AQA GCSE BIOLOGY (HIGHER) · 8461

BIOLOGY



EXAM QUESTION PACK

4.6.2 VARIATION AND EVOLUTION (PACK 5)

SCORE	PERCENTAGE
/246	%

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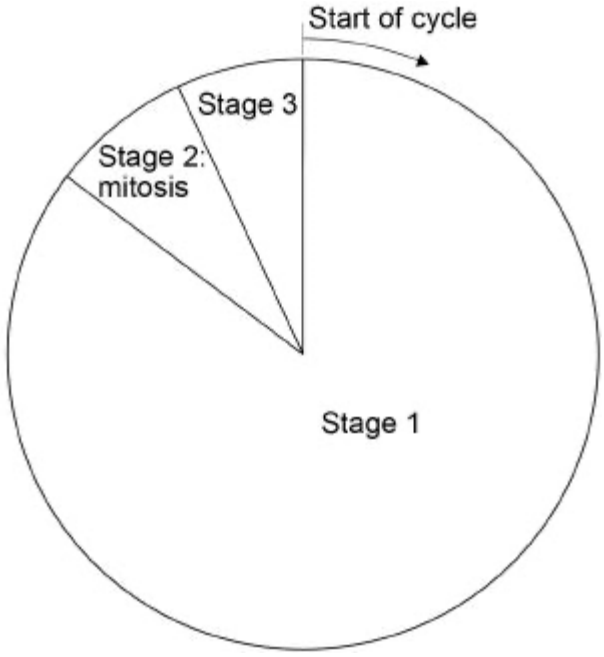
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Q1.

Cells divide in a series of stages called the cell cycle.

Stage 2 of the cycle is mitosis.

The diagram below shows a simplified cell cycle for a human body cell.



(a) Draw **one** line from each stage in the cell cycle to what happens during that stage.

Stage in the cell cycle	**What happens during that stage**
Stage 1	Nucleus divides
Stage 2	Cell divides into two
Stage 3	Copies of the DNA are made

(2)

(b) The mass of DNA in a human body cell at the start of the cell cycle is 6 picograms.

What mass of DNA will be in each of the new cells produced by this cell division?

Tick **one** box.

3 picograms ☐

6 picograms ☐

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9 picograms ☐

12 picograms ☐

(1)

(c) Stem cells are undifferentiated cells.

Which statement about stem cells is correct?

Tick **one** box.

Animal stem cells are found in meristems ☐

Animal stem cells divide by meiosis ☐

Meristem cells in plants can differentiate throughout the life of the plant ☐

Meristem cells in plants can only differentiate into one type of cell ☐

(1)

Stem cells from human embryos can differentiate into most types of human cell.

Research is being done into the use of embryonic stem cells in medical treatments.

The long-term effects of using embryonic stem cells in patients are not well understood.

In therapeutic cloning, human embryos are produced using a donated human egg cell and a cell from the patient.

- The embryo produced contains the same genetic information as the patient.
- Stem cells are taken from the embryo and stimulated to divide to form cells the patient needs.
- The embryo is then destroyed.

(d) Suggest **two** advantages of therapeutic cloning.

1. _____

_____

2. _____

_____

(2)

(e) Suggest **two** disadvantages of therapeutic cloning.

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1. _____

_____

2. _____

_____

(2)

(Total 8 marks)

Q2.

This question is about stem cells.

(a) Give **one** place in a plant where stem cells are found.

_____

_____

(1)

(b) What is **one** economic use of plant stem cells?

Tick **one** box.

To create genetically modified crops	☐
To create new species of plants	☐
To increase variation in plants	☐
To produce large numbers of identical plants	☐

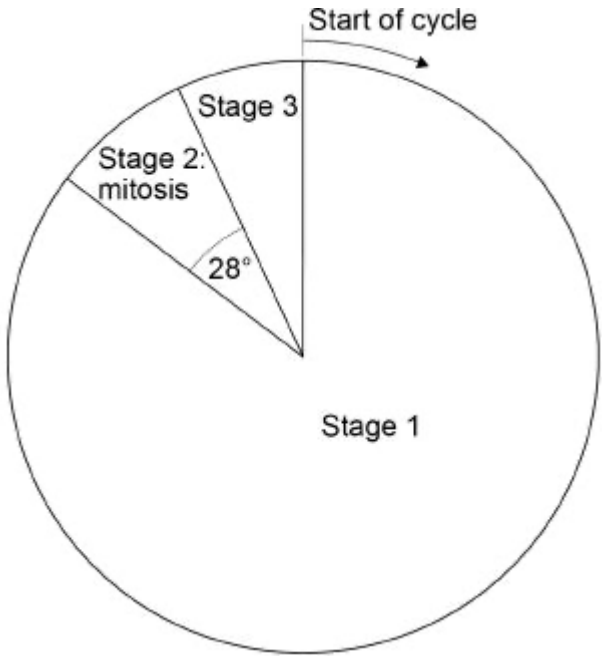
(1)

Embryonic stem cells divide by mitosis.

Figure 1 represents a cell cycle for a human embryonic stem cell.

Figure 1

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(c) The mass of DNA in the cell at the start of the cycle is 6 picograms.

A picogram is 10^{-3} nanograms.

Convert 6 picograms to grams.

Give your answer in standard form.

Mass = _____ g

(1)

(d) The time taken for this complete cell cycle is 15 hours.

Calculate how many hours the cell spent in mitosis.

Give your answer to 3 significant figures.

Time spent in mitosis = _____ hours

(2)

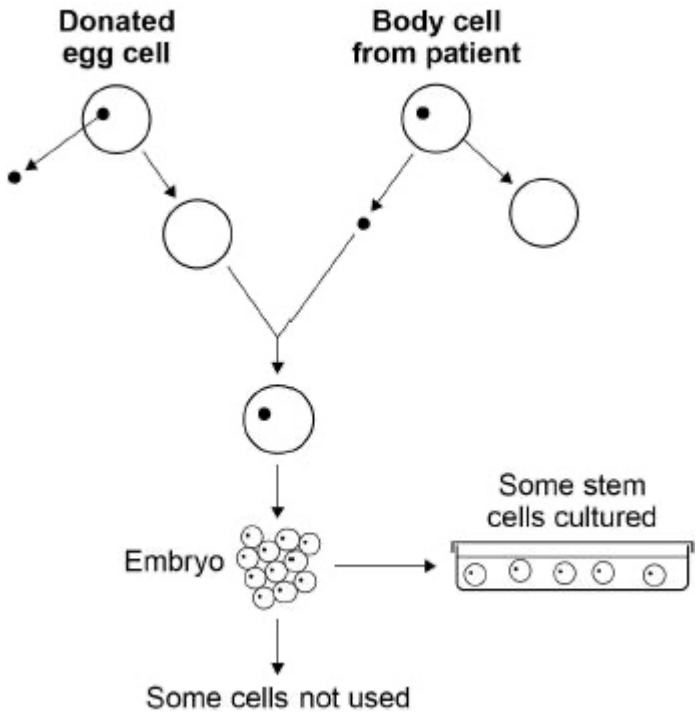
(e) Describe what happens in each of the three stages of the cell cycle.

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(5)

(f) **Figure 2** shows how embryonic stem cells are produced in therapeutic cloning for use in patients.

Figure 2



Give **two** advantages and **two** disadvantages of therapeutic cloning in medical treatments.

Use **Figure 2** to help you.

Advantage 1 _____

_____

Advantage 2 _____

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_____

Disadvantage 1 _____

_____

Disadvantage 2 _____

_____

(4)

(Total 14 marks)

Q3.

Variation in individual organisms can be caused by:

- genes
- the environment
- a combination of both genes and the environment.

Figure 1 shows variations in a woman.

Figure 1



(a) What is the cause of each variation in the table below?

Tick only **one** box in each row.

Variation	Cause of variation		
	Genes only	**Environment only**	**Both genes and the environment**
Brown eyes			
Light brown skin colour			
Short hair			

(3)

(b) The allele for blue eyes is recessive (**b**).

