

VARIATION AND EVOLUTION PART 2

Q1.

The use of cloned animals in food production is controversial.

It is now possible to clone 'champion' cows.

Champion cows produce large quantities of milk.

- (a) Describe how adult cell cloning could be used to produce a clone of a 'champion' cow.

(4)

- (b) Read the passage about cloning cattle.

The Government has been accused of 'inexcusable behaviour' because a calf of a cloned American 'champion' cow has been born on a British farm. Campaigners say it will undermine trust in British food because the cloned cow's milk could enter the human food chain.

But supporters of cloning say that milk from clones and their offspring is as safe as the milk we drink every day.

Those in favour of cloning say that an animal clone is a genetic copy. It is not the same as a genetically engineered animal. Opponents of cloning say that consumers will be uneasy about drinking milk from cloned animals.

Use the information in the passage and your own knowledge and understanding to evaluate whether the government should allow the production of milk from cloned 'champion' cows.

Remember to give a conclusion to your evaluation.

(5)

(Total 9 marks)

Q2.

Some organisms are in danger of extinction.

The photograph shows an African elephant feeding on tree leaves.



(a) Read the information about elephants and humans in Africa.

- The African elephant is the largest land animal.
- The African elephant feeds on lots of leaves.
- Adult African elephants have no natural predators.
- Elephants are killed by poachers for their ivory tusks.
- African elephants live for about 70 years.
- Most African elephants live in large herds.
- Land available to elephants is disappearing rapidly.

The African elephant is now extinct in many parts of Africa.

Use information from the list to give **three** reasons why.

1. _____

2. _____

3. _____

(3)

(b) Organisms that are in danger of extinction can be cloned.

List A gives the names of three different cloning techniques.

List B gives information about these techniques.

Draw a line from each technique in **List A** to the correct information about it in **List B**.

List A
Technique

List B
Information

Adult cell cloning

Embryo transplanting

Tissue culture

Small groups of cells from parts of a plant are grown on a special jelly.

Cells from a developing animal are separated before they become specialised and then placed into host mothers.

Genes are cut out from chromosomes and inserted into other organisms.

A nucleus is removed from an unfertilised egg cell. The nucleus from a body cell is inserted into the egg cell. An electric shock causes the egg to start to divide.

(3)

(Total 6 marks)

Q3.

The photograph shows a snake eating a toad.



Cane toads were first introduced into Australia in 1935. The toads contain toxins and most species of Australian snake die after eating the toad.

The cane toad toxin does not affect all snakes the same way. Longer snakes are less affected by toad toxin.

Scientists investigated how red-bellied black snakes had changed in the 70 years since cane toads were introduced into their area. They found that red-bellied black snakes had become longer by around 3 – 5 %.

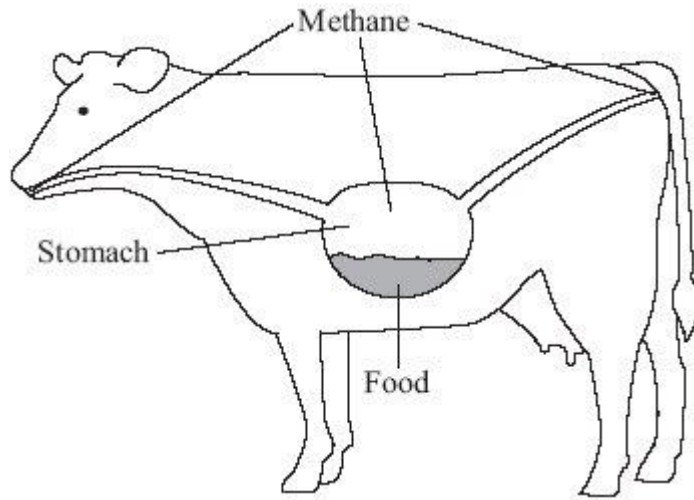
Suggest an explanation for the change in the body length of the red-bellied black snakes since the introduction of the cane toads.

(Total 4 marks)

Q4.

Scientists are investigating how to reduce methane emissions from cattle.

Most of this methane is emitted by the cows belching.



Scientists have found that less methane is belched if the cows eat high-sugar rye grass.

This rye grass has been produced by genetic engineering.

- (i) Suggest how the high-sugar rye grass might have been produced by genetic engineering.

(3)

- (ii) Some people might object to the growing of genetically-engineered, high-sugar rye grass for feeding cattle.

Give **two** reasons why.

1. _____

2. _____

(2)

(Total 5 marks)

Q5.

Scientists have produced many different types of GM (genetically modified) food crops.

- (a) Use words from the box to complete the sentence about genetic engineering.

clones	chromosomes	embryos	genes
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GM crops are produced by cutting _____ out of the _____ of one plant and inserting them into the cells of a crop plant.

(2)

(b) Read the information about GM food crops.

- Herbicide-resistant GM crops produce higher yields.
- Scientists are uncertain about how eating GM food affects our health.
- Insect-resistant GM crops reduce the total use of pesticides.
- GM crops might breed naturally with wild plants.
- Seeds for GM crops can be bought from only one manufacturer.
- The numbers of bees will fall in areas where GM crops are grown.

Use this information to answer these questions.

(i) Give **two** reasons why some farmers are in favour of growing GM crops.

1. _____

 2. _____

(2)

(ii) Give **two** reasons why many people are against the growing of GM crops.

1. _____

 2. _____

(2)

(Total 6 marks)

Q6.

The dodo is an extinct bird. The drawing shows an artist's impression of the bird.



The dodo lived on a small island in the middle of the Indian Ocean. Its ancestors were pigeon-like birds which flew to the island millions of years ago. There were no predators on the island. There was a lot of fruit on the ground. This fruit became the main diet of the birds. Gradually, the birds became much heavier, lost their ability to fly and evolved into the dodo.

- (a) Suggest an explanation for the evolution of the pigeon-like ancestor into the flightless dodo.

(4)

- (b) The dodo became extinct about 80 years after Dutch sailors first discovered the island in the eighteenth century.

Scientists are uncertain about the reasons for the dodo's extinction.

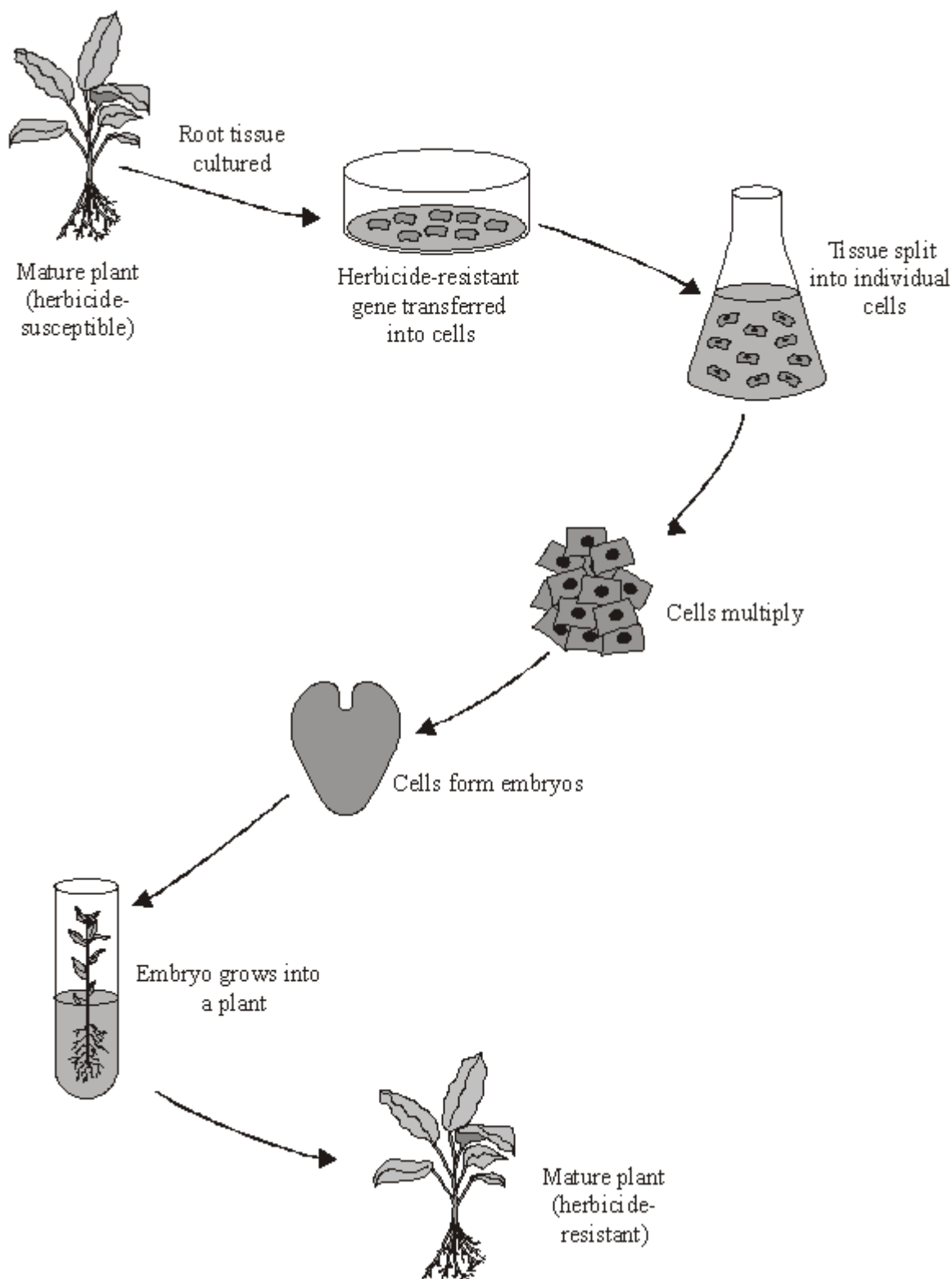
Suggest an explanation for this uncertainty.

(1)

(Total 5 marks)

Q7.

The diagram shows one method of producing herbicide-resistant crop plants.



(a) (i) The herbicide-resistance gene is obtained from a herbicide-resistant plant.

Which structure in a cell carries the genes?

(1)

(ii) How is the herbicide-resistance gene cut out of this structure?

(1)

- (b) Apart from having the herbicide-resistance gene, the herbicide-resistant plants are identical to the herbicide-susceptible plants.

Explain why.

(2)

- (c) Suggest **one** advantage to a farmer of growing herbicide-resistant crops.

(1)

- (d) Many people are opposed to the growing of herbicide-resistant crops produced in this way.

Suggest **one** reason why.

(1)

(Total 6 marks)

Q8.

In the 1850s, Gregor Mendel carried out breeding experiments using peas.

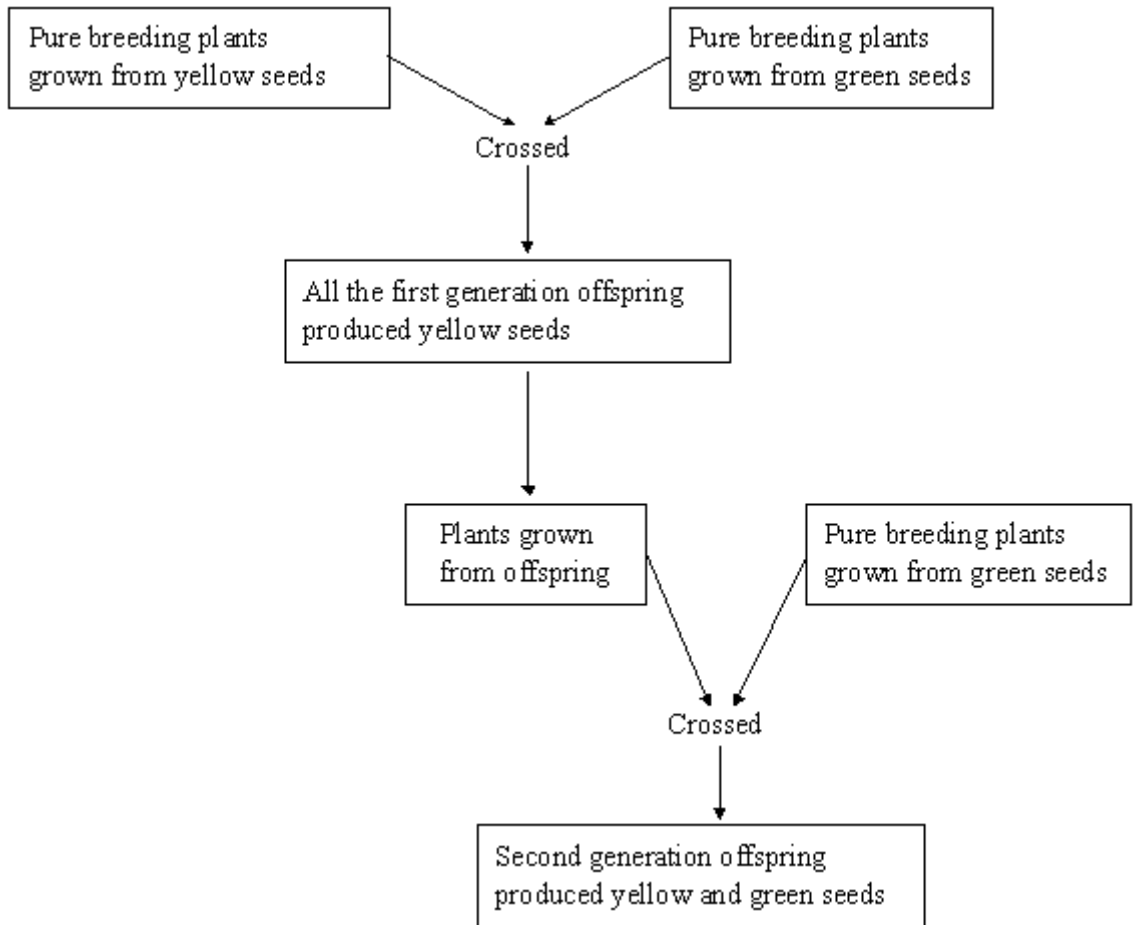
- (a) The importance of Mendel's work was not recognised until the early 1900s.

