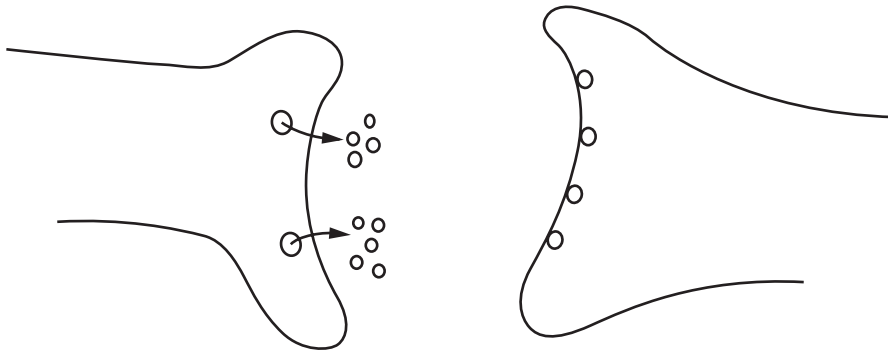
[Turn over

5 This is a question about the human nervous system.

(a) The diagram shows the endings of two nerve cells.

(i) Use these words to label the diagram.

receptor molecules synapse synaptic chemicals



[3]

(ii) Add an arrow to the diagram to show which way the impulse is travelling.

[1]

(b) Reflex actions are used by most animals.

Look at the statements about reflex actions.

Some are **true** and some are **false**.

Write **T** in the box next to each **true** statement and **F** in the box next to the **false** one.

	T (true) or F (false)
Reflexes produce rapid involuntary responses.	<input type="checkbox"/>
Only simple animals use simple reflexes.	<input type="checkbox"/>
Conditioning is when reflex responses are learnt.	<input type="checkbox"/>
Only complex reflexes are used to improve an animal's chances of survival.	<input type="checkbox"/>
Conditioned reflexes usually increase the chances of survival.	<input type="checkbox"/>

[3]

[Total: 7]

6 This question is about different kinds of reflexes.

(a) Which **two** statements best describe a conditioned reflex?

Put ticks (✓) in the boxes next to the **two** correct statements.

Conditioned reflexes happen when something occurs only once.

Pavlov's dogs show an example of a conditioned reflex.

Being startled by a loud noise is an example of a conditioned reflex.

Conditioned reflexes reduce an animal's chances of survival.

The final response has no direct connection with the stimulus.

[2]

(b) Draw a straight line linking each **type of reflex** to its correct **example** and then to its correct **purpose**.

type of reflex	example	purpose
simple	falling asleep	protecting a sense organ
conditioned	salivating when hearing a bell ring	refreshing the brain
	blinking in a bright light	helping digestion

[2]

[Turn over

(c) In some circumstances it is possible for the brain to modify a reflex response.

Which three statements are the best examples of how the brain can modify a reflex response?

Put ticks (✓) in the boxes next to the **three** best answers.

- | | |
|---|--------------------------|
| being frightened of thunderstorms | <input type="checkbox"/> |
| holding on to a hot plate | <input type="checkbox"/> |
| going to the dentist even though you are frightened | <input type="checkbox"/> |
| killing spiders | <input type="checkbox"/> |
| salivating when you smell some delicious food | <input type="checkbox"/> |
| not blinking when something comes close to your eyes | <input type="checkbox"/> |
| hearing someone speak your name across a crowded room | <input type="checkbox"/> |

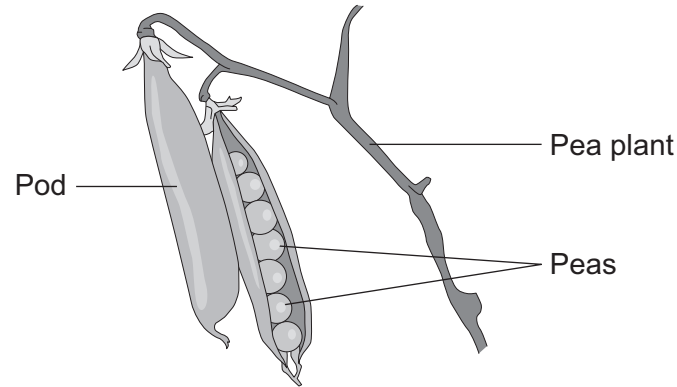
[3]

[Total: 7]

END OF QUESTION PAPER

Answer **all** questions in the spaces provided.