The allele for brown eyes is dominant (**B**).

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A woman has blue eyes.

What are the woman's alleles?

Tick **one** box.

BB ☐ **Bb** ☐ **bb** ☐

(1)

(c) The woman marries a man with the alleles **Bb** for eye colour.

What colour eyes does the man have?

_____

(1)

(d) Complete the Punnett square diagram in **Figure 2** for this man and woman.

Figure 2

		Woman	
Man	**B**		
	b		

(1)

(e) What is the probability that a child of this man and woman will have brown eyes?

_____

(1)

(f) What is the scientific term used for the child's eye colour?

Tick **one** box.

Chromosome ☐

Condition ☐

Genotype ☐

Phenotype ☐

(1)

(g) What effect will a mutation have?

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Tick **one** box.

Almost certainly have no effect ☐

Definitely change appearance ☐

Definitely be passed on to all children ☐

Probably cause a disease ☐

(1)

(Total 9 marks)

Q4.

Read the following.

> In the 1950s farmers in India could not grow enough rice to feed the rapidly increasing population.
>
> At the International Rice Research Institute (IRRI) scientists began a selective breeding programme with 10 000 different varieties of rice plants.
>
> In 1966 the IRRI produced a new variety called IR8 which gave a yield of up to ten times the traditional varieties. IR8 has short stems and large rice grains.
>
> IR8 was grown by farmers all over India so people had enough to eat.

(a) The IR8 variety of rice was produced by selective breeding.

Describe the steps the scientists would have taken to produce IR8

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(4)

(b) The IRRI has now developed several new varieties of genetically modified (GM) rice plants.

Some people in India agree and some people disagree with GM varieties of rice being grown.

Explain why.

_____

_____

_____

_____

_____

_____

_____

_____

(4)

(Total 8 marks)

Q5.

All living organisms are classified into groups.

Table 1 shows the classification of one species of wheat.

Table 1

Kingdom	Plant
Phylum	Angiosperms
Class	Monocotyledons
Order	Commelinids
Family	Poaceae
Genus	Triticum
Species	spelta

(a) What is the binomial name for the wheat in **Table 1**?

Tick **one** box.

Angiosperm monocotyledons ☐

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Poaceae triticum ☐

Species spelta ☐

Triticum spelta ☐

(1)

Modern classification systems compare the similarity between the DNA of organisms.

The more similar the DNA code, the more closely the organisms are related.

Table 2 shows DNA codes in five different organisms.

Table 2

	DNA Codes									**Number of differences in DNA code compared with the human sequence**
Human	**A**	**B**	**C**	**D**	**E**	**F**	**G**	**H**	**I**	
Pig	J	F	C	D	E	F	G	H	I	
Wheat	C	I	K	D	M	F	G	H	I	
Yeast	C	I	K	D	L	M	G	H	I	5
Chicken	J	F	C	D	M	F	G	H	I	3

(b) Complete the final column of **Table 2** for Pig and for Wheat.

(1)

(c) Which organism in **Table 2** appears to be most closely related to humans?

_____

(1)

(d) Give **one** reason why conclusions about the similarities between organisms should not be made using **only** the DNA codes in **Table 2**.

_____

_____

(1)

Chickens can be bred either for meat or for laying eggs.

The diagram below gives some information about different types of chicken.

Chicken bred for meat	**Chicken bred for laying eggs**

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Average weight in kg	1.8	0.7
Average number of eggs laid per week	2	6

(e) Describe how selective breeding has been used to produce chickens bred for meat.

_____

_____

_____

_____

_____

_____

(3)

(f) Give **one** advantage of selective breeding to the farmer.

_____

_____

(1)

(g) Selective breeding can lead to disadvantages for the chickens.

What is a possible disadvantage of selective breeding for the chickens bred for meat in the diagram above?

Tick **one** box.

The chickens will be genetically identical ☐

There will be less food to feed people ☐

The chickens may weigh too much to be able to stand ☐

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The chickens will be kept in better conditions ☐

(1)

(Total 9 marks)

Q6.

Dravet syndrome is caused by a genetic mutation.

Dravet syndrome causes epileptic seizures. An epileptic seizure is caused by unusual brain activity.

(a) Mutations often happen when cells divide.

Give **one** other cause of genetic mutations.

_____

_____

(1)

(b) Scientists have transferred the mutated gene for Dravet syndrome into zebrafish using genetic engineering.

This means the scientists could test a new drug to treat Dravet syndrome on the zebrafish.

Which **two** of the following are used during the process of genetic engineering?

Tick **two** boxes.

Enzymes ☐

Placebos ☐

Vaccines ☐

Vectors ☐

White blood cells ☐

(2)

(c) Scientists used the genetically engineered zebrafish to test the new drug.

Describe the processes that then need to happen to test the new drug before it can be used to treat all children with Dravet syndrome.

_____

_____

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(6)
(Total 9 marks)

Q7.

Millions of people get salmonella food poisoning each year.

(a) A new vaccine has been developed to protect people against salmonella food poisoning.

Explain how the vaccine prevents people becoming ill with salmonella food poisoning.

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_____

_____

(5)

(b) Salmonella food poisoning is caused by *Salmonella* bacteria.

Salmonella is treated with an antibiotic called nalidixic acid.

Nalidixic acid is no longer effective for some strains of *Salmonella* bacteria.

Explain how these bacteria have evolved by natural selection.

_____

_____

_____

_____

_____

_____

(3)

(Total 8 marks)

Q8.

Rose black spot is a disease that affects rose plants.

The leaves of infected plants develop black spots, then turn yellow and drop off the plant.

(a) Give the name of the substance in leaves that is broken down when leaves change from green to yellow.

_____

(1)

(b) Rose black spot can be transferred between plants in water droplets.

Draw **one** line from each method of black spot prevention to the explanation of why that method works.

Method	Explanation
	Fungus spores are removed
Plant roses with large gaps between plants	
	Helps leaves dry faster
	Increases infection in

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	warm weather
Clear dead leaves	
	Prevents rain falling on the leaves

(2)

(c) Fungicides can be sprayed on rose plants to prevent infection with black spot.

Some fungicides appear to be less effective than they were 10 years ago.

Suggest why the fungicides are less effective now compared with 10 years ago.

_____

_____

(1)

Some gardeners claim that rose black spot has become more of a problem since the Clean Air Act of 1958.

The table shows how the mass of sulfur dioxide (SO2) emissions has changed.

Year	**SO2 emissions from each source in megagrams**			**Total SO_2 emissions in megagrams**
	Power stations	**Manufacturing industry**	**Homes and transport**	
1970	3300	1750	**X**	6200
1980	3250	900	550	4700
1990	2900	450	300	3650
2000	900	150	150	1200
2010	250	100	50	400

(d) The sulfur dioxide emissions in the table are shown in megagrams.

Calculate value **X** in the table.

_____

_____

X = _____ Mg

(1)

(e) Give your answer to part (d) in kilograms.

1 megagram = 1000 kilograms

_____

_____

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X = _____ Kg

(1)

(f) How have power stations reduced their sulfur dioxide emissions?

Tick **one** box.

Power stations used more at night than during the day	☐
Power stations generate more electricity	☐
Power stations use less coal	☐
Power stations use more oil	☐

(1)

A gardener concluded that the information in the table shows the Clean Air Act of 1958 changed sulfur dioxide emissions.

(g) Give **one** reason to support the conclusion.

_____

_____

(1)

(h) Give **one** reason why the conclusion may **not** be valid.

_____

_____

(1)

(i) Suggest how changing sulfur dioxide emissions increased the number of cases of rose black spot.

