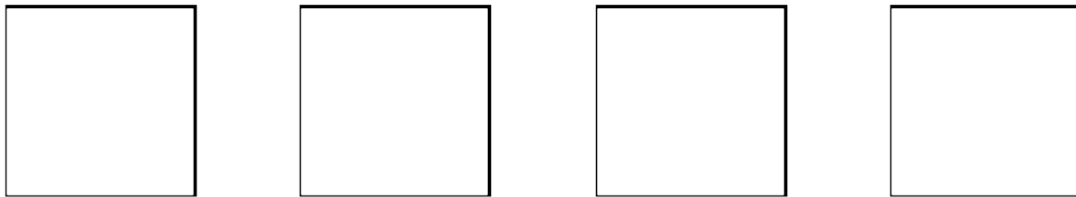
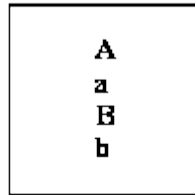


1

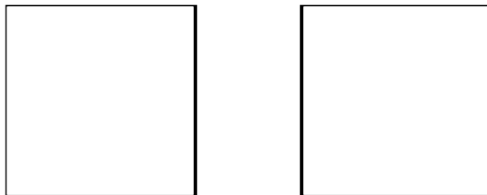
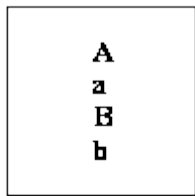
In the cell shown in the diagram as a box, one chromosome pair has alleles **Aa**. The other chromosome pair has alleles **Bb**. The cell undergoes meiosis.

- (a) Complete the diagram of the four gametes to show the independent assortment, or reassortment, of genetic material during meiosis.



(2)

- (b) If the cell undergoes mitosis instead of meiosis, draw the two daughter cells which result to show the chromosomes in each.



(2)

- (c) State the number of chromosomes in:

- (i) a normal human cell;

.....

(1)

- (ii) a human gamete;

.....

(1)

(iii) the daughter cell from mitosis of a human cell.

.....

(1)

(Total 7 marks)

2

Two heterozygous parents, with alleles Rr, produce offspring.

(i) Draw a genetic diagram to show all the possible arrangements of alleles in their offspring.

(2)

(ii) One of the offspring is dominant homozygous. What is the chance of this occurring?

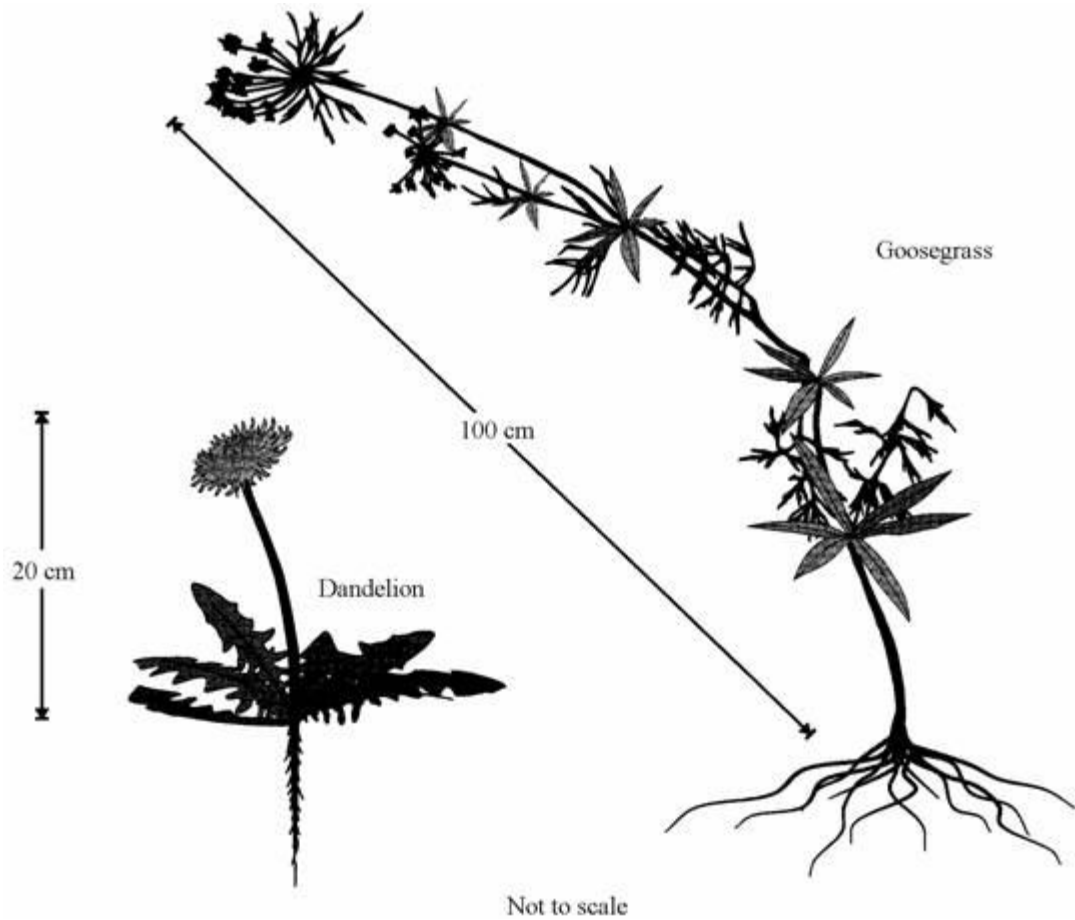
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(1)