- 1 Peas grow in pods on pea plants.



A gardener grew four varieties of pea plants, **A**, **B**, **C** and **D**, in his garden. The gardener counted the number of peas in each pod growing on each plant.

The table shows his results.

Variety	Range of number of peas in each pod	Mean number of peas in each pod
A	2–6	4
B	3–7	5
C	3–8	6
D	6–8	7

- 1 (a) Give **one** environmental factor and **one other** factor that might affect the number of peas in a pod.

Environmental factor

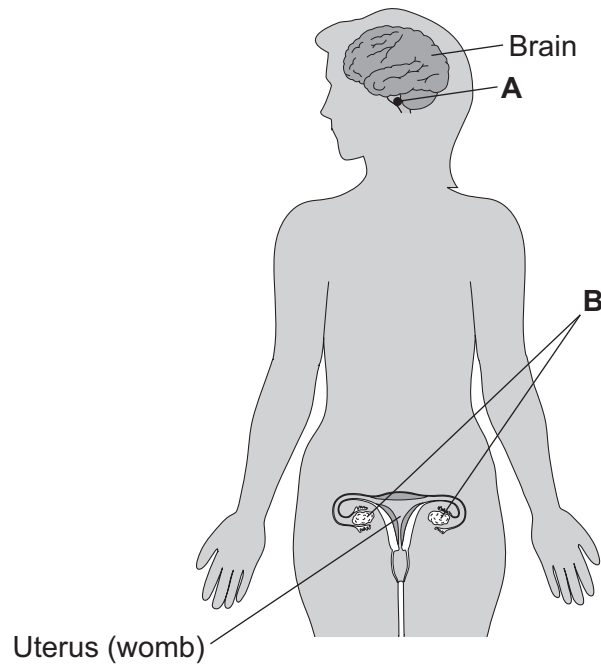
Other factor

(2 marks)

There are no questions printed on this page

**DO NOT WRITE ON THIS PAGE
ANSWER IN THE SPACES PROVIDED**

- 2 The diagram shows the position of two glands, **A** and **B**, in a woman.



- 2 (a) (i) Name glands **A** and **B**.

A

B

(2 marks)

- 2 (a) (ii) Gland **A** produces the hormone Follicle Stimulating Hormone (FSH).

FSH controls changes in gland **B**.

How does FSH move from gland **A** to gland **B**?

.....

(1 mark)

Question 2 continues on the next page

Turn over ►

2 (b) (i) A woman is not able to become pregnant. The woman does not produce mature eggs. The woman decides to have In Vitro Fertilisation (IVF) treatment.

Which **two** hormones will help the woman produce and release mature eggs?

Tick (✓) **one** box.

FSH and Luteinising Hormone (LH)

FSH and oestrogen

Luteinising Hormone (LH) and oestrogen

(1 mark)

2 (b) (ii) Giving these hormones to the woman helps her to produce several mature eggs. Doctors collect the mature eggs from the woman in an operation.

Describe how the mature eggs are used in IVF treatment so that the woman may become pregnant.

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(3 marks)

2 (b) (iii) IVF clinics have been set a target to reduce multiple births.

At least 76% of IVF treatments should result in single babies and a maximum of 24% of treatments should result in multiple births.

Suggest **one** reason why the clinics have been set this target to reduce multiple births.

.....
.....

(1 mark)

- 2 (c)** Two clinics, **R** and **S**, used IVF treatment on women in 2007. Doctors at each clinic used the results of the treatments to predict the success rate of treatments in 2008.

The table shows the information.

	Total number of IVF treatments in 2007	Number of IVF treatments resulting in pregnancy in 2007	Predicted percentage success rate in 2008
Clinic R	1004	200	18–23
Clinic S	98	20	3–56

- 2 (c) (i)** Compare the success rates of the two clinics in 2007.