_____

_____

_____

_____

(2)

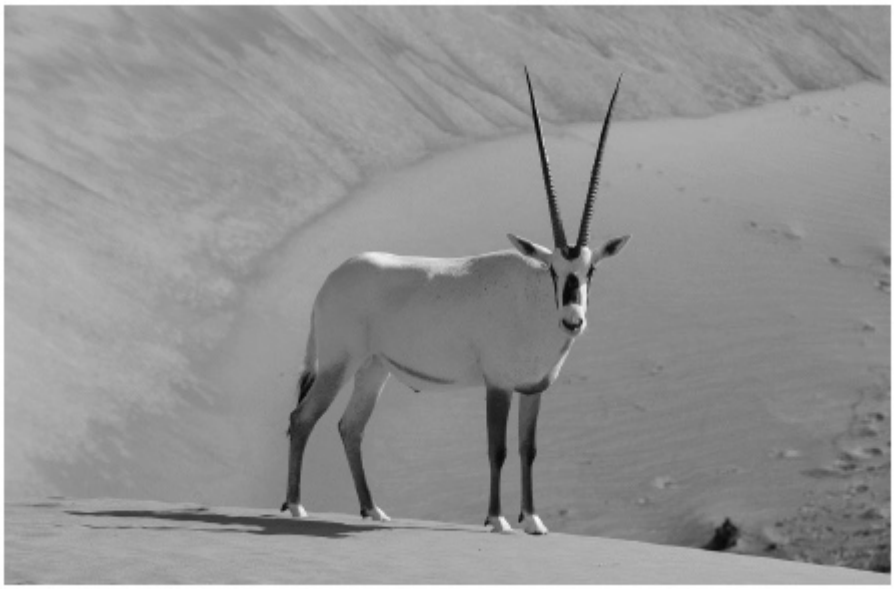
(Total 11 marks)

Q9.

The Arabian oryx (*Oryx leucoryx*) is a mammal that was once extinct in the wild.

The image shows an Arabian oryx.

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(a) What is the genus of the Arabian oryx?

Tick **one** box.

leucoryx ☐ *Oryx* ☐ *Oryx leucoryx* ☐

(1)

(b) Give **two** adaptations of the Arabian oryx to living in hot desert environments.

Use information from the image.

1. _____

_____

2. _____

_____

(2)

(c) The Arabian oryx uses its long horns to fight for territory and mates.

Describe how the long horns could have evolved.

_____

_____

_____

_____

_____

_____

(3)

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Arabian oryx from many different zoos were interbred so that they could be reintroduced to the wild.

(d) What is the name of this method of increasing the population of endangered animals?

Tick **one** box.

Breeding programme	☐
Genetic modification	☐
Natural selection	☐
Selective breeding	☐

(1)

(e) Explain why it was important to use Arabian oryx from many different zoos instead of one zoo.

_____

_____

(1)

(Total 8 marks)

Q10.

In 2012 scientists genetically modified goats to produce a specific protein in their milk.

The protein is found in the malarial parasite and can be used as a vaccine against malaria.

In the process:

- cells of goats are modified to produce the malarial protein
- the goats are milked
- the protein is removed from the milk
- the protein is purified.

(a) Describe how goat cells are modified so that they can produce the malarial protein.

_____

_____

_____

_____

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(4)

(b) The scientists have only modified female goat cells.

Suggest **one** reason why.

(1)

(c) Scientists can clone the genetically modified goats.

Suggest **two** reasons why the scientists clone the goats instead of producing offspring by sexual reproduction.

1.

2.

(2)

(d) The protein in the milk has to be extracted and purified before it can be used as a vaccine.

Scientists are improving the process so the protein will work as a vaccine **without** needing to be extracted and purified.

Give **two** possible advantages of producing goat's milk that contains an effective malaria vaccine.

1.

2.

(2)

(e) Malaria affects many people across the world.

Describe how the white blood cells might respond to an infection of the malaria pathogen.

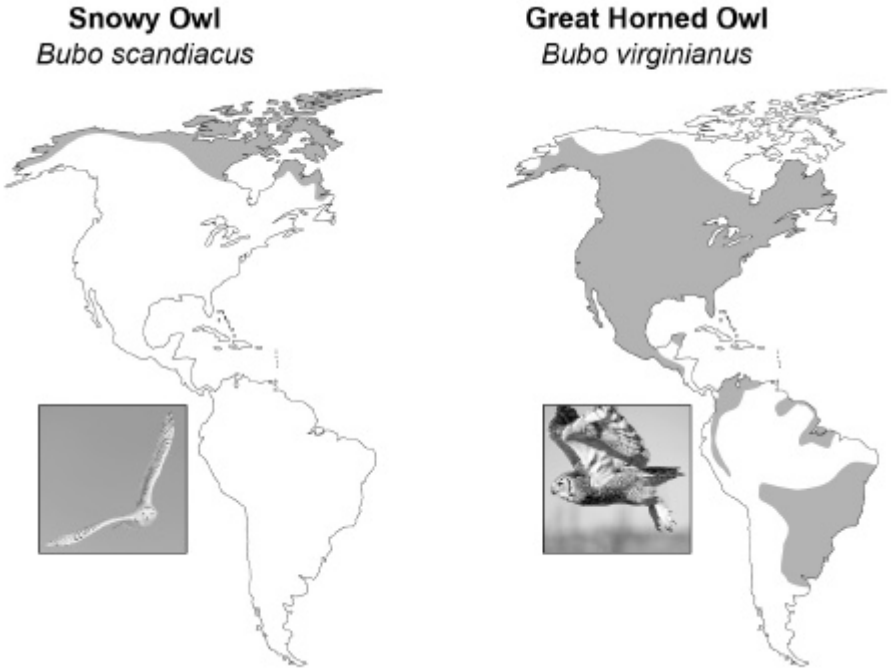
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(3)
(Total 12 marks)

Q11.

There are several species of owl alive today.

The image shows where two species of owl breed in North America.



(a) What is the genus name of the snowy owl?

(1)

(b) The snowy owl and the great horned owl are different species.

Define the term 'species'.

(1)

(c) Explain how the owls in the image may have evolved from a common ancestor to

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become different species.

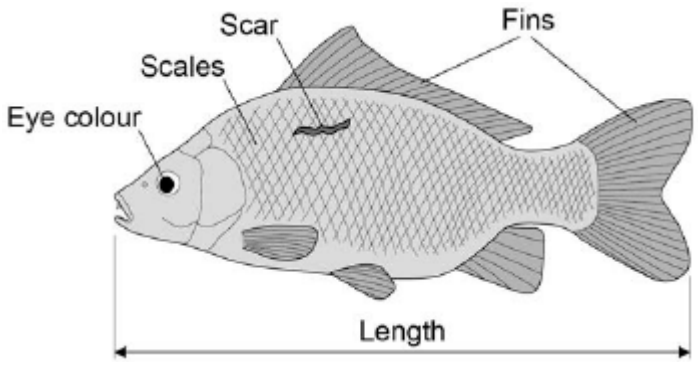
Use information from the image.

(6)
(Total 8 marks)

Q12.

Figure 1 shows a fish called a carp.

Figure 1



The characteristics of an animal can be a result of:

- only genetic causes

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- only environmental causes
- both genetic **and** environmental causes.

(a) Give **one** characteristic shown in **Figure 1** for each different cause.

Only genetic causes _____

Only environmental causes _____

Both genetic **and** environmental causes _____

_____

(3)

(b) Two alleles control the body colour of carp:

- brown (**B**)
- blue (**b**).

The brown allele is dominant to the blue allele.

The genetic cross from breeding two carp is shown in **Figure 2**.

Figure 2

	B	**b**
b	Bb	
b		

Complete **Figure 2**.

(2)

(c) Draw a ring around **one** blue offspring shown in **Figure 2**.

(1)

(d) What is the probability that the offspring from this genetic cross will be brown?

Tick **two** boxes.

0 ☐

0.25 ☐

0.5 ☐

1.0 ☐

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(1)

(e) Carp can produce large numbers of offspring.

The two carp crossed in **Figure 2** had 260 000 offspring.

Approximately how many offspring are expected to be brown?

_____

Brown carp offspring = _____

(1)

(f) A pond contains carp used for breeding.