Explain why.

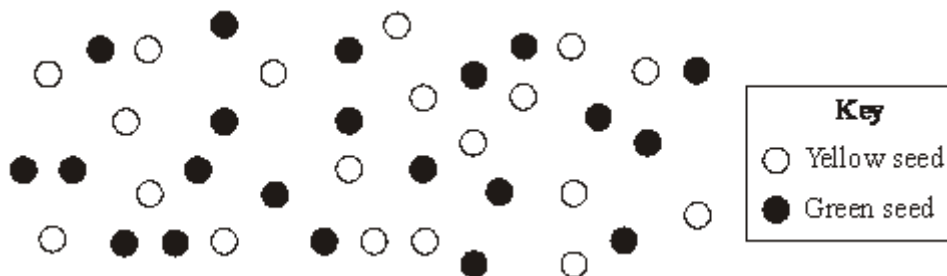
(2)

- (b) A student repeated one of Mendel's experiments.

The flow chart shows her procedure.



The diagram shows a representative sample of seeds produced by second generation plants.



- (i) Describe how the student could obtain a sample that is representative of seeds produced by the second generation.

(1)

- (ii) What was the approximate ratio of yellow seeds to green seeds in the seeds produced by the second generation?

(1)

- (iii) Seed colour in peas is controlled by a single gene which has two alleles.

Use a genetic diagram to show why this ratio of yellow seeds to green seeds was produced by the second generation.

Use the symbol **A** to represent the dominant allele, and **a** to represent the recessive allele.

(4)

(Total 8 marks)

Q9.

The diagram shows an evolutionary tree for a group of animals called primates.

The names of extinct animals are printed in italics e.g. *Nycticeboides*.

The drawings show animals that are alive today.

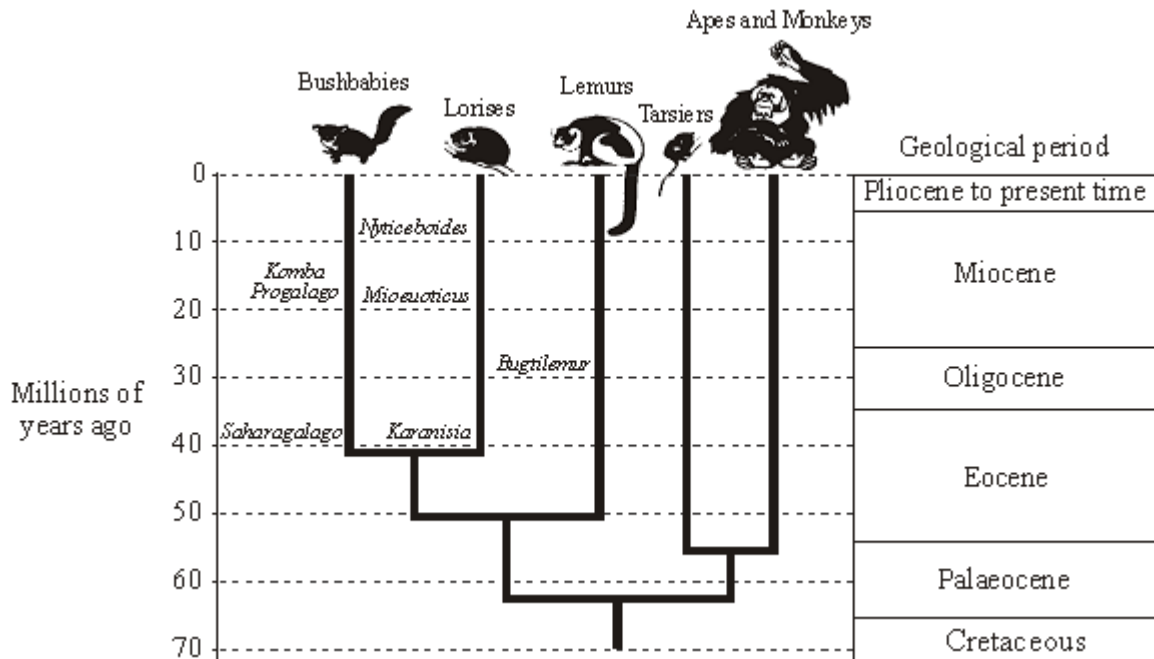


Illustration by Lucrezia Beerli-Bieler

- (a) (i) How many million years ago did *Karanisia* first appear?
 _____ millions of years ago. (1)
- (ii) During which geological period did the Apes and Monkeys begin to evolve?
 _____ (1)
- (iii) Which group of primates alive today are the closest relatives of the Lorises?
 _____ (1)
- (b) Darwin was the first scientist to state that humans and other primates had common ancestors.
 Many people were against Darwin's ideas at that time.
 Give **two** reasons why they were against his ideas.
 1. _____

2. _____

(2)
(Total 5 marks)

Q10.

The photograph shows a Crossbill.



A Crossbill feeds by using its bill (beak) to force apart the scales on conifer cones. It then uses its tongue to extract the seeds. If the bill is clipped it grows back again.

Scientists were interested in the evolution of the bill of the Crossbill.

In an investigation, they clipped the bills of several Crossbills so that their bills no longer crossed.

They observed that Crossbills with clipped bills took much longer to get seeds.

Use information from the investigation to suggest an explanation for the evolution of the bill in the Crossbill.

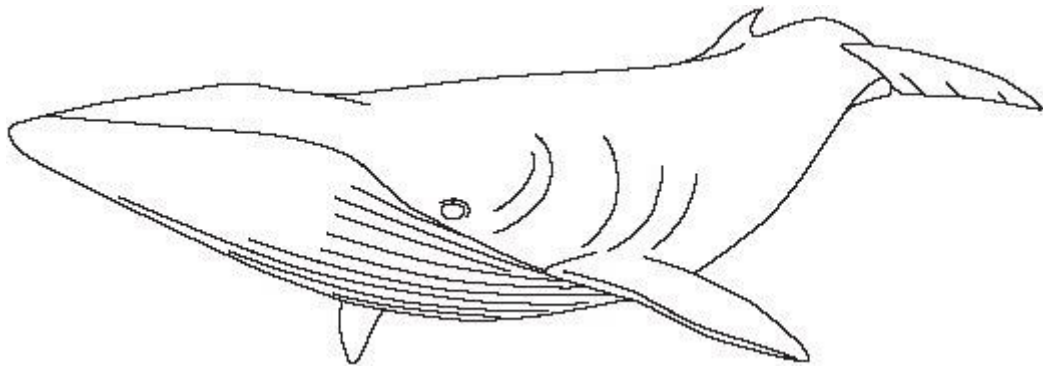
In your explanation, use the ideas of *selection*, *competition* and *mutation*.

(Total 4 marks)

Q11.

(a) **Figure 1** shows a minke whale. Whales live in the sea.

Figure 1



Write down **two** ways in which the body of the whale is adapted for swimming.

1. _____

2. _____

(2)

(b) **Figure 2** shows the skeleton of a minke whale.

Figure 2

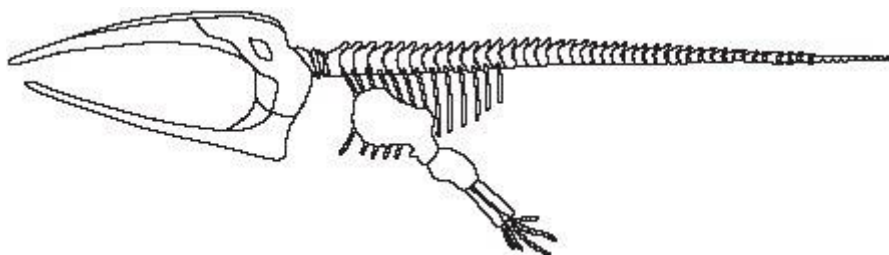
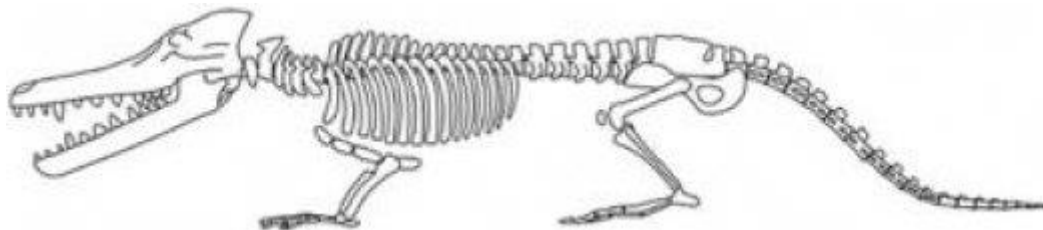


Figure 3 shows the fossil skeleton of an extinct whale.

Figure 3



Hans G Thewissen/ The Thewissen Lab

- (i) Apart from size, give **two** differences between the skeleton of the minke whale and the fossil skeleton of the extinct whale.

1. _____

2. _____

(2)

- (ii) In each of the sentences below, draw a ring around the correct answer.

Life on Earth first developed more than three

billion

million

thousand

years ago.

Fossils

disprove

give evidence for

prove

the theory of evolution.

(2)

(Total 6 marks)

Q12.

- (a) Use words from the box to complete the sentences about curing disease.

antibiotics

antibodies

antitoxins

painkillers

statins

The substances made by white blood cells to kill pathogens are called _____

The substances made by white blood cells to counteract poisons produced by pathogens

are called _____

Medicines which kill bacteria are called _____

(3)

(b) The MMR vaccine protects people against three diseases.

Write down the names of **two** of these diseases.

1. _____

2. _____

(2)

(c) All vaccinations involve some risk.

The table shows the risk of developing harmful effects:

- from the disease if a child is **not** given the MMR vaccine;
- if a child **is** given the MMR vaccine.

Harmful effect	Risk of getting the harmful effect from the disease (if not vaccinated)	Risk of getting the harmful effect from MMR vaccine
Convulsions	1 in 200	1 in 1000
Meningitis	1 in 3000	Less than 1 in 1 000 000
Brain damage	1 in 8000	0

A mother is considering if she should have her child vaccinated with the MMR vaccine.

Use information from the table to persuade the mother that she should have her child vaccinated.

(2)

(d) The vaccine used to protect us from the Hepatitis B virus is produced by genetic engineering.

Yeast cells are used to produce the vaccine.

Use words from the box to complete the sentence.

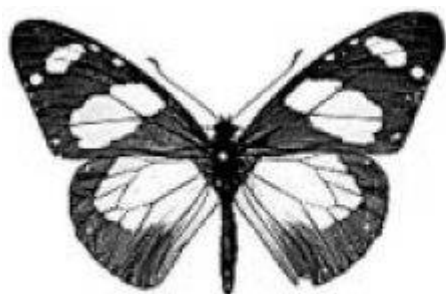
chromosomes	drugs	enzymes	genes	hormones
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To produce the vaccine _____ are used to cut out _____ from the Hepatitis B virus which are then inserted into the yeast cells.

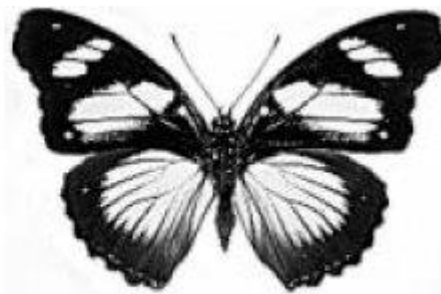
(2)

Q13.

The drawings show two different species of butterfly.



Amauris



Hypolimnas

- Both species can be eaten by most birds.
- *Amauris* has a foul taste which birds do not like, so birds have learned not to prey on it.
- *Hypolimnas* does **not** have a foul taste but most birds do not prey on it.

(a) Suggest why most birds do **not** prey on *Hypolimnas*.

(2)

(b) Suggest an explanation, in terms of natural selection, for the markings on the wings of *Hypolimnas*.

(3)

(Total 5 marks)

Q14.

Read the passage about IVF (in-vitro fertilisation) and embryo-splitting.

“IVF is not as successful as we would like it,” says scientist Michael Tucker. “On average, only one in five or one in six of all the embryos that we generate in the IVF lab will develop as far as full-term delivery as a baby.”

“There is a way to perhaps double those odds. A new, identical embryo is split off from the original embryo made in the IVF lab.”

“What we are really doing is creating an identical twin,” says scientist Dr Hilton Kort.

“And that’s what happens in nature every day. Cloning is creating a replica of a person or an animal.”

- (a) Explain why the two embryos will develop into identical twins.