(Total 3 marks)

3

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.

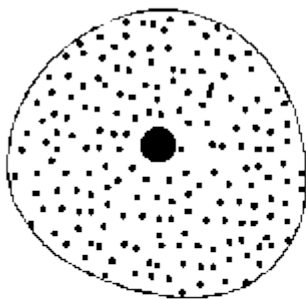
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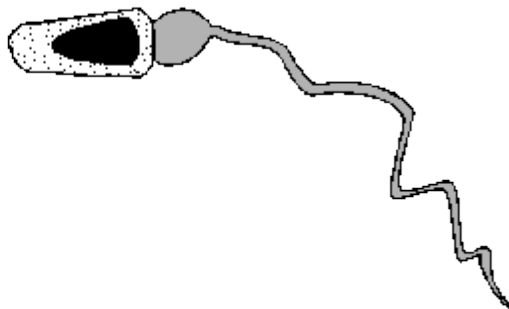
(Total 8 marks)

4

Men and women produce different gametes (sex cells).



Female gamete



Male gamete

Not to scale

(a) In sexual reproduction the male and female gametes join together.

What is the name for this process?

.....

(1)

(b) Complete the sentences about sex cells.

(i) Male gametes are called

They are produced in the

(2)

(ii) Female gametes are called

They are produced in the

(2)

(Total 5 marks)

5

One of Mendel's original experiments was to cross pure-breeding, red-flowering pea plants with pure-breeding white-flowering pea plants. The next year he grew the seed he had collected. This first generation, F_1 , of pea plants all had red flowers. Mendel then made each flower on these plants self-pollinate. He collected the seed from these flowers and grew them. The second generation, F_2 , gave the following result:

705 red-flowering plants and 224 white-flowering plants.

(a) Which flower colour is due to the recessive allele?

.....

(1)

- (b) Draw a genetic diagram to show the inheritance of flower colour in the first generation (**F₁**) of plants.

Use the letters **r** and **R** to represent the alleles for flower colour.

(3)

- (c) Explain why Mendel made the first generation of plants self-pollinate.

.....
.....
.....

(2)

- (d) If Mendel had taken any two of his white-flowering peas and crossed them, what would have been the colour of the flowers of the next generation of plants?

.....

(1)

- (e) It is very difficult to get red-flowering pea plants that breed true. Explain why you cannot guarantee to breed, by self-pollination, pea plants that only have red flowers.

.....

.....

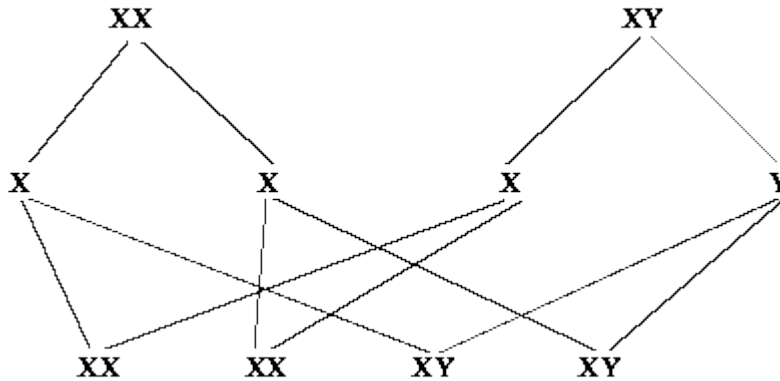
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.....

(2)
(Total 9 marks)

6

The genetic diagram shows how the chromosomes divide and combine in human reproduction.



- (a) Draw circles around the symbols for the **two** male gametes.

(2)

- (b) State the chance of a child being a girl.

.....

(1)

- (c) (i) How many pairs of chromosomes are there in a human body cell?

.....

(1)

- (ii) How many chromosomes are there in a human egg cell?

.....

(1)

- (d) Chromosomes contain genes. From what substance are genes made?

.....