The carp for breeding are brown or blue.

A red carp has been seen.

The red carp was **not** added to the pond.

Suggest what might have caused the red carp to appear.

_____

_____

(1)

(Total 9 marks)

Q13.

Moose are animals that eat grass.

Figure 1 shows a moose.

Figure 1



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Figure 2 shows a food chain.

Figure 2

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Grass → Moose → Wolves

(a) Name the secondary consumer shown in **Figure 2**.

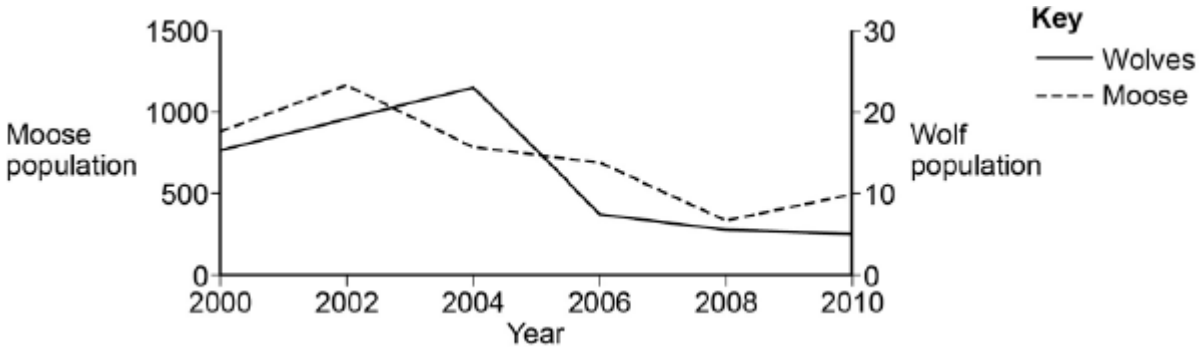
_____

(1)

(b) **Figure 3** shows how the moose population and wolf population have changed in one area.

This is a predator-prey cycle.

Figure 3



In 2004 the line on **Figure 3** for wolves is above the line for moose.

How does **Figure 3** show that there are more moose than wolves in 2004?

_____

_____

(1)

(c) Suggest why the moose population decreased between 2002 and 2004.

Use information from **Figure 3**.

_____

_____

(1)

(d) The number of wolves is one biotic factor that could affect the size of the moose population.

Give **two** other biotic factors that could affect the size of the moose population.

1. _____

_____

2. _____

_____

(2)

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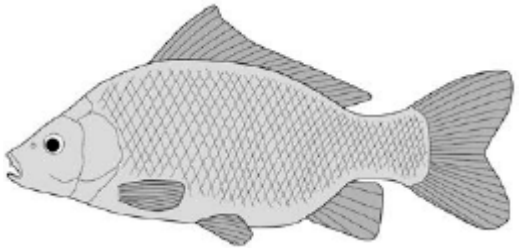
(e) Moose have distinct characteristics such as antlers.

Describe how moose may have evolved to have large antlers.

(5)
(Total 10 marks)

Q14.

The figure below shows a carp.



(a) A mutation causes a blue colour in some carp.

What is a mutation?

(1)

(b) Suggest how a mutation could cause a different colour in carp.

(1)

(c) Two alleles control the body colour of carp:

- brown (**B**)

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- blue (**b**).

The brown allele is dominant to the blue allele.

Two carp that are heterozygous for colour are crossed and produce 2.6×10^5 offspring.

Approximately how many of the offspring are expected to be blue?

Draw a genetic diagram to explain your answer.

Give your answer in standard form.

Number of offspring expected to be blue = _____

(5)

(d) A scientist wanted to find out whether a brown carp has the genotype **BB** or **Bb**.

Describe what genetic cross a scientist could do to determine this.

_____

_____

_____

_____

_____

_____

(2)

(Total 9 marks)

Q15.

A person's characteristics can be due to:

- environmental causes
- genetic causes
- both environmental and genetic causes.

(a) Complete **Table 1**.

Put a tick to show what each characteristic is due to.

Table 1

Characteristic	Characteristic due to		
	Environmental causes	Genetic causes	Both environmental and genetic causes
Eye colour			

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A scar			
Weight			

(3)

(b) Draw **one** line from each key term to the correct definition.

Key term	**Definition**
	The set of alleles for a characteristic
Genotype	The genus of an organism
	The inheritance of chromosomes
Phenotype	The mutation of genes
	The physical characteristic of an organism

(2)

(c) Farmers use selective breeding to control the characteristics in cows.

Table 2 shows the stages of selective breeding in cows.

Complete **Table 2** to show the correct order of the stages.

The first stage has been numbered for you.

Table 2

Stage in selective breeding	**Order of stage**
Cows are bred over many generations	
Parents are bred together	
Cows with the desired characteristics are chosen	1
Calves with the most desired characteristics are bred together	

(2)

(d) Farmers selectively breed cows for many different reasons.

Suggest **two** characteristics that cows may be bred for.

Do **not** suggest coat colour.

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1. _____

_____

2. _____

_____

(2)

(e) Selective breeding can lead to problems.

Suggest how problems caused by selective breeding in cows can have negative financial effects for the farmer.

_____

_____

_____

_____

(2)

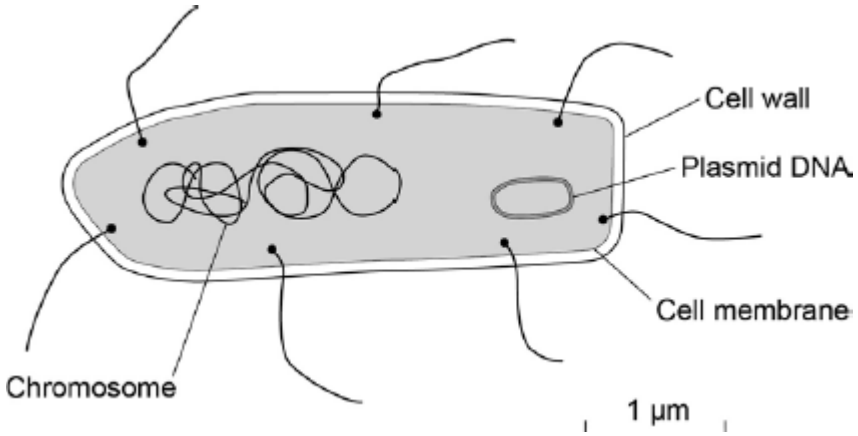
(Total 11 marks)

Q16.

Bacteria can cause disease.

Figure 1 shows some features of a *Salmonella* bacterium.

Figure 1



(a) Draw **one** line from each feature of the *Salmonella* bacterium to the function.

Feature	Function
Cell membrane	Controls the movement of substances into and out of the cell
	Carries genetic information

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Plasmid DNA	Provides support and protection
	The site of protein synthesis

(2)

(b) How is *Salmonella* spread between people?

Tick **one** box.

- Animal bites ☐
- Contaminated food ☐
- Sneezing ☐
- Sexual contact ☐

(1)

(c) Give **two** ways you could stop *Salmonella* from spreading.

1. _____

_____

2. _____

_____

(2)

(d) Harmful bacteria can also be useful.

Scientists are doing research to find out if *Salmonella* can be used in a vaccine to treat cancer.

The *Salmonella* vaccine can be injected into the blood or swallowed in a tablet.

One benefit of injecting the vaccine is that it gets to the cancer quickly in the blood.

What is another benefit?

Tick **one** box.