(2)

- (b) Explain why the embryos are **not** clones of their parents.

(2)

- (c) The scientists want to develop this technique, but are afraid to do so because public opinion might be against the technique.

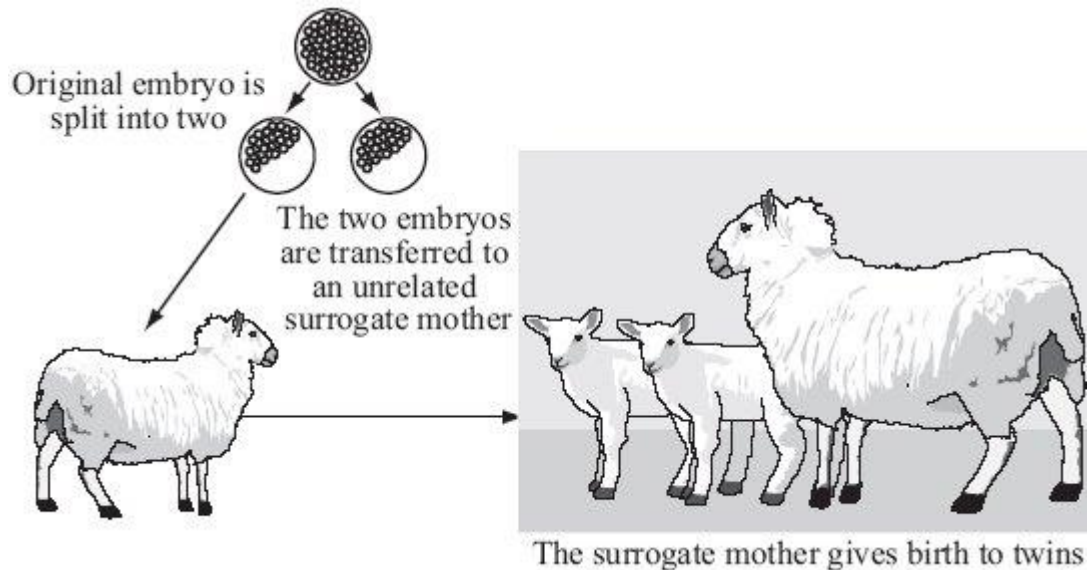
Suggest an explanation for this.

(1)

(Total 5 marks)

Q15.

The diagram shows one way of cloning sheep.



Use words from the box to complete the sentences.

asexual	clones	different	gametes
identical	joining	sexual	splitting

The original embryo in the diagram developed following the _____ of an egg

and a sperm. This is called _____ reproduction. The twins in the diagram have

_____ genetic information. This is because the two embryos were produced by

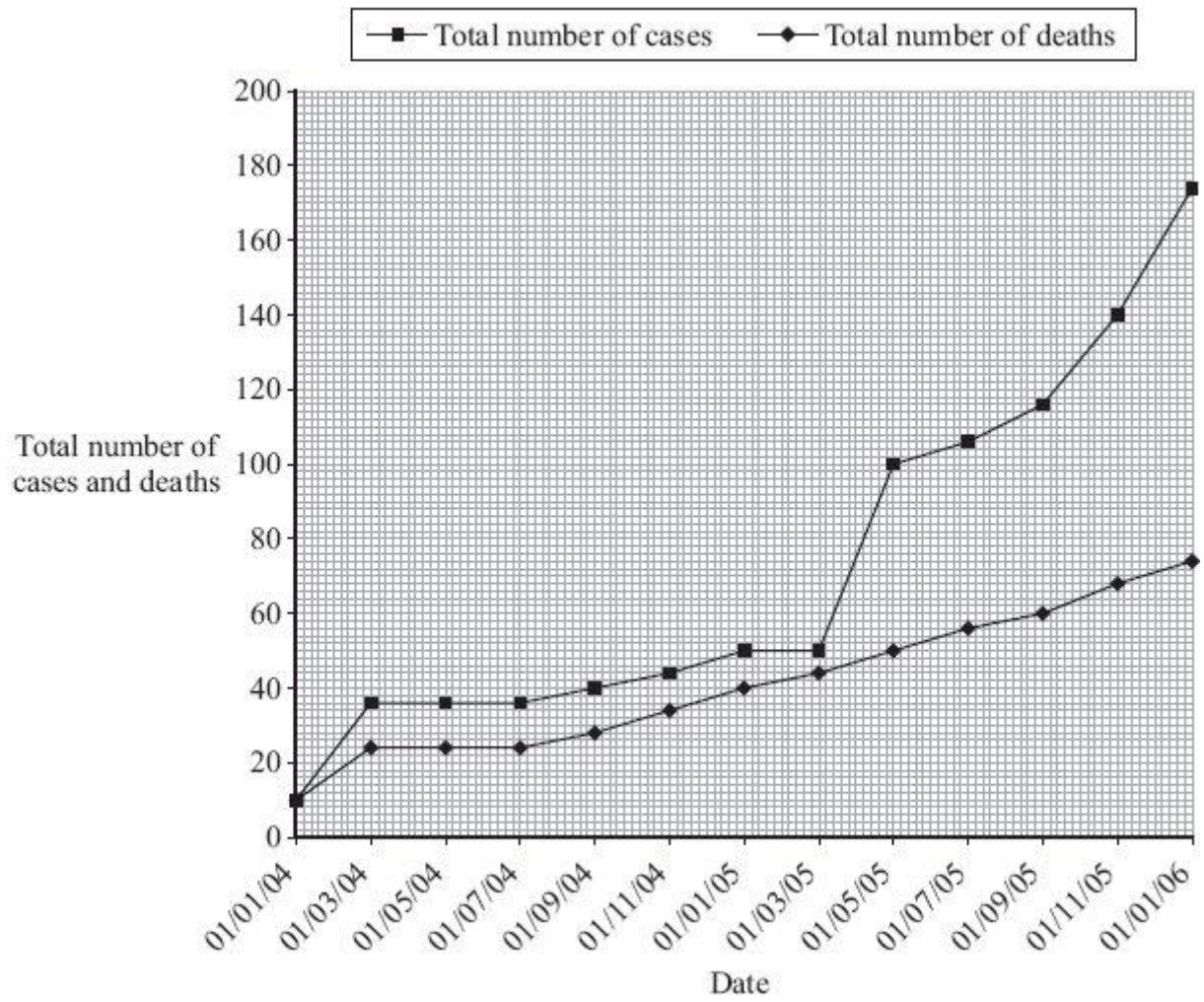
_____ reproduction. Because of this they are known as _____

(Total 5 marks)

Q16.

Scientists began to keep records of cases of H5N1 bird flu in humans in January 2004.

The graph shows the total number of cases of bird flu in humans and the total number of deaths up to January 2006.



(a) (i) How many people had died from bird flu up to 01/07/05?

(1)

(ii) Describe, as fully as you can, how the number of cases of bird flu in humans changed between 01/07/04 and 01/01/06.

(2)

(b) At present, humans can only catch bird flu from contact with infected birds. The bird flu virus may mutate into a form that can be passed from one human to another.

Explain why millions of people may die if the bird flu virus mutates in this way.

Q17.

Tetra is the first monkey to be cloned.



The method is described below.

- A sperm and an egg were combined and the resulting embryo was allowed to split into two cells, then four, then eight cells.
- At the eight-cell stage, the embryo itself was split by scientists to produce four two-cell embryos.
- The four embryos were then implanted into surrogate mothers. Three of the embryos did not survive. The fourth, Tetra, was born 157 days later. Her name means 'one of four'.

(a) Explain why this method could produce several identical monkeys.

(2)

(b) Suggest **two** reasons why these monkeys would be valuable in trials of new treatments for human diseases.

1. _____

2. _____

(2)
(Total 4 marks)

Q18.

- (a) What does the theory of evolution state?

(2)

- (b) *Daphnia* are microscopic water fleas. Midge larvae prey on *Daphnia*. The midge larvae release a hormone into the water. *Daphnia* respond to these hormones by growing larger protective 'helmet'-like structures

Scientists were surprised to observe that the offspring of *Daphnia* females who had been exposed to these hormones always had larger helmets than offspring whose mothers had never been exposed to the hormones. The offspring with the large helmets went on to produce offspring with large helmets.

Explain why the scientists' observations seem to contradict the theory of natural selection.

(2)

(Total 4 marks)

Q19.

The photographs show two varieties of moths, X and Y. The moths belong to the same species.

The moths are resting on a tree trunk in open countryside.



Moth X

Moth Y

- (a) Which variety of moth, X or Y, is more likely to be killed by insect-eating birds? Give a reason for your answer.

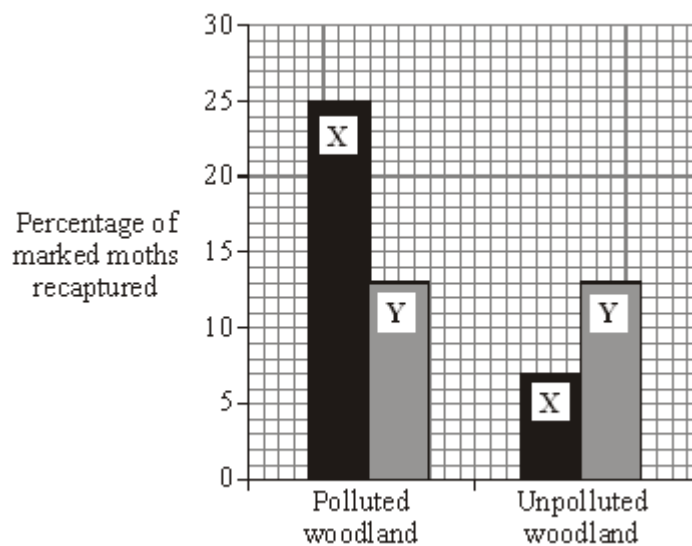
Variety of moth: _____

Reason _____

_____ (1)

- (b) In an experiment, large numbers of each variety of moth were caught in a trap.
- They were marked with a spot of paint on the underside of one wing and then released.
 - A few days later, moths were again trapped and the number of marked moths was counted.
 - The experiment was carried out in a woodland polluted by smoke and soot, and also in an unpolluted woodland.

The results are shown in the bar graph.



- (i) When the moths were being marked, suggest why the paint was put on the underside of the wing and not on the top.

_____ (1)

- (ii) What percentage of moths of type X was recaptured in:

the polluted woodland; _____

the unpolluted woodland? _____

(2)

- (iii) In each woodland, only a small number of marked moths of both varieties were recaptured. Suggest **one** reason for this.

(1)

- (c) (i) The colour of the moths is controlled by a gene. The dark form was first produced by a mutation in the gene.

What chemical, found in a gene, is changed by a mutation? Draw a ring around your answer.

carbohydrate DNA fat protein

(1)

- (ii) Some of the offspring from the original dark moth were also dark. What caused this?

(1)

(Total 7 marks)

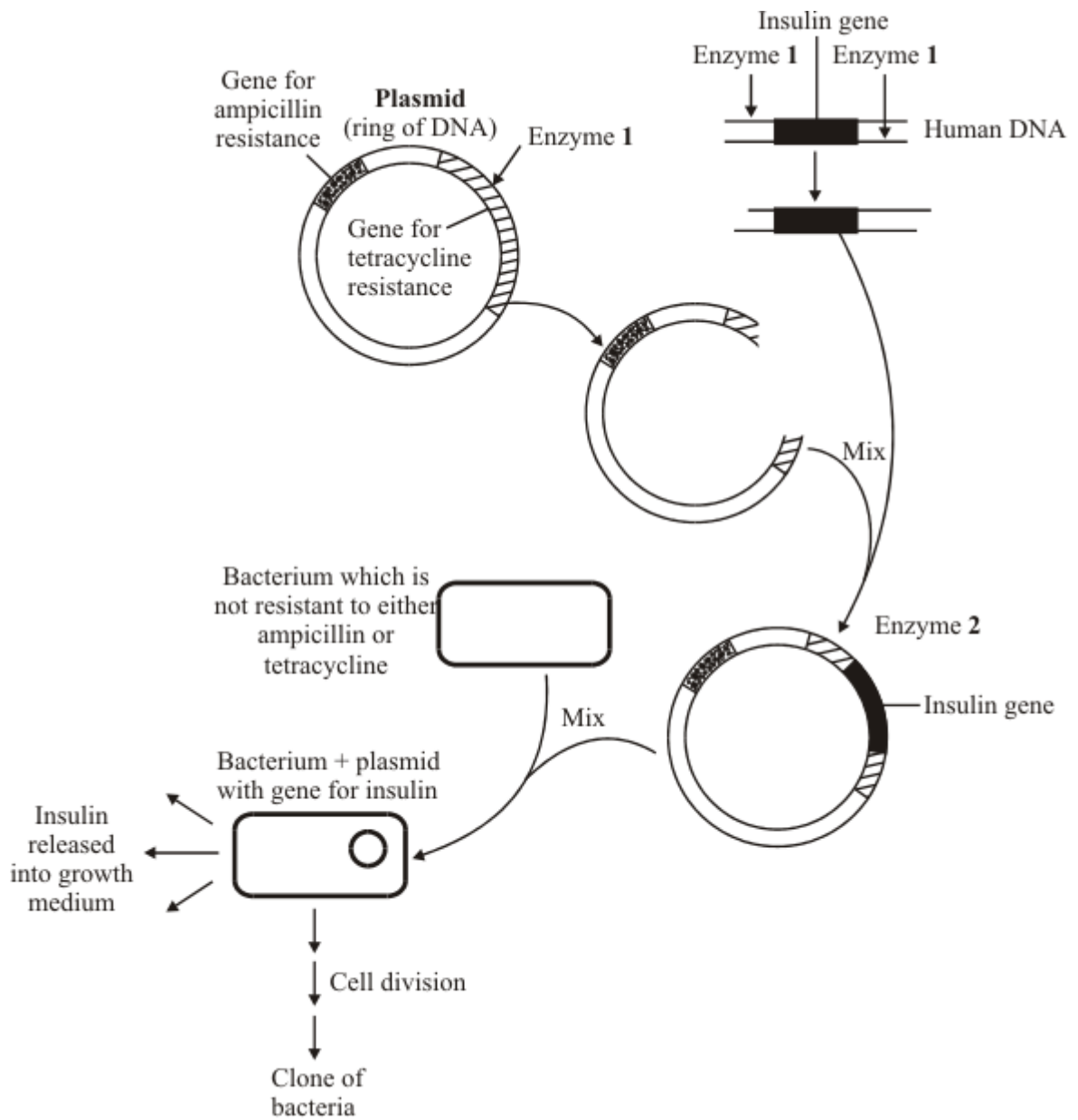
Q20.