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.....

(1 mark)

- 2 (c) (ii)** The range of the predicted success rate in 2008 for clinic **R** is much smaller than the range of the predicted success rate for clinic **S**.

Suggest why.

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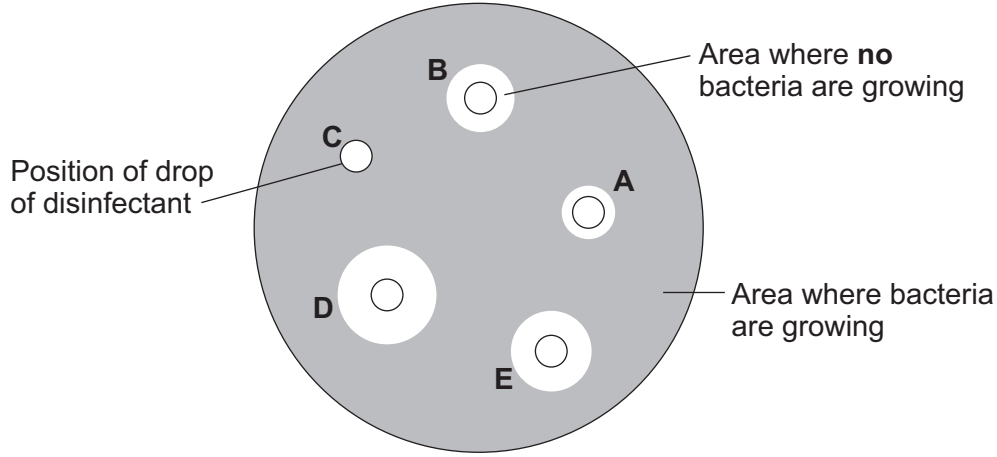
(2 marks)

Turn over for the next question

Turn over ►

3 (b) After the culture had been prepared, the student added one drop of each of five disinfectants, **A**, **B**, **C**, **D** and **E**, onto the culture.

The diagram shows the appearance of the Petri dish 3 days later.



3 (b) (i) There are areas on the agar jelly where **no** bacteria are growing.

Why?

.....

 (1 mark)

3 (b) (ii) The student concluded that disinfectant **D** would be the best for using around the home.

Give **one** reason why the student might be correct.

.....

Give **one** reason why the student might **not** be correct.

.....

 (2 marks)

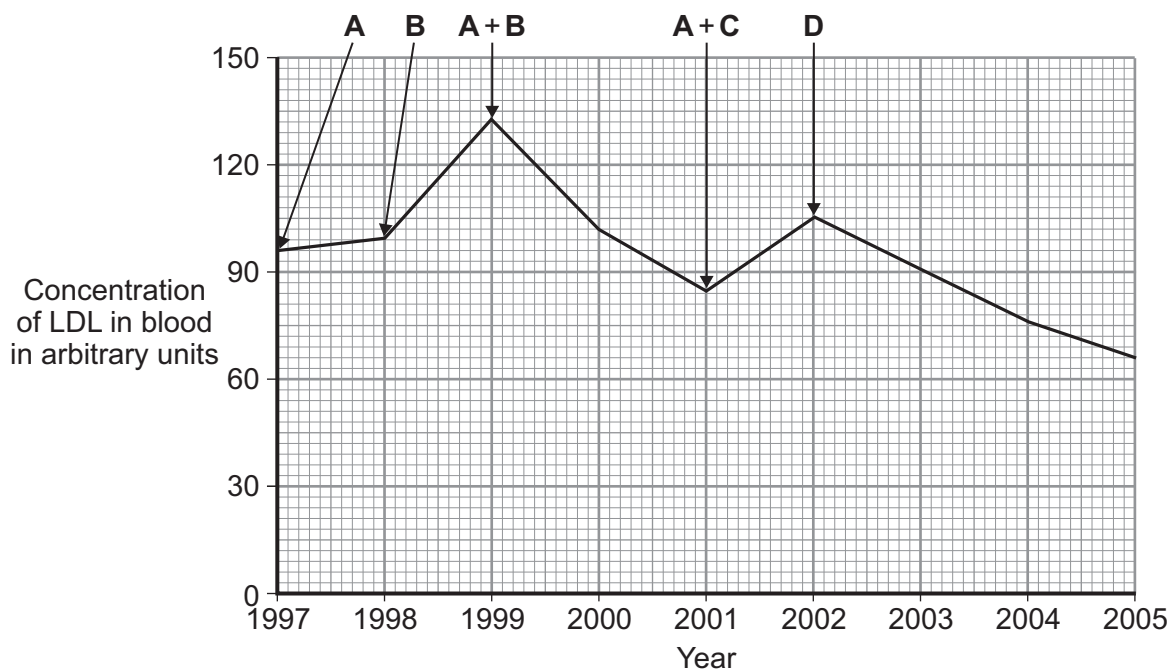
4 LDL is one form of cholesterol found in the blood.