- All cancers can be treated by the injection ☐
- It will not cause sickness and diarrhoea side effects ☐

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The injection is not painful to the patient ☐

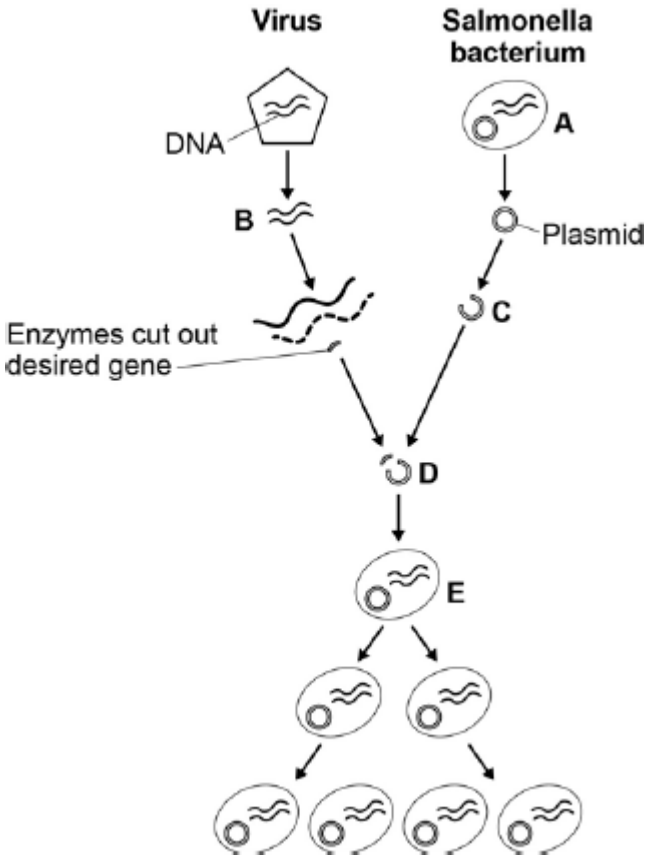
The injection introduces cancer cells into the body ☐

(1)

(e) The *Salmonella* bacterium used in the vaccine is genetically modified using part of a virus.

Look at **Figure 2**.

Figure 2



Complete the sentences.

Use the letters from **Figure 2**.

Bacteria reproduce quickly in part _____

DNA with the desired gene is removed from the virus in part _____

The chosen gene is inserted into the plasmid in part _____

(3)

(Total 9 marks)

Q17.

Humans can use different methods to produce animals and plants with desired

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characteristics.

The figure below shows some different breeds of horse.



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(a) All breeds of horse are of the same species.

Suggest what you could do to show this.

_____

_____

_____

_____

(2)

(b) Horse racing is an ancient sport.

Selective breeding has been used for centuries to produce racehorses.

Describe the steps involved in selective breeding to produce a racehorse.

_____

_____

_____

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(3)

(c) Another way of producing organisms with desired characteristics is genetic engineering.

Bt cotton is a variety of cotton that has been genetically engineered to produce a poison.

The poison kills several different species of insect that feed on cotton plants.

The poison is naturally produced by a soil bacterium called *Bacillus thuringiensis*.

Describe how cotton plants can be genetically engineered to produce the Bt poison.

(3)

(d) Describe the advantages and disadvantages of growing Bt cotton.

(4)

(Total 12 marks)

Q89.

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(a) (i) Darwin's theory of evolution states that all species of living things have evolved from simple life forms.

Draw a ring around the correct answer to complete the sentence.

Simple life forms first developed on Earth more than

3 thousand years ago. **3 million years ago.** **3 billion years ago.**

(1)

(ii) Darwin's theory of evolution was not accepted when he first suggested it.

Give **one** reason why.

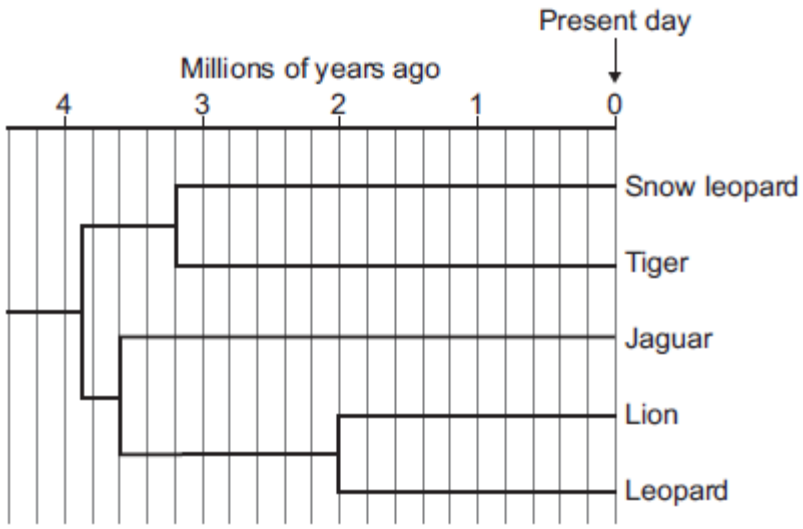
_____

_____

(1)

(b) **Figure 1** shows an evolutionary tree for the 'big cats'.

Figure 1



(i) How long ago did the lion evolve?

_____ million years ago

(1)

(ii) Which animal is the closest relative to the tiger?

_____

(1)

(c) **Figure 2** shows a tiger. Tigers are large, striped animals. Tigers live and hunt in grassland and forest areas of Asia. They feed on animals such as deer.

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Figure 2



© Jupiterimages/PHOTOS.com/Thinkstock

Suggest how stripes help the tiger to survive in its habitat.

_____

_____

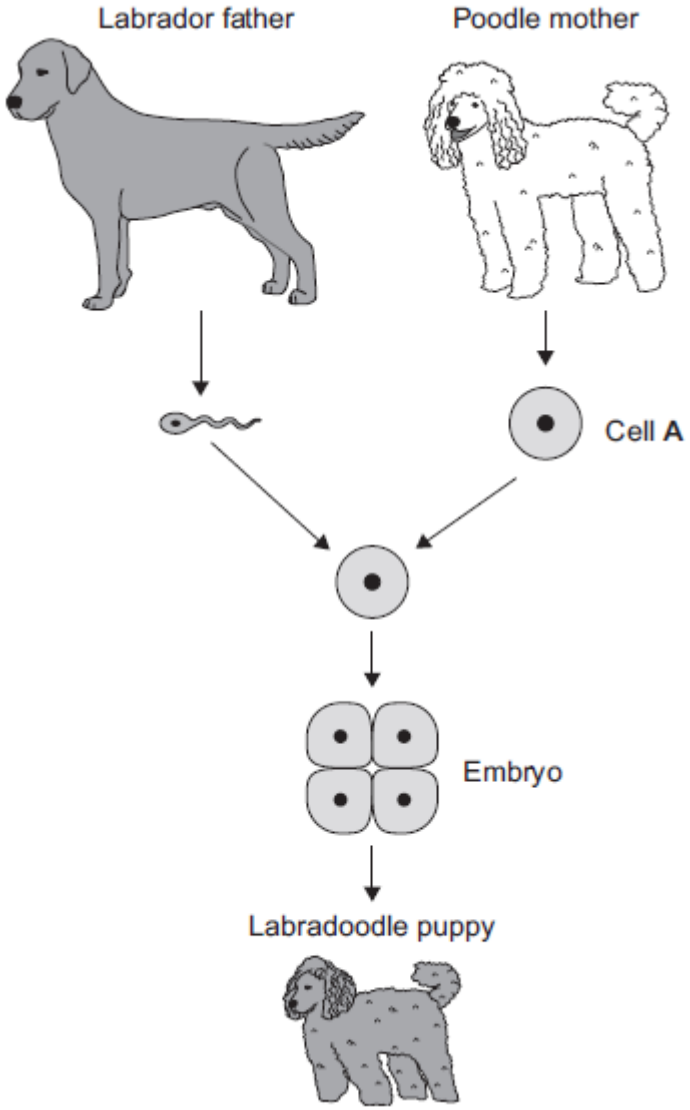
(1)

(Total 5 marks)

Q90.

The diagram shows how a Labrador can be crossed with a Poodle to produce a Labradoodle puppy.

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(a) (i) What is the name of Cell **A** shown above?

_____

(1)

(ii) Draw a ring around the correct answer to complete each sentence.