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

(Total 5 marks)

Q21.

The diagram shows how genetic engineering can be used to produce human insulin from bacteria. Ampicillin and tetracycline are two types of antibiotic. Study the diagram carefully and answer the questions.



In experiments like these, some bacteria take up the plasmid (ring of DNA) containing the insulin gene. Other bacteria fail to take up a plasmid, or they take up an unmodified plasmid (a ring of DNA which has not been cut open and which does not contain the insulin gene).

- (a) Complete the table by putting a tick (✓) in the correct boxes to show which bacteria would be able to multiply in the presence of ampicillin and which bacteria would be able to multiply in the presence of tetracycline.

	Bacterium can multiply in the presence of	
	Ampicillin	Tetracycline
Bacterium + plasmid with the insulin gene		
Bacterium without a plasmid		
Bacterium with an unmodified plasmid		

- (b) The bacterium with the plasmid containing the insulin gene multiplies by cell division to form a clone of bacteria.

Will **all** the bacteria in this clone be able to produce insulin? Explain your answer.





(3)
(Total 6 marks)

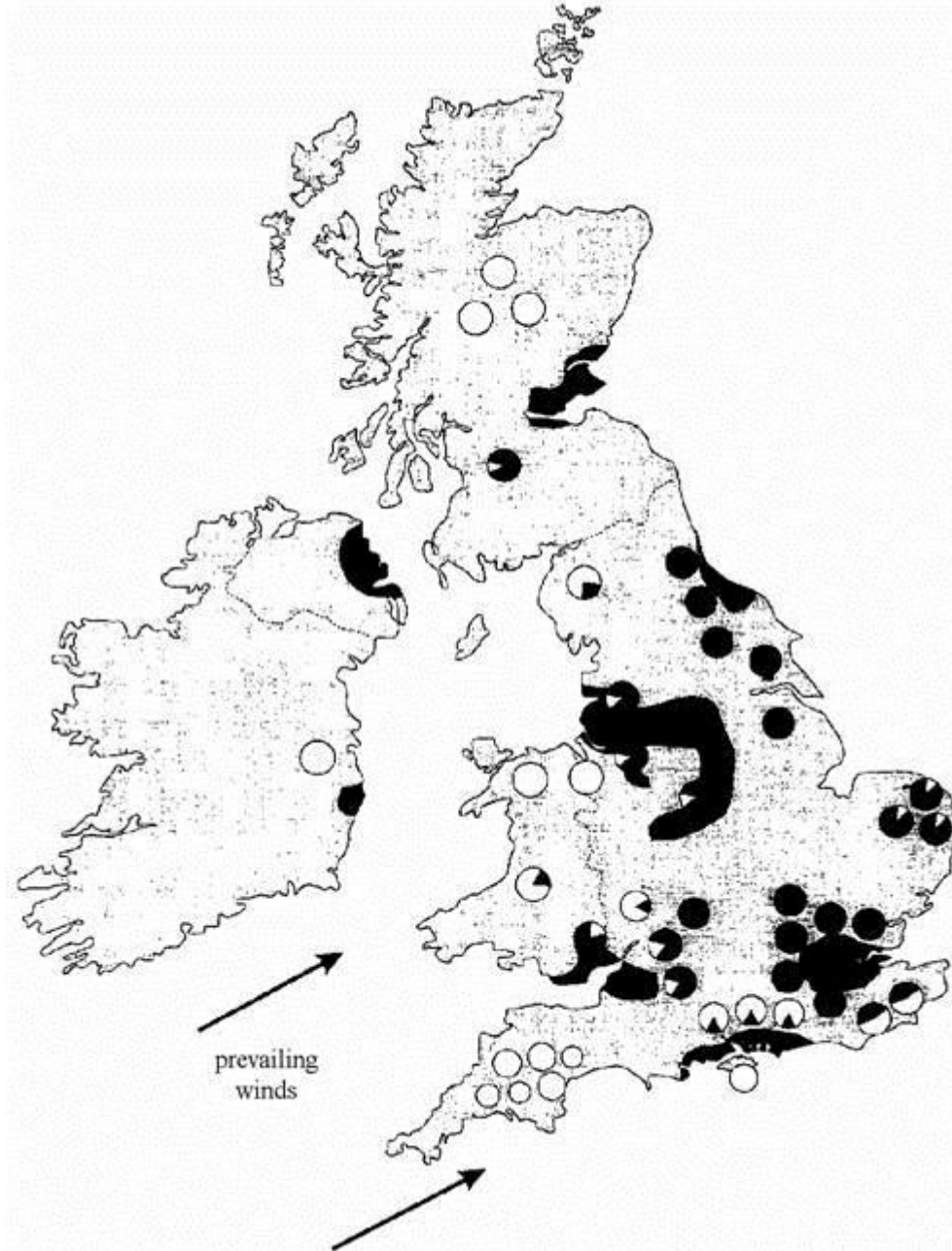
Q22.

The map shows:

the most densely populated industrial areas;
the frequency of pale and dark forms of the peppered moth;
the direction of the prevailing winds in the British Isles.

Key

-  Densely populated industrial areas
-  All normal pale forms
-  All mutant dark forms
-  Combinations of both forms



Peppered moths usually rest on trees covered with lichen, and they are preyed upon by many birds. In areas of low air pollution the lichen on trees is usually pale in colour. In areas of high air pollution the lichen turns black.

- (a) (i) State a pattern of the distribution of the mutant dark form shown on the map.

(1)

- (ii) Suggest a reason for your pattern.

(1)

- (b) The dark form of peppered moth developed after a *mutation* in the pale form. What is a *mutation*?

(1)

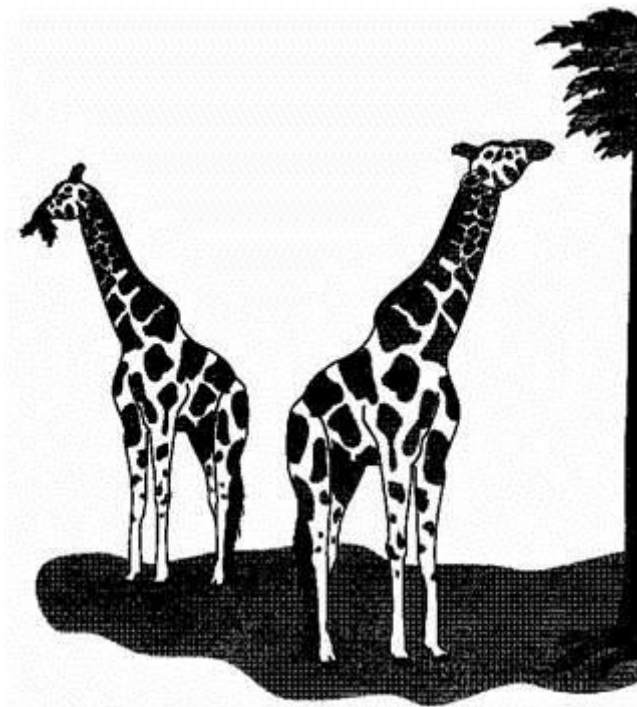
- (c) Using the idea of Natural Selection explain why the dark form of the moth is restricted to the areas shown.

(4)

(Total 7 marks)

Q23.

Giraffes feed on the leaves of trees and other plants in areas of Africa. They are adapted, through evolution, to survive in their environment.



- (a) Use the information in the picture to give **one** way in which the giraffe is adapted to its environment.

(1)

- (b) Explain how Jean-Baptiste Lamarck (1744–1829) accounted for the evolution of the long neck in giraffes.

(3)

- (c) Another scientist, August Weismann (1834 -1914) wanted to check Lamarck's explanation. To do this he cut off the tails of a number of generations of mice and looked at the offspring.

His results did not support Lamarck's theory. Explain why.

(2)

- (d) Explain how Charles Darwin (1809–1882) accounted for the evolution of the long neck in giraffes.


(4)

(Total 10 marks)

Q24.

These are all dogs. They are *in the same species*.

Type:	Great Dane	Yorkshire Terrier	Standard Dachshund
Weight:	54 kg	3.5 kg	9 kg
Height to shoulder:	57 cm	25 cm	20 cm



(a) What does it mean to be *in the same species*?

(2)

(b) Complete the following sentences.

- When dogs reproduce the _____ produces sperm in the _____ and the female produces eggs in the _____
- Sperm and eggs are also called _____
- During mating, the sperm and eggs fuse together. This is known as _____
- Once this has happened the _____ starts to develop in the uterus of the mother.

(6)

(c) Explain why puppies have some of the characteristics of both parents.

(2)

(Total 10 marks)

Q25.

Penicillin is an antibiotic which stops bacteria from reproducing. It was used a lot in the past to treat bacterial infections in humans and other animals. In many hospitals there are now strains of penicillin resistant bacteria.

Explain how natural selection could have produced these strains of penicillin resistant bacteria.

(Total 5 marks)

Q26.

The following passage is adapted from an article by Martin Kelly in The Independent newspaper.

Thanks to the test tube banana

*Specially bred resistant varieties may
save African crops from disease*

A banana is a fruit, but it has no seeds. And if there are no seeds how do the plants reproduce? At one level the answer is easy; centuries of selective breeding have resulted in varieties with plenty of tasty flesh but few bitter inedible seeds, and propagation is carried out by means of root corms.

Most bananas we eat are thus actually 'clones' of a few successful plants, as is also the case with the potato. Banana clones are genetically identical to their parents, so growers can be completely sure their fruits will be big and tasty.

Genetic variability of these cloned plants is extremely low. Resistance to new diseases, therefore, is almost nil; witness the spread of potato blight through Ireland in the 1840s.

The issue goes well beyond our high streets and supermarkets. The banana has a larger relative called a plantain, which is starchy rather than sweet and is a staple food of more than 60 million Africans. Bananas and plantains are being ravaged by a new fungal disease called Black Sigatoka. The commercial planters that produce the bananas we buy in supermarkets have little problem here; they can afford to buy chemicals to spray their crops. African subsistence farmers, forced to rely on 'organic' methods can only sit by and watch their plants die.

Several governments have turned to the International Institute for Tropical Agriculture (IITA) for help. IATA is in Africa, but is not of Africa. It is internationally funded with levels of staffing and equipment that enable advanced bio-technological techniques to be used. However, even with genetic engineering, to breed resistant varieties is a long-term project and Black Sigatoka is not going to wait. IATA scientists have had to divide their energies between two approaches: an interim solution and the development of resistant

varieties.

The interim solution was easily found in a group of 'cooking bananas' which were resistant to Black Sigatoka disease and which could, to some extent, be substituted for plantain in the diet. These, however, were only found in localised areas and the first problem facing IATA was to obtain enough plants from the few available plants of resistant varieties to supply the needs of the affected farmers.

- (a) Explain how selective breeding may have been used to produce bananas with tasty flesh.

(2)

- (b) Explain, as fully as you can, why "Genetic variability of these cloned plants is extremely low" compared with natural populations.

(4)

- (c) Explain, as fully as you can, how IATA scientists might be able to "obtain enough plants from the few available plants of resistant varieties to supply the needs of affected farmers".

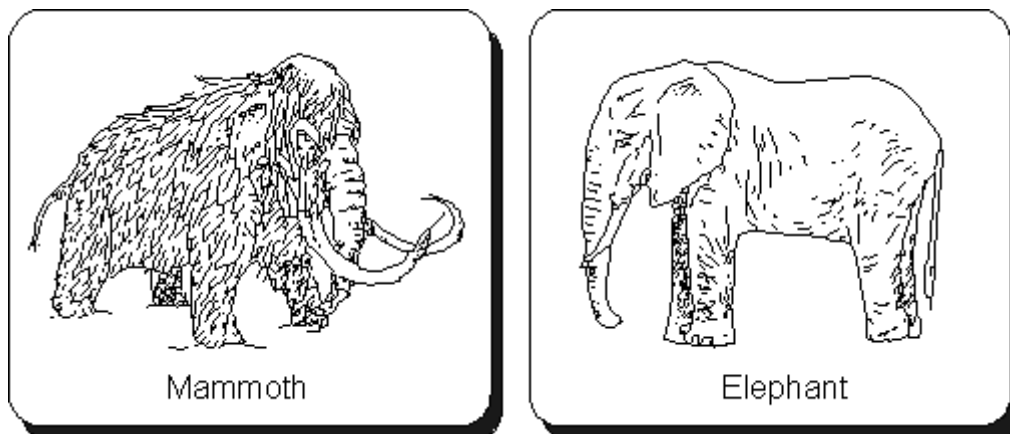
(3)

- (d) Explain, as fully as you can, how IATA scientists may use genetic engineering to produce varieties of banana resistant to Black Sigatoka disease.