People with a high concentration of LDL in their blood may be treated with drugs called statins.

A high concentration of LDL cholesterol in the blood may result in an increased risk of heart and circulatory diseases.

The graph shows the effects of the treatment of one person with four different statins, **A**, **B**, **C** and **D**, over a period of 8 years. The arrows show when each new treatment was started.

Each treatment was continued until the next treatment was started.



Compare the effectiveness of the five treatments in reducing the risk of heart and circulatory diseases for this person.

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(4 marks)

4

Turn over for the next question

Turn over ►

5 On a rocky shore, when the tide goes in and out, organisms are exposed to the air for different amounts of time.

5 (a) On hot, windy days when the tide is out the concentration of the salt solution in rock pools may become very high.

What term is used to describe organisms that can survive in severe conditions such as very high concentrations of salt solution?

.....
(1 mark)

5 (b) Periwinkles are types of snail.
Students surveyed the different types of periwinkle living on a rocky shore.

The diagram shows the results of the students' survey.
The highest position that the sea water reaches on the shore is called the high tide level.
Each bar represents the range of habitats for each type of periwinkle.

Position on shore	Small periwinkle	Rough periwinkle	Common periwinkle	Flat periwinkle
High tide level ↓ Low tide level	I	I	I	I

5 (b) (i) Which **two** types of periwinkle are likely to compete with each other to the greatest extent?

.....
(1 mark)

5 (b) (ii) Explain your answer to part (b)(i).

.....
.....
(1 mark)

5 (b) (iii) The small periwinkle can survive much nearer to the high tide level than the flat periwinkle.

Suggest **two** reasons why the flat periwinkle cannot survive near to the high tide level.

1

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2

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(2 marks)

5

Turn over for the next question

Turn over ►

6 White blood cells protect the body against pathogens such as bacteria and viruses.

6 (a) (i) Pathogens make us feel ill.

Give **one** reason why.

.....
.....

(1 mark)

6 (a) (ii) White blood cells produce antibodies. This is one way white blood cells protect us against pathogens.

Give **two** other ways that white blood cells protect us against pathogens.

1

2

(2 marks)

6 (b) Vaccination can protect us from the diseases pathogens cause.

6 (b) (i) One type of virus causes measles.

A doctor vaccinates a child against measles.