The sperm cell and Cell **A** are types of

embryo. **gamete.** **gene.**

The type of reproduction shown in the diagram is called

asexual reproduction. **tissue culture.** **sexual reproduction.**

(2)

(b) The Labradoodle puppy has some characteristics of each of its parents, but it is not identical to either parent.

(i) Give **one** characteristic of the Labradoodle puppy which is similar to the Labrador father but **not** the Poodle mother.

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_____

_____

(1)

(ii) Give **one** characteristic of the Labradoodle puppy which is similar to the Poodle mother but **not** the Labrador father.

_____

_____

(1)

(Total 5 marks)

Q91.

Tigers are large, striped animals that feed on deer. Tigers live and hunt in grassland and forest areas of Asia.

The image shows a tiger.



© Jupiterimages/PHOTOS.com/Thinkstock

The ancestor of the tiger did not have stripes.

Use your knowledge of Darwin's theory of evolution to suggest how the tiger evolved to have stripes.

_____

_____

_____

_____

_____

_____

_____

_____

(Total 4 marks)

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Q92.

The Arctic flounder is a fish that can survive in extremely cold waters.

In the 1990s scientists transferred genes from the Arctic flounder into tomatoes to create a frost-resistant tomato. The tomatoes were never grown commercially, partly because of public concern.

(a) What is the name of the technique in which genes are transferred from one organism into the cells of another organism?

_____

(1)

(b) Describe the advantages **and** disadvantages of using this technique to produce crop plants such as frost-resistant tomatoes.

_____

_____

_____

_____

_____

_____

(3)

(Total 4 marks)

Q93.

Some species of wolf are endangered and are at risk of becoming extinct.

The image shows a Red wolf. The Red wolf is an endangered species.



© SGRIES00/iStock/Thinkstock

Red wolves are only in season (fertile) once a year.

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Scientists have developed a method that could be used to protect Red wolves from becoming extinct.

Sperm from a male Red wolf can be used to fertilise eggs from a female Red wolf. The embryos produced can then be frozen.

Later, when female wolves are in season and able to support a pregnancy, the embryos are implanted into their wombs.

All the Red wolf cubs produced would be different from their biological parents and different from each other.

(a) Explain why the Red wolf cubs would be different from their biological parents and different from each other.

_____

_____

_____

_____

_____

_____

(3)

(b) In the long-term it would be better to produce Red wolves that are different from each other.

Suggest why.

_____

_____

(1)

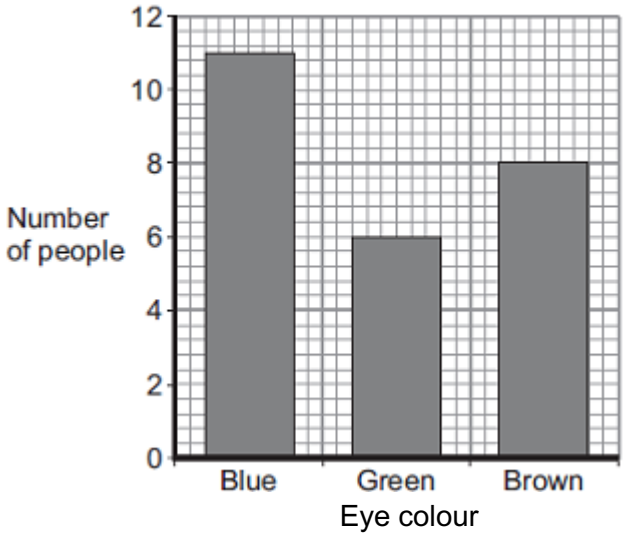
(Total 4 marks)

Q94.

A student carried out a survey of eye colour in her class.

Her results are shown in the figure below.

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(a) What type of variable is eye colour?

Draw a ring around the correct answer.

categoric **continuous** **control**

(1)

(b) (i) How many people in the class had blue eyes?

Number of people with blue eyes = _____

(1)

(ii) How many people were in the student's class?

_____

_____

Number of people in the class = _____

(1)

(iii) Give **one** conclusion that can be made from the data in the figure above.

_____

_____

(1)

(c) (i) Use the correct answer from the box to complete the sentence.

a cell	**a gene**	**nucleus**

Eye colour is controlled by _____ .

(1)

(ii) Use the correct answer from the box to complete the sentence.

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mother's milk	enzyme	sex cells

The information for eye colour is passed from parents to offspring in the

_____ .

(1)

(Total 6 marks)

Q95.

The figure below shows flamingos. Flamingos are birds. They have long legs.

They can walk in deep water and use their long necks to reach food in the mud.



How would Darwin have explained the evolution of the flamingo's long neck?

Use the correct answer from the box to complete each sentence.

mutation	natural selection	sexual reproduction	variation

In a population of flamingos there are birds with different lengths of neck.

This range of differences in neck length is called _____ .

The flamingos with longer necks are better adapted to feed in deeper waters. They are more likely to survive than flamingos with shorter necks.

This is an example of _____ .

The surviving flamingos pass on their genes for a longer neck to their offspring

during _____ .

(Total 3 marks)

Q96.

Researchers carried out a survey to find out about the variation in eye colour in different European countries.

Table 1 shows the number of people with blue, brown, green or other eye colours and the total number of people surveyed in each country.

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Table 1

Eye colour	Number of people			
	Britain	**Germany**	**Ireland**	**Italy**
Blue	711	539	185	22
Brown	661	462	145	145
Green	335	222	86	19
Other	391	269	79	45
Total	2098	1492	495	231

Table 2 shows the percentage of the people surveyed in each country who had each different eye colour.

Table 2

Eye colour	Percentage (%) of people surveyed			
	Britain	**Germany**	**Ireland**	**Italy**
Blue	33.89	36.13	37.37	9.52
Brown	31.51	30.97	29.29	
Green	15.96	14.88	17.37	8.23
Other	18.64	18.03	15.96	19.48

(a) To compare results, it is better to use the percentage of people with each eye colour instead of the number of people with each eye colour.

Suggest why.

_____

_____

(1)

(b) (i) In **Table 2** there is no data for the percentage of people in Italy with brown eyes.

Use information from **Table 1** to calculate the percentage of people surveyed in Italy who had brown eyes.

_____

_____

Percentage of people surveyed in Italy with brown eyes _____ %

(2)

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(ii) Use the data in **Table 2** to give **one** conclusion about the variation in eye colour between different countries.

_____

_____

_____

(1)

(iii) Suggest how the survey could be improved so that the results would be more accurate.

_____

_____

(1)

(Total 5 marks)

Q97.

One type of soil bacterium produces a poison. The poison kills some insects that feed on cotton plants.

A cotton plant



© Michael Valdez/iStock

(a) Cotton plants can be genetically modified to produce this poison.

Draw a ring around the correct answer to complete each sentence.

The gene that codes for the production of the poison is cut from the

chromosome of	an insect.
	the soil bacterium.
	the cotton plant.

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This is done using

an enzyme.
a microorganism.
scissors.

The gene is then transferred to the cells of the

soil bacterium.
cotton plant.
insect pests.

(3)

(b) Read the following statements about genetically modified (GM) cotton.

- GM cotton reduces the need to use pesticides.
- GM cotton may kill useful insects.
- GM cotton produces higher yields.
- GM cotton may cause wild plants to produce the poison.
- Some people will not wear clothes made from GM cotton.

Some people do not agree with growing GM cotton plants.
Other people think it is a good idea to grow GM cotton plants.

Use information given in the statements to answer the following question.

Suggest **one economic advantage** and **two environmental disadvantages** of growing GM cotton plants.