(4)
(Total 13 marks)

Q27.

The drawings below show a mammoth, an extinct relation of the elephant which lived in arctic regions, and a modern elephant which lives in tropical areas.



The mammoth, which was very hairy, and the elephant, are both thought to have evolved from a scantily haired ancestor. Explain, as fully as you can, how the **mammoth** evolved from the common ancestor.

(Total 5 marks)

Q28.

The article below appeared in the Daily Mail on February 24 1993.

March of the mutant tomatoes as Frankenfood hits the menu

Just when you thought it was safe to go back to the dinner table, 'Frankenfoods' are heading for the menu.

Rainbow trout with human genes and tomatoes grown with traits of flounder fish are the latest products of food scientists.

It is good news for producers – the trout grow bigger and more quickly, while the tomatoes have a lower freezing point, preventing them becoming damaged.

But consumer groups fear a whole breed of these 'genetically modified organisms' (GMOs) may be introduced without proper trials.

David King, director of the pressure group Genetic Forum, said: 'The march of scientists who want to genetically alter food has very serious implications both for animal welfare and the environment.'

'You run the risk of introducing triffid-like creatures – plants which have the capacity to overtake landscapes and force out other plant life.'

Genetic forum is to join groups including the RSPCA and World Wide Fund for Nature to debate a number of GMOs awaiting licenses in the United States.

They have called for proper labelling so shoppers can decide for themselves whether they want to buy modified foods.

Two genetic compounds – certain brands of cheddar cheese and bakers' yeast are already approved for use in British food manufacture, said Mr. King.

British multi-national ICI also has a company, Zeneca seeds, working on genetically altering food and is planning to sell tomatoes in which the ripening gene has been 'blocked' to increase shelf life.

An ICI spokesperson said 'Extensive trials are carried out on all these modified foods and we are required by the Ministry of Agriculture to provide full information on all our trials.'

Growers were able to pick the new tomato when it was ripe and red instead of green and it was wrong to label such an advance 'Frankenfood', she said.

'It has very negative connotations which are not at all correct. The entire drive behind this work is to produce positive benefits to the consumer.'

ICI had helped to produce crops able to resist pests and diseases, bringing food to people who otherwise would go hungry, she added.

- (a) The foods described in the article have been produced by genetic engineering. Explain, as fully as you can, how this technique is used to produce 'genetically modified organisms'.

(4)

- (b) Having produced the desired type of tomato by genetic engineering, how might scientists quickly produce large numbers of the new plants to supply to horticulturists?

(2)

- (c) Using information from the article and your own knowledge, assess the advantages and disadvantages of producing new types of food by genetic engineering.

(6)
(Total 12 marks)

Q29.

Cotton crops may become infested with weeds. Scientists are developing genetically-engineered strains of cotton which resist the action of herbicides. This means that when the crop is sprayed with herbicide, only the weeds are killed. However, there are potential dangers with this procedure. Cotton plants can interbreed with some other species of plants.

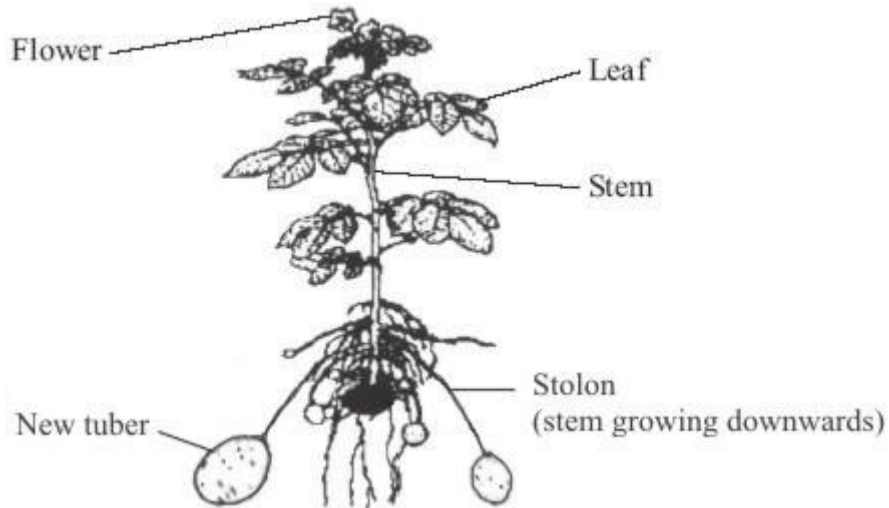
Evaluate the possible advantages and disadvantages of developing genetically-engineered herbicide-resistant crops.

(Total 5 marks)

Q30.

The drawing shows a potato plant producing new tubers (potatoes). Buds on the stem of

the parent plant produce stolons. The new tubers are formed at the ends of the stolons (stems that grow downwards).



- (a) Explain why the new tubers are genetically identical to each other.

(2)

- (b) Some of the tubers are used to produce potato plants. These new potato plants will not all grow to the same height.

Give **one** reason why.

(1)

(Total 3 marks)

Q31.

Read the extract.

Super-bug may hit the price of coffee

The coffee bean borer, a pest of the coffee crop, can be controlled by the pesticide endosulphan. However, strains of the insect that are up to 100 times more resistant to the pesticide have emerged on the South Pacific island of New Caledonia.

For full resistance to be passed on to an offspring two copies of the new resistance allele

- 5 should be inherited, one from each parent. There is much inbreeding with brother-sister matings happening in every generation, so it takes only a few generations before all the descendants of a single resistant female have inherited two copies of the resistance allele.

If this resistance spreads from New Caledonia, it will mean the loss of a major control

10 method. This will present a serious threat to the international coffee industry.

(a) Suggest how the allele for resistance to endosulfan may have arisen.

(1)

(b) (i) How would you expect the proportion of normal coffee bean borers on New Caledonia to change over the next few years?

(ii) Explain why this change will take place.

(3)

(c) Explain why "it takes only a few generations before all the descendants of a single resistant female have inherited two copies of the resistance allele." (lines 6-8)

(3)

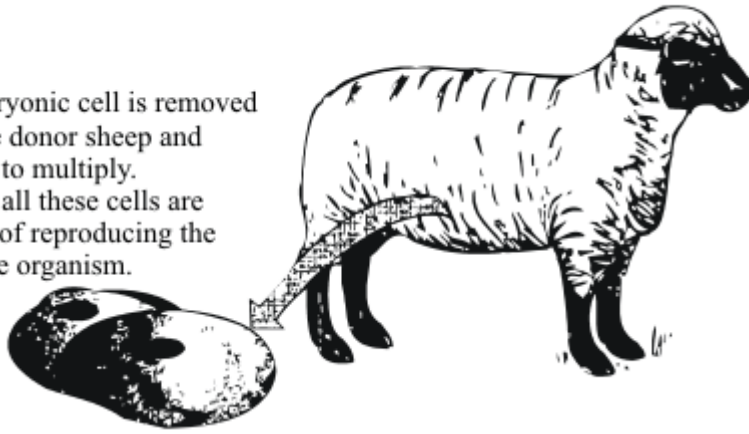
(Total 7 marks)

Q32.

The diagram shows one method of cloning sheep.

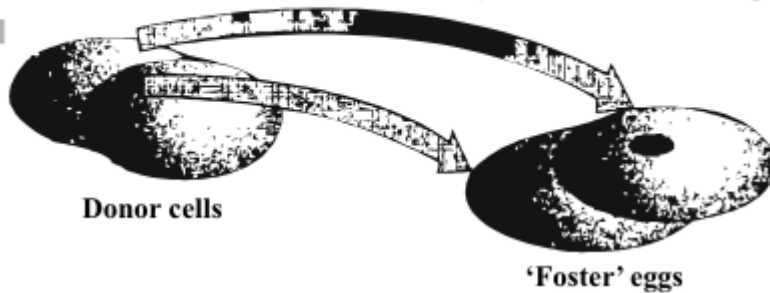
1

An embryonic cell is removed from the donor sheep and allowed to multiply. Initially all these cells are capable of reproducing the complete organism.



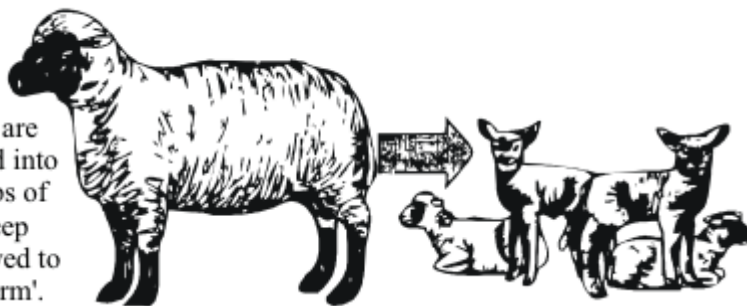
2

The nuclei are taken from the donor cells and imported into 'foster eggs' (nuclei-less ova from other sheep). They are allowed to develop.



3

The eggs are implanted into the wombs of foster sheep and allowed to 'go full term'.



(a) Explain why the lambs produced by this technique are identical to each other.

(2)

(b) Explain why the lambs are **not** genetically identical to the sheep which produced the 'foster' eggs.

(2)

(c) Explain the drawback of widespread use of just a few clones of sheep.

(3)

(Total 7 marks)

Q33.

A market gardener produces large numbers of attractive, large flowered geranium plants.



(a) Give two advantages to the gardener of producing geraniums from cuttings rather than from seeds.

1. _____

2. _____

(2)

(b) Gardeners often cover trays of cuttings with large polythene bags.

Suggest **one** advantage of this.

(1)
(Total 3 marks)

Q34.

The drawings show two forms of the peppered moth.



Pale form



Dark form

In an investigation, pale and dark moths were placed in different positions on trees in two woods. One wood was in an industrial area where the bark was blackened by pollution. The other wood was unpolluted, and the tree bark was covered in pale mosses and lichen. After three days, the surviving moths were counted. The results are shown in the table.

WOOD	POSITION OF MOTH ON TREE	PERCENTAGE OF MOTHS EATEN BY BIRDS	
		PALE	DARK
Polluted	On main trunk	58	40
	Underside of branch	50	28
Unpolluted	On main trunk	32	62
	Underside of branch	26	40

(a) What can you tell from these results about the survival of the two types of moth in polluted and unpolluted woods, and in different positions on the tree?

(3)

(b) Explain how the results provide evidence for **one** theory of evolution.

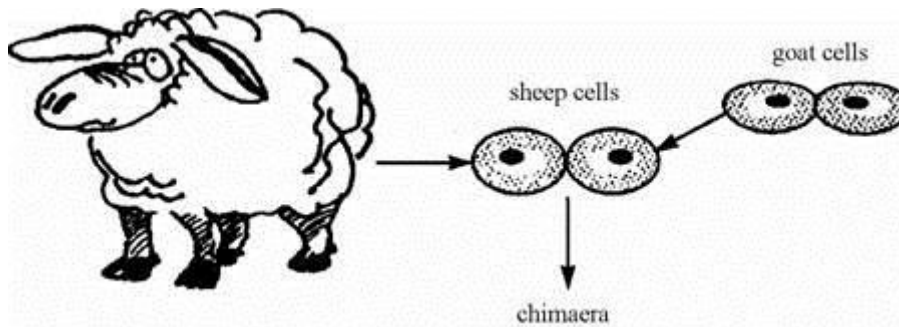
(3)
(Total 6 marks)

Q35.

Read the passage.

One reason for cloning animals is to prevent rare breeds from becoming extinct. Early embryos can be divided into four to produce identical quads. Dividing a young embryo into more than four parts is a problem because each part may not have enough cells to create both an embryo and a placenta.

The problem can be overcome by adding cells from another embryo, to make a mixture of cells called a chimaera. The two sets of cells may be from two different breeds of animals, or even two different species, such as sheep and goats.



The aim is not to create freaks but chimaeras in which the added cells form the placenta only. The sheep embryos are given cells to make goat placentas and are carried to full term in the uteri of goats. They are born as pure sheep.

- (a) Explain why the sheep embryos with added goat placental cells develop into sheep, not goats.

(2)

- (b) Use information from the passage and your own knowledge and understanding to evaluate the use of cloning techniques in agriculture.

(6)
(Total 8 marks)

Q36.

Busy lizzie plants produce flowers with many different colours.



A gardener wants to produce busy lizzie plants to fill a flower bed in her garden. She decides to grow them from cuttings rather than seeds.

- (a) Give **one** condition that she should supply to the new cuttings so that they grow well.

(1)

Busy Lizzie plants can produce flowers which are white, pink or red. A gardener wants to grow a display containing all three colours of flowers.