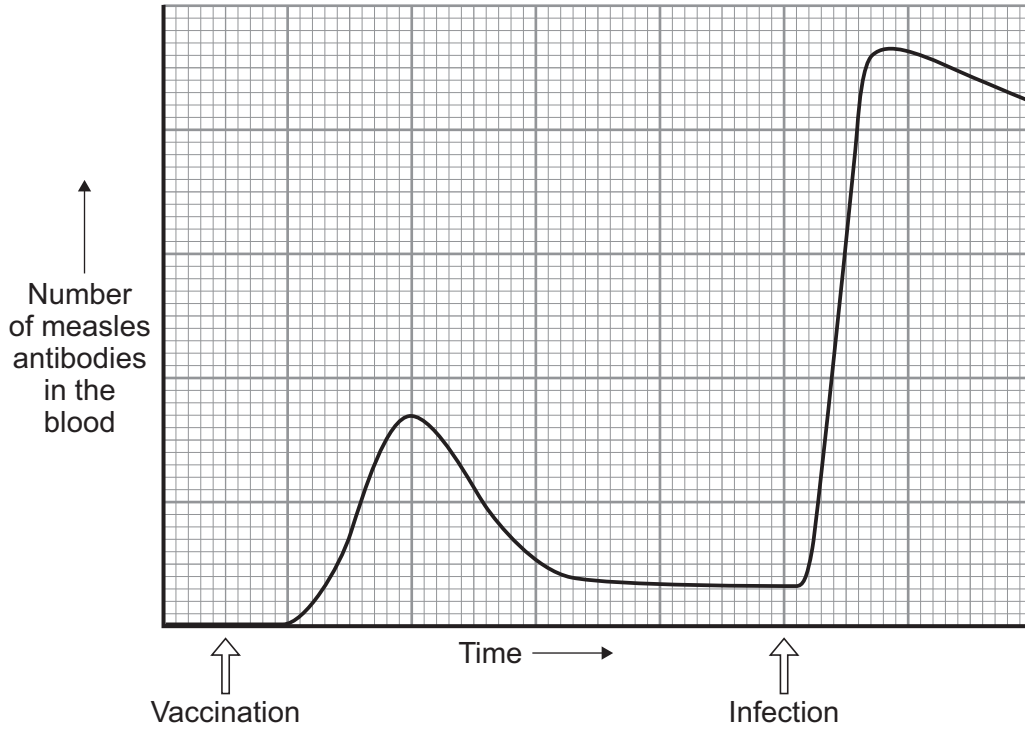
What does the doctor inject into the child to make the child immune to measles?

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.....
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.....

(2 marks)

6 (b) (ii) A few weeks after the vaccination, the child becomes infected with measles viruses from another person.

The graph shows the number of measles antibodies in the child's blood from before the vaccination until after the infection.



More measles antibodies are produced after the infection than after the vaccination.

Describe other differences in antibody production after infection compared with after vaccination.

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(3 marks)

6 (b) (iii) Vaccination against the measles virus will **not** protect the child against the rubella virus.

Why?

.....

(1 mark)

6 (c) What is the advantage of vaccinating a large proportion of the population against measles?

.....

(1 mark)

7 Darwin suggested the theory of natural selection.

7 (a) Explain how natural selection occurs.

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(3 marks)

7 (b) Latitude is a measure of distance from the Earth's equator.

Scientists investigated the effect of latitude on:

- the time taken for new species to evolve
- the number of living species.

The table shows the scientists' results.

Latitude in degrees North of equator	Time taken for new species to evolve in millions of years	Relative number of living species
0 (at the equator)	3–4	100
25	2	80
50	1	30
75 (in the Arctic)	0.5	20

As latitude increases environmental conditions become more severe.

7 (b) (i) Describe the patterns shown by the data.

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(2 marks)

7 (b) (ii) Suggest explanations for the patterns you have described in part (b)(i).

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.....

(2 marks)

7

Turn over for the next question

Turn over ►

8 The photographs show four different species of bird.

Great tit



Blue tit



Coal tit



Long-tailed tit



The table gives information about the four species of bird in winter.

Bird species	Mean body mass in grams	Mean energy needed in kJ per day	Mean percentage of day spent feeding
Great tit	21	84.2	75
Blue tit	12	62.4	81
Coal tit	9	49.5	88
Long-tailed tit	7	42.0	92

8 (a) (i) Calculate the energy needed per day per gram of body mass for the blue tit.

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.....

.....

Answer = kJ per day per gram of body mass
(2 marks)

8 (a) (ii) Describe the trend for energy needed per day per gram of body mass for the four species of bird.

.....
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(1 mark)

8 (a) (iii) Suggest an explanation for the trend you have described in part (a)(ii).

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(2 marks)

8 (b) Describe and explain the trend shown by the data for the time spent feeding in winter for the birds.

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(2 marks)

7

END OF QUESTIONS