One economic advantage: _____

_____

_____

Two environmental disadvantages: _____

_____

_____

_____

_____

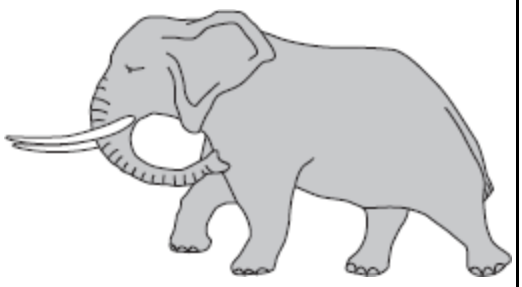
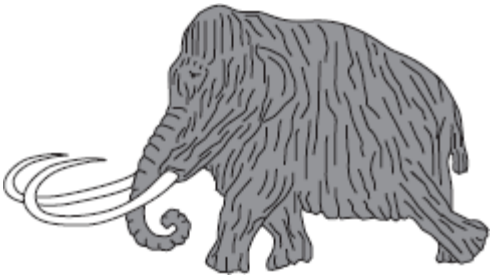
(3)

(Total 6 marks)

Q98.

The table gives some information about the African elephant and the woolly mammoth.

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African elephant	Woolly mammoth
	
Mass of male: 6000 kg	Mass of male: 8000 kg
Habitat: near the equator	Habitat: northern Europe
An endangered species	Extinct

(a) Use information from the table to help you to answer the following questions.

(i) The diagrams show that both animals have tusks. Tusks help animals to compete.

Suggest **two** things animals may compete for.

1. _____

2. _____

(2)

(ii) The woolly mammoth was adapted to survive during the ice age.

Use information from the table to suggest **two** ways the woolly mammoth was adapted to survive in the cold.

Adaptation 1: _____

How this helped the woolly mammoth survive: _____

_____

_____

Adaptation 2: _____

How this helped the woolly mammoth survive: _____

_____

_____

(4)

(b) Darwin's theory of evolution says that elephants developed a trunk because animals with a longer nose had an advantage over animals with a shorter nose.

The elephants with a longer nose survived to breed and pass on the gene for a

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longer nose to their offspring.

(i) Name the process by which evolution happens.

_____

(1)

(ii) Describe how Lamarck's theory would explain how elephants developed a trunk.

_____

_____

_____

_____

(2)

(Total 9 marks)

Q99.

A cotton plant



© Michael Valdez/iStock

Bacillus thuringiensis (Bt) is a soil bacterium.
It produces a poison that kills several different species of insect that feed on cotton plants.

Over 90% of the cotton plants grown in Australia, the USA and China today are genetically modified to produce the Bt poison, resulting in less crop damage.

(a) Explain in detail how cotton plants can be genetically modified to produce the Bt poison.

_____

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_____

_____

_____

_____

_____

_____

_____

(4)

(b) Many environmentalists do not think we should grow genetically modified cotton plants.

Suggest **two** reasons why.

_____

_____

_____

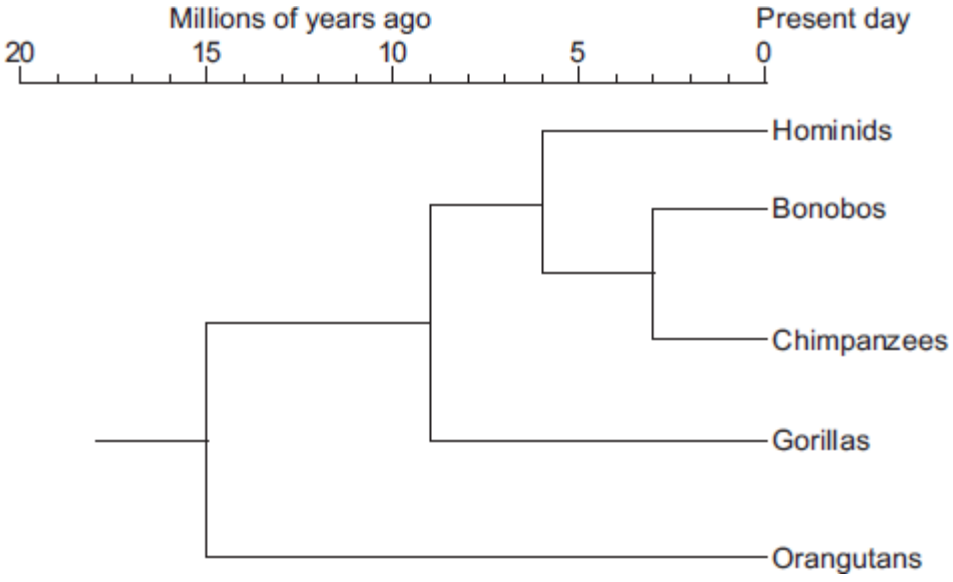
_____

(2)

(Total 6 marks)

Q100.

The diagram shows an evolutionary tree for the great apes.



(a) (i) How many years after gorillas did hominids evolve?

_____ millions of years

(1)

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(ii) Which animal in the diagram is the most distant relative of chimpanzees?

_____

(1)

(b) Charles Darwin is well known for his theory of evolution.

Complete the sentence.

Darwin's theory states that evolution happens by a process called

_____

(1)

(Total 3 marks)

Q101.

Darwin's theory of evolution states that all species of living things have evolved from simple life forms.

(a) Draw a ring around the correct answer in the box to complete the sentence.

Simple life forms first developed on Earth more than

3 thousand
3 million
3 billion

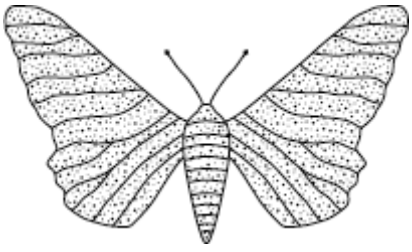
years ago.

(1)

(b) Before the 19th Century, almost all peppered moths in the UK were light-coloured. During the 19th Century, factories began to pollute the environment with soot. A dark-coloured form of the moth then became more common.

Birds feed on both types of moth.

Pale form
(light-coloured)



Dark form
(dark-coloured)



Use words from the box to complete each sentence.

Use words from the box to label structures **A**, **B** and **C**.

evolution	**mutation**	**selection**	**variation**

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The change in a gene that produced the dark-coloured moth was caused by

_____

In the late 19th Century, birds ate mainly the light-coloured moths. More of the dark-coloured moths survived.