- (b) Give **one** advantage and **one** disadvantage to the gardener of growing Busy Lizzie plants from cuttings rather than seeds.

Advantage _____

Disadvantage _____

(2)
(Total 3 marks)

Q37.

- (a) Use words from the list to complete the sentences.

alleles chromosomes gametes genes mutations

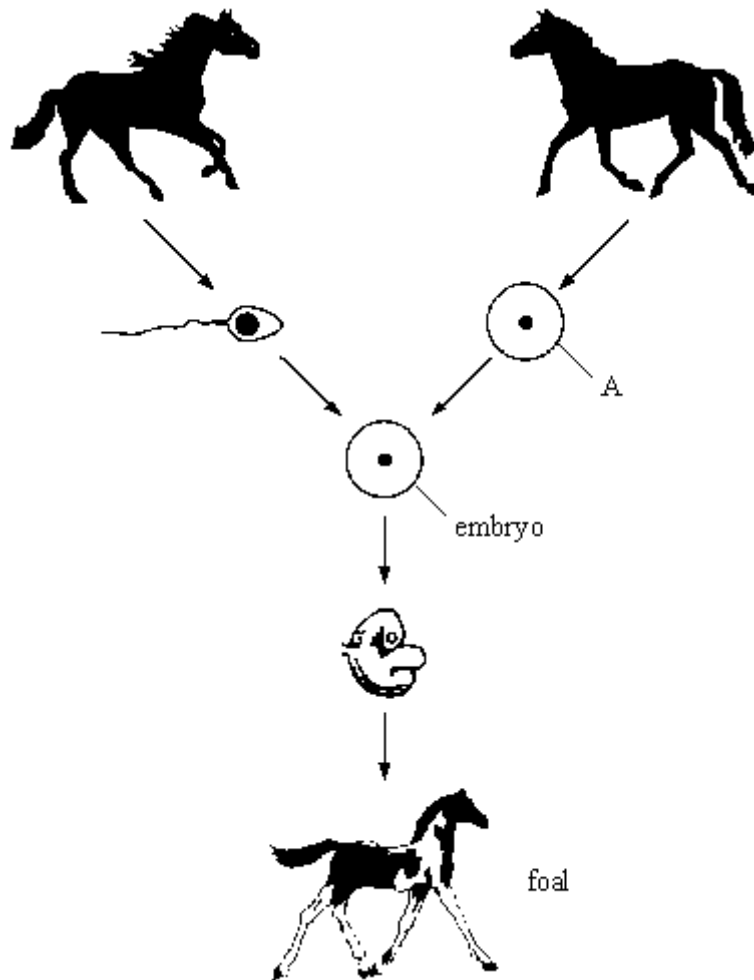
The nucleus of a cell contains thread-like structures called _____ .

The characteristics of a person are controlled by _____

which may exist in different forms called _____ .

(3)

- (b) The drawing shows some of the stages of reproduction in horses.



(i) Name this type of reproduction _____ (1)

(ii) Name the type of cell labelled **A** _____ (1)

(c) When the foal grows up it will look similar to its parents but it will **not** be identical to either parent.

(i) Explain why it will look similar to its parents.

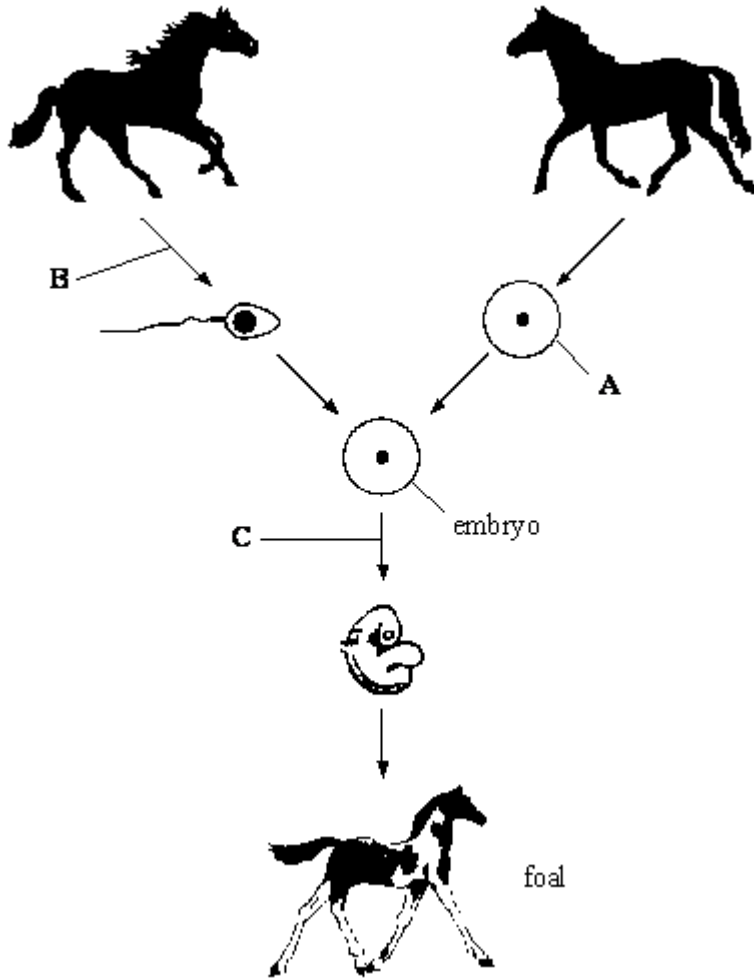
(1)

(ii) Explain why it will **not** be identical to either of its parents.

(2)

(Total 8 marks)

The drawing shows some of the stages of reproduction in horses.



- (a) (i) Name this type of reproduction _____ (1)
- (ii) Name the type of cell labelled **A** _____ (1)
- (b) Name the type of cell division taking place at the stage labelled:
- (i) **B** _____
- (ii) **C** _____ (2)
- (c) How does the number of chromosomes in each cell of the embryo compare with the number of chromosomes in cell **A**?
- _____ (1)
- (d) When the foal grows up it will look similar to its parents but it will **not** be identical to either parent.
- (i) Explain why it will look similar to its parents.
- _____
- _____ (1)

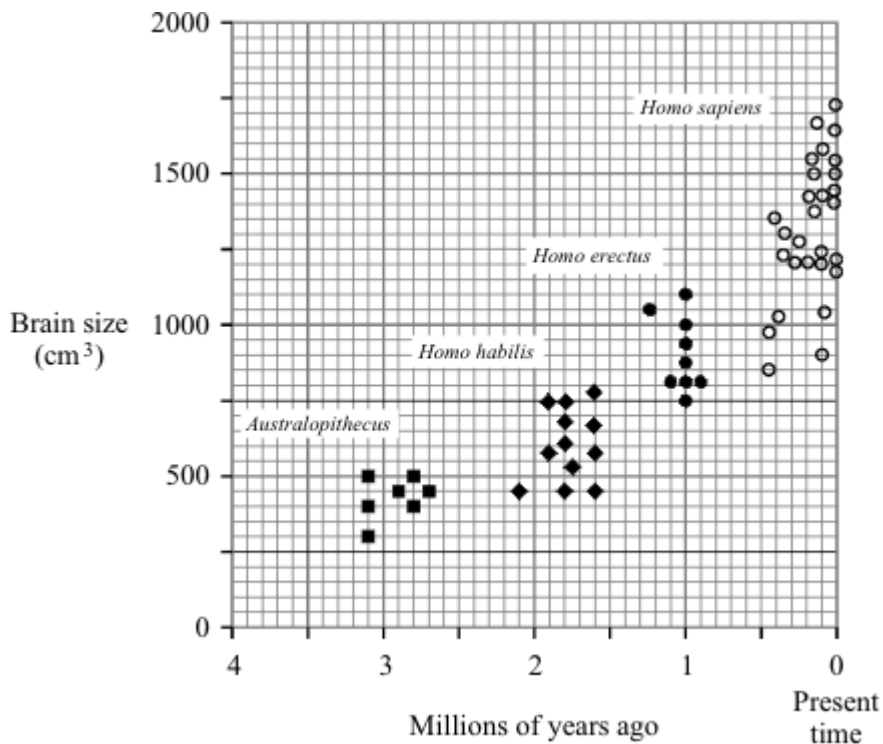
(ii) Explain why it will **not** be identical to either of its parents.

(2)

(Total 8 marks)

Q39.

Modern humans belong to the species *Homo sapiens*. Many people think that modern humans evolved from more primitive species. Three of these primitive species were *Australopithecus*, *Homo habilis* and *Homo erectus*. These three species are now extinct. The graph shows the brain size of several specimens from each of the species.



(a) Estimate the mean brain size of *Homo habilis*.

_____ cm³

(1)

(b) Suggest how we know about the brain size of *Australopithecus*.

(2)

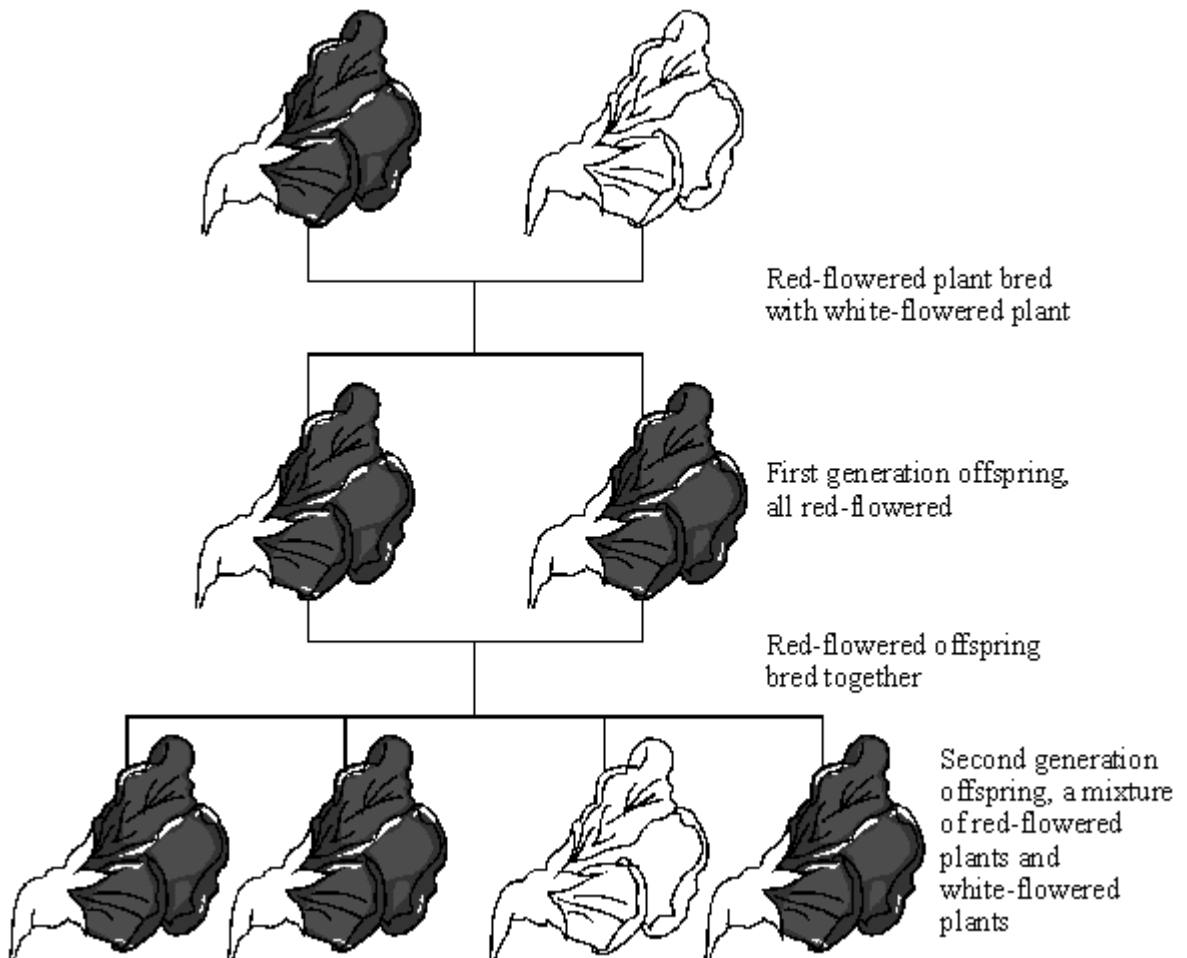
(c) Suggest an explanation, in terms of natural selection, for the change in brain size during the evolution of *Homo sapiens*.

(3)
(Total 6 marks)

Q40.

The diagrams show one of the experiments performed by a scientist called Mendel.

He bred sweet pea plants.



In the sentences below, cross out the **two** lines which are wrong in each box.

Mendel proposed that flower colour was controlled by inherited factors.

The first generation plants show that the red factor is dominant
environmental
recessive

The second generation plants show that the white factor is dominant
environmental
recessive

We now call inherited factors chromosomes
gametes
genes

These factors are passed from generation to generation in gametes
glands
organs

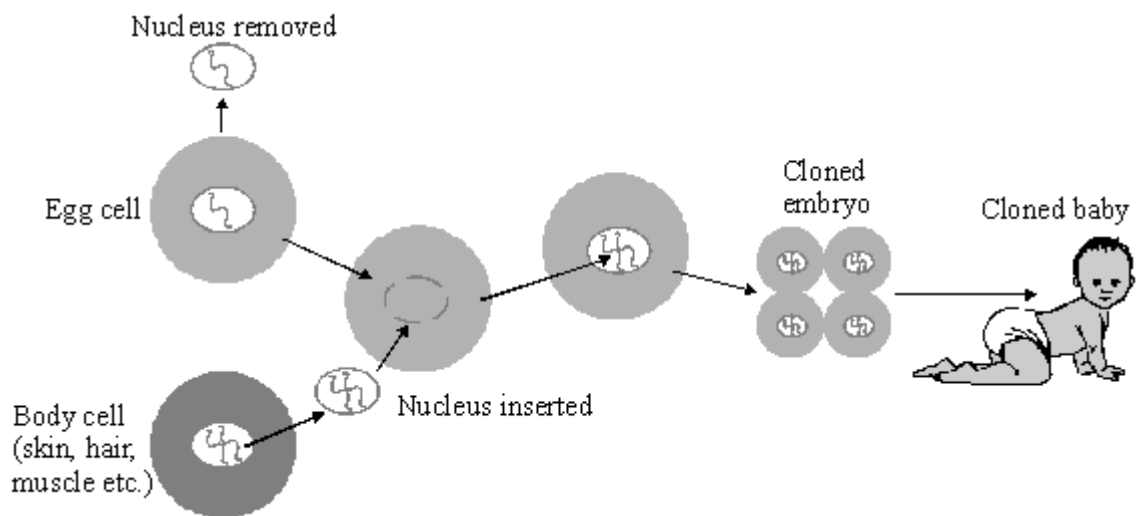
The red-flowered sweet pea plants did not all grow to the same height.

This was due to dominant
environmental
recessive factors.

(Total 5 marks)

Q41.

It is now possible to clone humans. The diagram shows one way in which this can be done.



(a) What type of reproduction is this?

(1)

(b) Will the baby have the characteristics of the egg cell or the body cell?

Explain the reason for your answer.

(2)

(c) The procedure in the diagram could be used to produce several cloned embryos.

Suggest how this might be done.

(1)

(Total 4 marks)

Q42.

Genetic engineering is being used to help sufferers of cystic fibrosis.

In the sentence below, cross out the **two** lines which are wrong in each box.

In genetic engineering, genes are cut out of

cell membranes
chromosomes
cytoplasm

 using

drugs
enzymes
hormones

(Total 2 marks)

Q43.

In some methods of reproduction, clones are made.

(a) Explain what is meant by a clone.

(2)

- (b) To gain full marks for this question you should write your ideas in good English. Put them into a sensible order and use the correct scientific words.

Describe, in as much detail as you can, **one** way in which an embryo can be cloned.

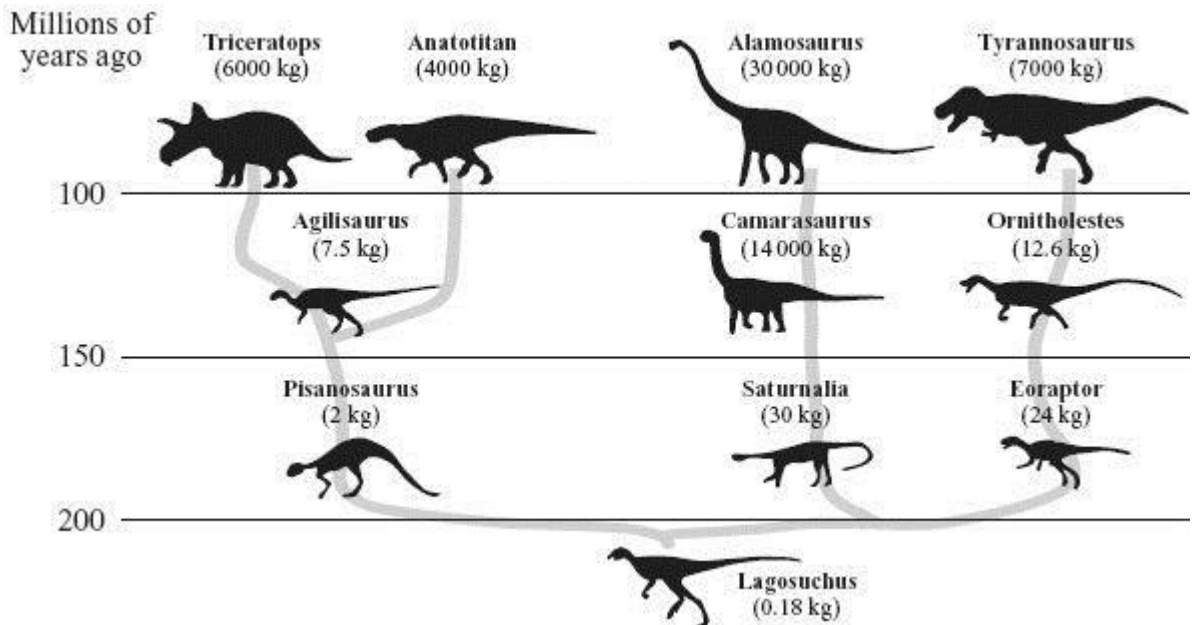
(3)

(Total 5 marks)

Q44.

The diagram shows a timeline for the evolution of some dinosaurs.

The mass of each dinosaur is shown in the brackets by its name.



- (a) Name **one** dinosaur which lived between 100 and 150 million years ago.

(1)

- (b) Which dinosaur did Ornitholestes evolve from?

(c) Apart from body size and mass, give **one other** difference between Lagosuchus and Alamosaurus. (1)

(1)

(d) (i) Which dinosaur had the largest mass? (1)

(ii) What happened to the mass of dinosaurs during evolution? (1)

(1)

(e) We know about dinosaurs from their fossils. Describe **one** way in which fossils are formed (1)

(1)

(f) Complete the sentence by using the correct words from the box.

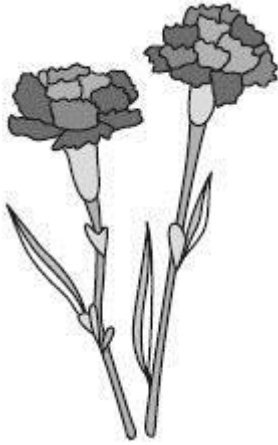
billion	complex	large	million	simple	thousand
----------------	----------------	--------------	----------------	---------------	-----------------

The theory of evolution states that all species of living things have evolved from _____ life forms which first developed more than three _____ years ago.

(2)
(Total 8 marks)

Q45.

Carnation plants have attractive flowers.



- (a) Carnation plants are grown from cuttings.

Complete the sentences by using the correct words from the box.

asexual clones genes mutation sexual

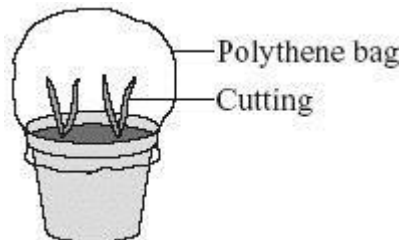
Carnations grown from cuttings have the same _____ as their parents.

This type of reproduction is _____ .

The new plants are known as _____ .

(3)

- (b) Gardeners usually cover the cuttings with a polythene bag as shown in the diagram below.



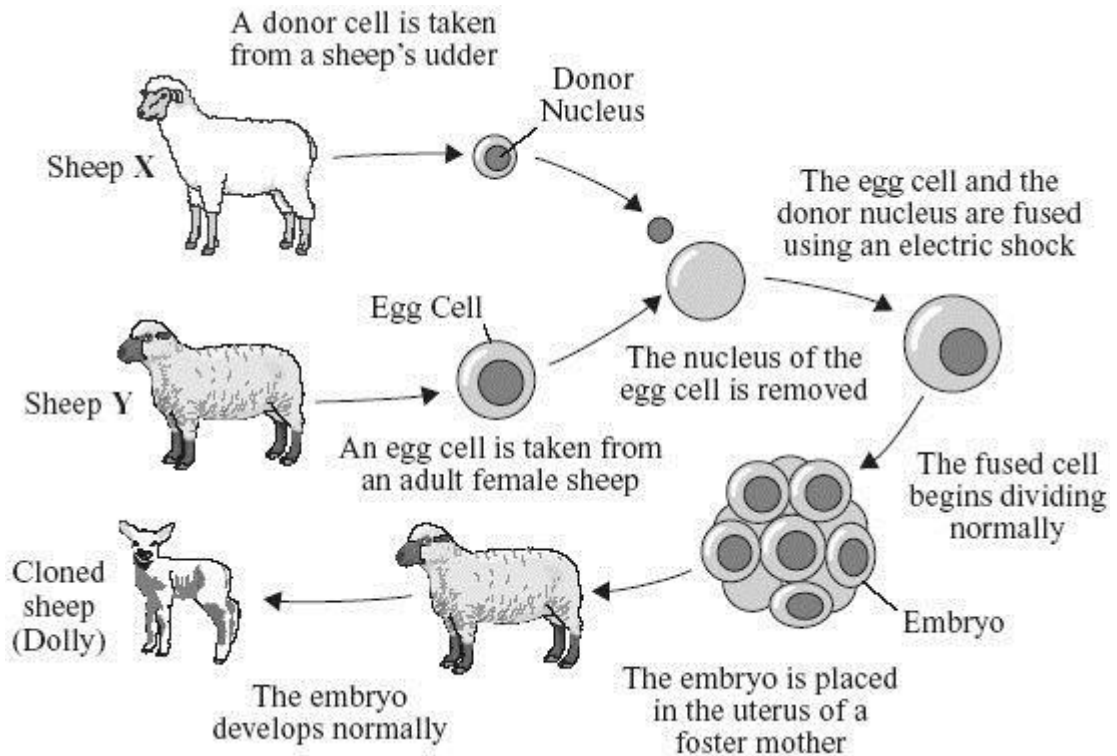
Why do the cuttings grow better if gardeners do this?

(1)

(Total 4 marks)

Q46.

The diagram shows how Dolly the sheep was cloned.

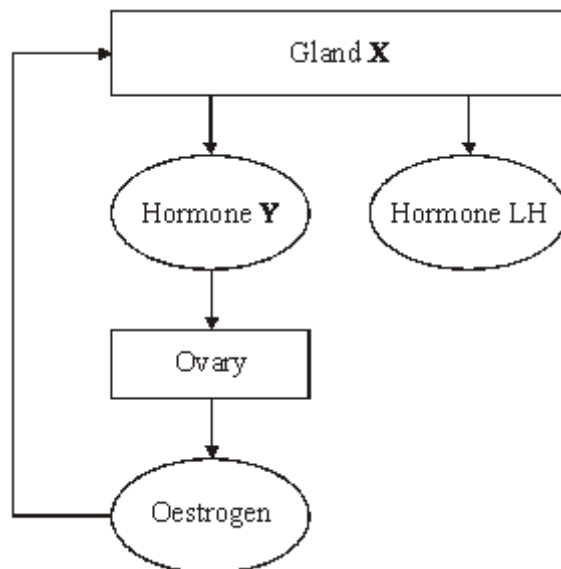


(a) Name the type of cell division that occurs:

- (i) as the egg cell is produced; _____
- (ii) as the fused cell begins to divide normally. _____

(2)

(c) The diagram below shows the relationships between the glands and hormones that control the menstrual cycle of a woman.



- (i) Name:
- gland X; _____
- hormone Y. _____

(2)

- (ii) Give **two** effects of the hormone oestrogen on gland X.

1. _____

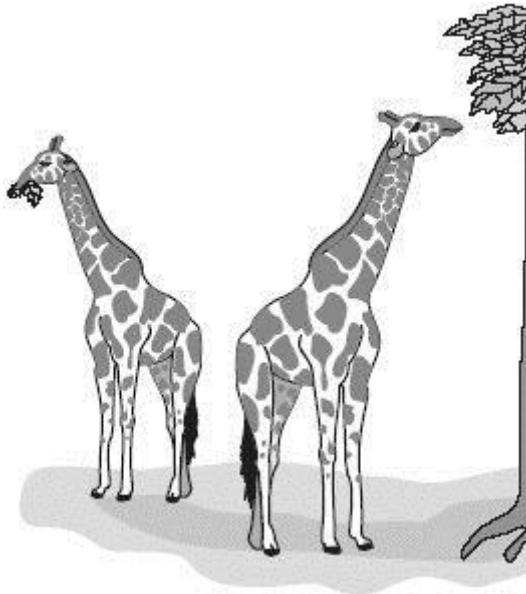
2. _____

(2)

(Total 6 marks)

Q47.

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



Lamarck explained the evolution of the long neck of the giraffe in terms of the animals stretching their necks to eat leaves from tall trees.

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

Neither scientist used any evidence to support their explanation.

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

These are some of their observations.

- Giraffes spend almost all of the dry season, when food is scarce, feeding from low bushes.
- Only in the wet season do they feed from tall trees when new leaves are plentiful.
- Females spend over 50 % of their time feeding with their necks horizontal. 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!
- Female giraffes prefer male giraffes with longer necks.

(a) Do the observations support or reject the explanation that the long neck of the

giraffe evolved to get leaves from tall trees? Explain the reasons for your answer.