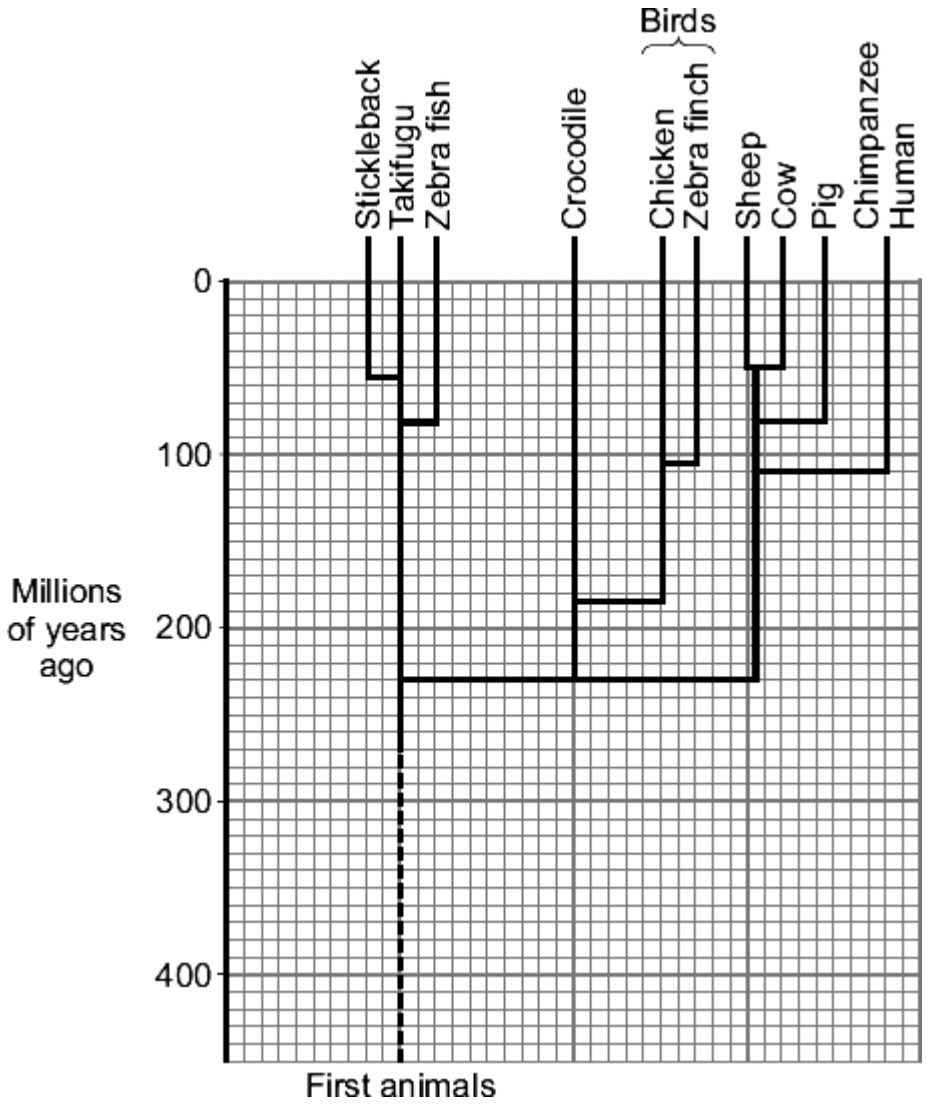
This is an example of _____

Over a long period of time, new species of moths develop.

This is an example of _____

(3)

(c) The diagram shows how and when some different types of animal are thought to have evolved.



(i) Which animal is most closely related to birds?

_____

(1)

(ii) How long ago did pigs evolve?

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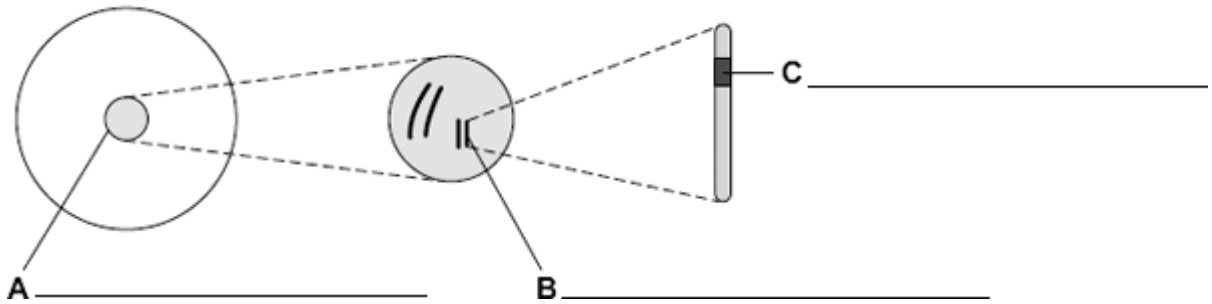
(1)

(Total 6 marks)

Q102.

Diagram 1 shows an animal cell and some of the structures inside the cell.

Diagram 1



(a) Use words from the box to label structures **A**, **B** and **C**, on **Diagram 1**.

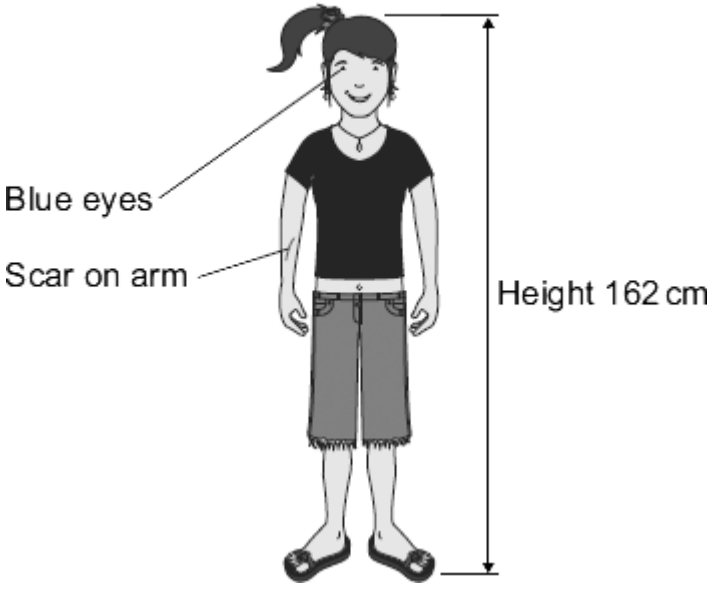
Characteristic	**Chromosome**	**Gamete**	**Gene**	**Nucleus**

(3)

(b) Factors that may affect characteristics include genes and the environment.

Diagram 2 shows some of the characteristics of a girl.

Diagram 2



Draw **one** line from each characteristic in **List A** to the factor(s) that affect the characteristic in **List B**.

List A **Characteristic**	**List B** **Factor(s) that affect the characteristic**

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Blue eyes	Affected by genes only
Height 162 cm	Affected by environment only
Scar on arm	Affected by both genes and the environment
	Affected by neither genes nor the environment

(3)

(Total 6 marks)

Q103.

Head lice live on people's heads and feed on their blood.
Head lice cause itching and people may develop open wounds from scratching.



By CDC/James Gathany (http://phil.cdc.gov/phil/ #9217) [Public domain], via Wikimedia Commons

A poisonous chemical has been used to kill head lice for many years.
Recently, the chemical has not been as successful at killing head lice. Many head lice now survive treatment with the chemical.

Explain in terms of **natural selection** why most head lice are no longer killed by the chemical.

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_____

_____

_____

_____

_____

_____

(Total 3 marks)

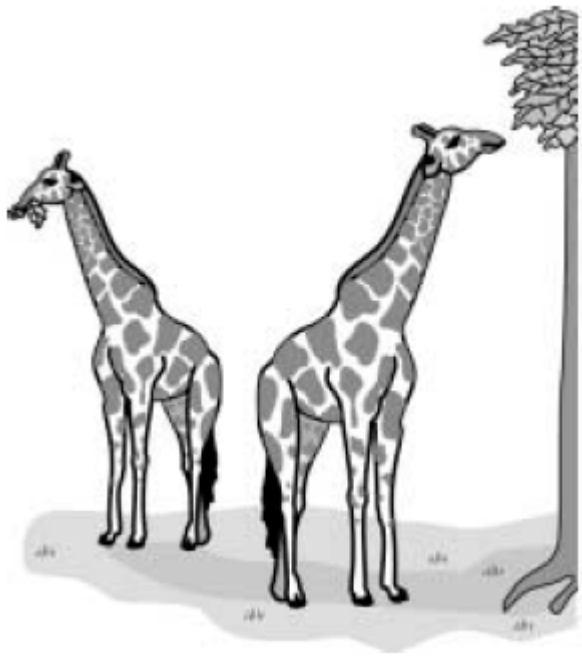
Q104.

(a) What is meant by natural selection?

_____

(1)

Giraffes feed on the leaves of trees and other plants in areas of Africa.



Darwin explained the evolution of the long neck in terms of getting leaves from the tall trees.

Recently, scientists have tried to explain how the long neck of the giraffe might have evolved.

These are some of the scientists' observations.

- Giraffes spend almost all the dry season, when there is not much food, feeding from low bushes.
- Only in the wet season do they feed from tall trees when there are plenty of new leaves.
- Females spend over 50 % of their time feeding with their necks horizontal.

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- Both sexes feed faster and most often with their necks bent.
- Long giraffe necks are very important in male-to-male combat. Males fight each other with their long, powerful necks.

(b) Do the observations support or reject the explanation that the long neck of the giraffe evolved to get leaves from tall trees?

Draw a ring around your answer. **Support / Reject**

Explain the reason for your answer.

(3)

(c) Use the scientists' recent observations to give another explanation for the evolution of the long neck of the male giraffe.

(3)

(Total 7 marks)

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