(2)

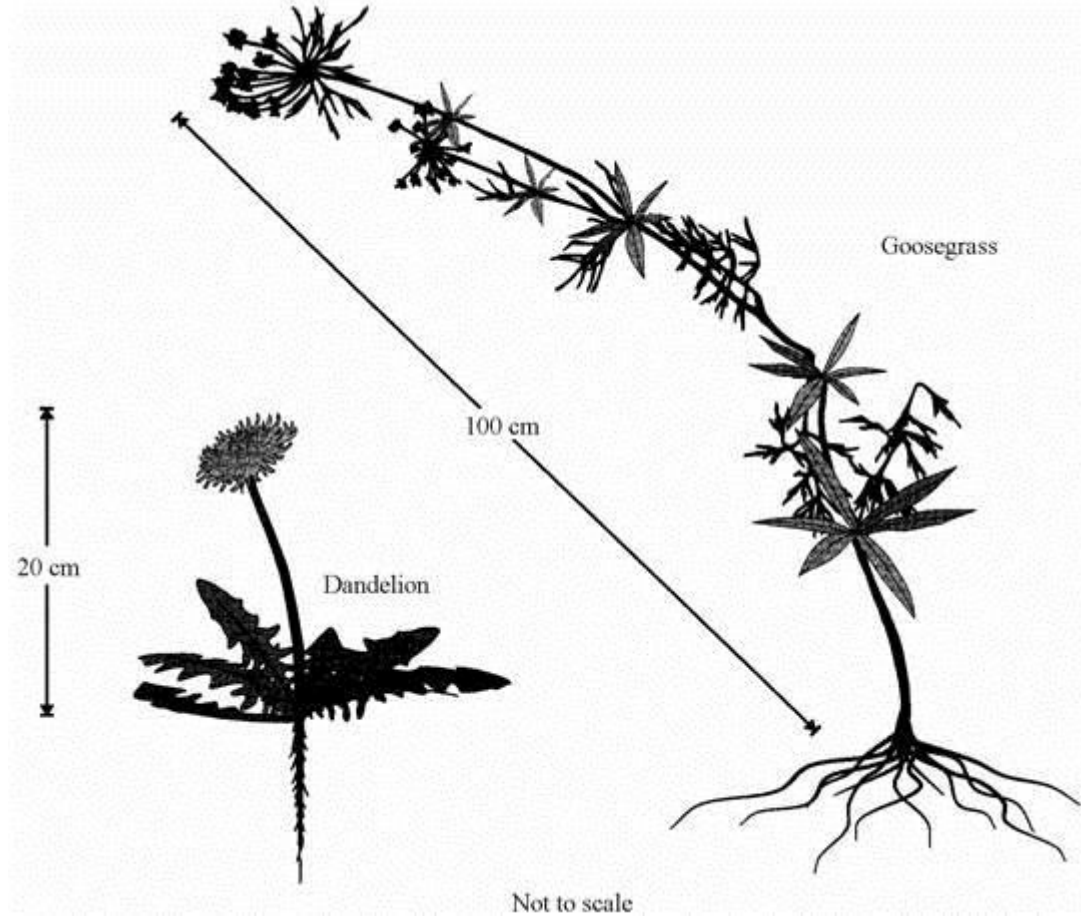
(b) Use the recent observations to give another explanation for the evolution of the long neck of the male giraffe.

(2)

(Total 4 marks)

Q48.

Dandelions have become adapted to live in lawns and grass areas where animals graze. Goosegrass, however, has become adapted to live alongside hedgerows and cannot survive being mown.



(a) Use the information in the drawings to suggest **one** advantage of each of the following adaptations.

(i) Dandelion leaves lie flat on the ground.

(1)

(ii) A dandelion has a thick tapered root.

(1)

(iii) Goosegrass stems are long.

(1)

(iv) Goosegrass roots are thin and very long.

(1)

(b) Dandelions and goosegrass are different species of plants.

(i) What name is given to the unit of inheritance which controls one particular characteristic of a plant or animal?

(1)

(ii) Why would you be unlikely to succeed if you tried to breed a new species of plant by crossing a dandelion with goosegrass?

(1)

(c) Animals as well as plants have become adapted to live in different environments.

State **one** way a polar bear has become adapted to living in the Arctic, and the reason for the adaptation.

(2)

(Total 8 marks)

Q49.

The peppered moth is an example of a mutation which gives the mutant variety an advantage in certain environmental conditions.

Normally the peppered moth is light coloured.

In 1848 the first dark form of the peppered moth was caught in the Manchester area. By 1895, 98% of the population was the dark form. In an area where a smokeless zone was established in 1972 the percentage of light-coloured peppered moths changed. In 1961 it was 5.2% but in 1974 it had risen to 10.5%.

Use the information above to explain the term *natural selection*.

(Total 4 marks)

Q50.

Insulin is now made by a biotechnological process. A description of the process is given below. Complete the gaps in the sentences.

- (a) The first step in the biotechnological process is that a special enzyme is used to cut the insulin _____ out from a human _____ .
In a separate operation, a ring of bacterial _____ is cut open using a special enzyme.
These two pieces of genetic material are combined together to form a new plasmid ring which is inserted into a bacterium.

(3)

- (b) Explain why large quantities of insulin are produced when this bacterium is put into a culture medium.

(2)

- (c) Before insulin was made in this way, it could only be obtained from sheep and pigs. Suggest **two** reasons, other than preventing the exploitation of animals, why it is better to obtain insulin by genetic engineering than from animals.

1. _____

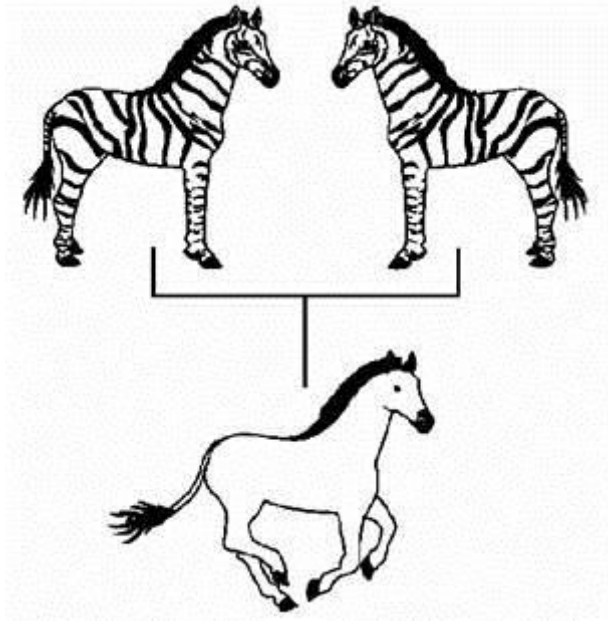
2. _____

(2)

(Total 7 marks)

Q51.

Sometimes an adult offspring will show a distinct variation from its parents, like a zebra appearing to have no stripes.



(a) (i) Changes of this sort are called _____ (1)

(ii) Which part of the cell has chemically changed to cause this variation? Circle the correct answer.

Cytoplasm gene membrane nucleus (1)

(b) Give a cause of this type of chemical change in a cell.

_____ (1)

(c) Use zebras as an example to explain the term *species*.

_____ (2)

(Total 5 marks)

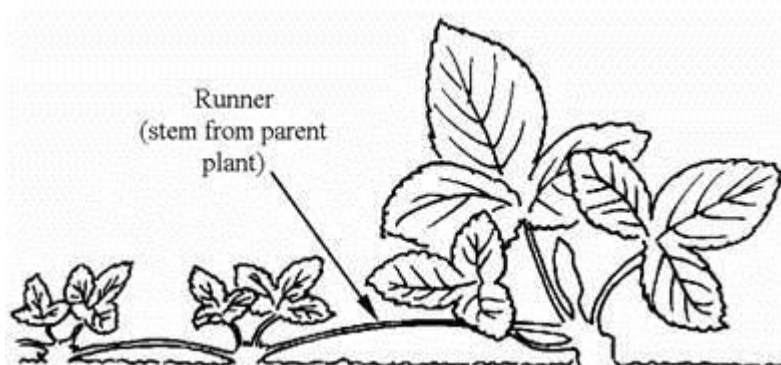
Q52.



A grower found some small strawberries with a nice taste, growing on a strawberry plant.

The grower then developed plants with strawberries which were larger but had the same nice taste.

Once the grower had developed his new plants, he could use runners to produce more plants which had the new large and tasty strawberries.



(i) What type of reproduction is this called?

(1)

(ii) Why would he use this type of reproduction to produce more new plants?

(1)

(Total 2 marks)

Q53.

A particular species of snail has a shell which may be pink, yellow or brown. It may also be plain or have bands running round it.

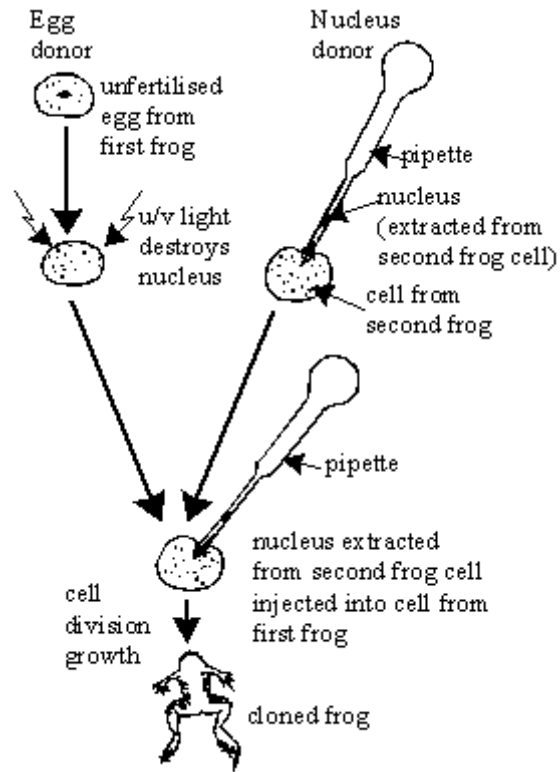
The snails are eaten by song thrushes.

Explain why snails with plain brown shells are the most common in hedgerows.

(Total 4 marks)

Q54.

The diagram shows how a frog can be cloned.



- (a) In the example shown, will the cells of the cloned frog be the same as those of frog 1 or frog 2?

Explain your answer as fully as possible.

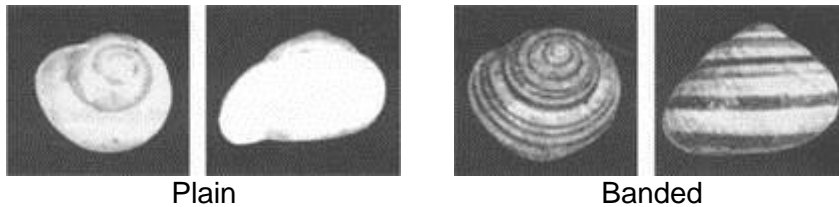
(4)

- (b) Discuss the advantages and disadvantages of cloning compared to sexual reproduction.

(5)

Q55.

Cepaea nemoralis is a snail which is found on sand dunes. It may have a plain or banded shell. The snails are found on grass stalks and leaves.

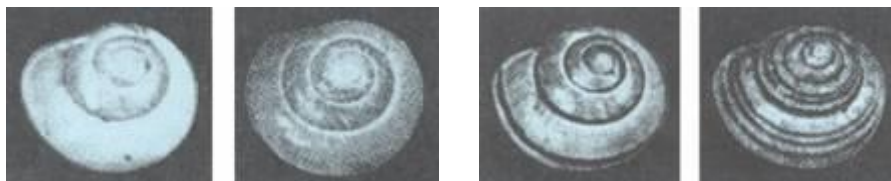


A scientist collected young unbanded snails and kept them until they were fully grown and mated them.

The eggs laid produced 35 unbanded and 12 banded snails.

- (a) Explain these figures as fully as you can. You may use a genetic diagram if you wish to make your answer clearer.

(7)



Variation in colour

Variation in banding

- (b) The snail shells show a lot of variation in colour. They are yellowy/green, brown,

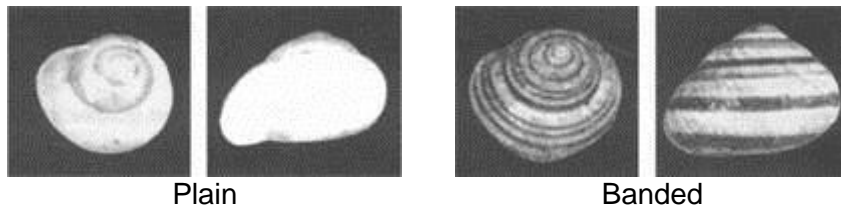
pink or cream. The banding varies from a single wide band to a mixture of thick and thin bands.

Describe briefly the factors which have produced this variation and explain how these factors may themselves have arisen.

(4)
(Total 11 marks)

Q56.

Cepaea nemoralis is a snail which is found on sand dunes. It may have a plain or banded shell. The snails are found on grass stalks and leaves.



When a scientist collected snails on the sand dunes he got 450 banded
280 unbanded.

Snails are eaten by birds. Sand dunes have clumps of grasses growing on them.

Suggest why there were more banded than unbanded snails on the sand dunes.

(Total 4 marks)