(1)

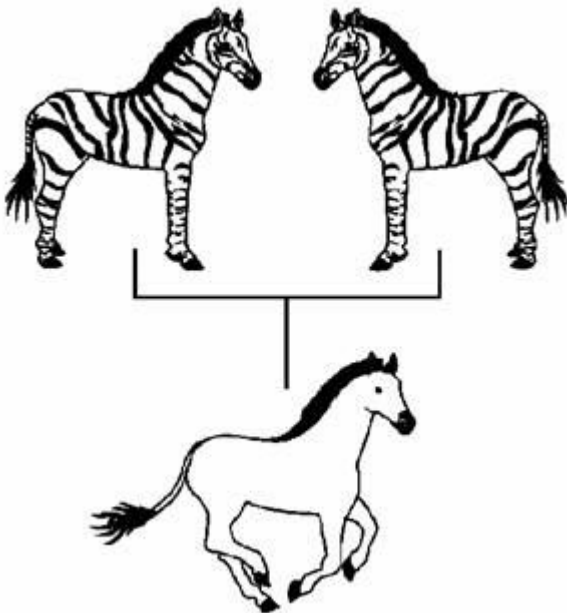
(e) In the process of mitosis, how do the number of chromosomes in the daughter cells compare to that in the original cell?

.....

(1)
(Total 7 marks)

7

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)

8

(a) How many pairs of chromosomes are there in a body cell of a human baby?

.....

(1)

(b) Place the following in order of size, **starting with the smallest**, by writing numbers **1 – 4** in the boxes underneath the words.

chromosome

nucleus

gene

cell

(1)

(c) For a baby to grow, its cells must develop in a number of ways.

Explain how each of the following is part of the growth process of a baby.

(i) Cell enlargement

.....

(1)

(ii) The process of cell division by mitosis

.....
.....
.....
.....
.....
.....

(3)

(d) Why is cell specialisation (differentiation) important for the development and growth of a healthy baby from a fertilised egg?

.....
.....

(2)
(Total 8 marks)

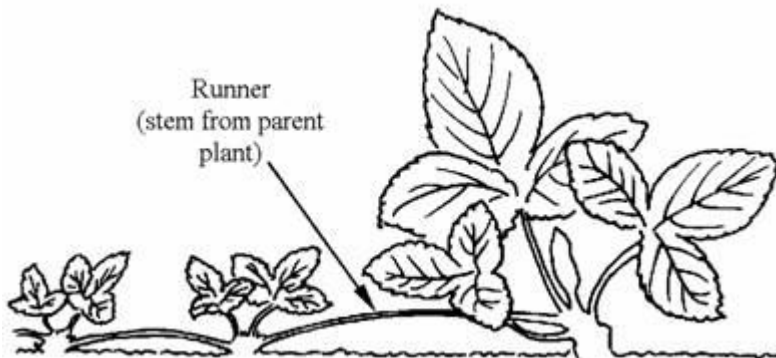
9



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)

10

Cystic fibrosis is a disease which affects 1 in 1600 babies.

(a) What are the symptoms of cystic fibrosis?

.....
.....
.....
.....
.....
.....

(3)

(b) Two parents with normal characteristics have a child who was born with cystic fibrosis.

Explain, as fully as you can, how this can happen.

You may use a genetic diagram if you wish.

.....

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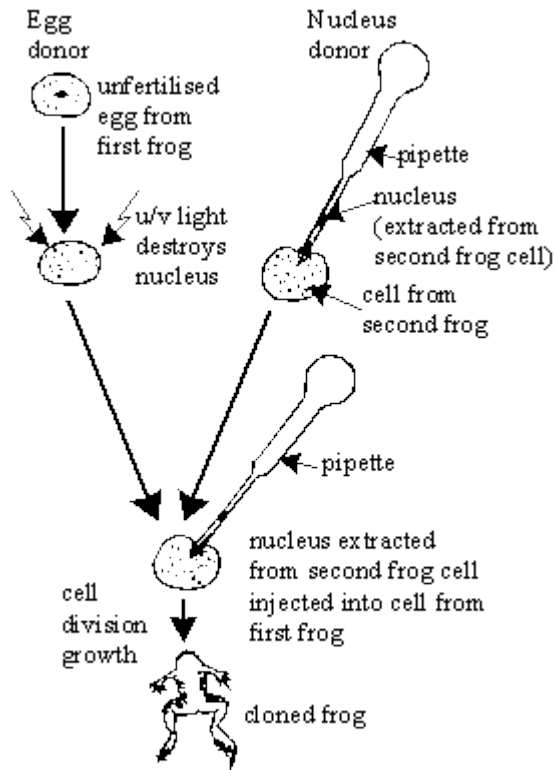
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(4)
(Total 7 marks)

11

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.

.....

.....

.....

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.....

(4)

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

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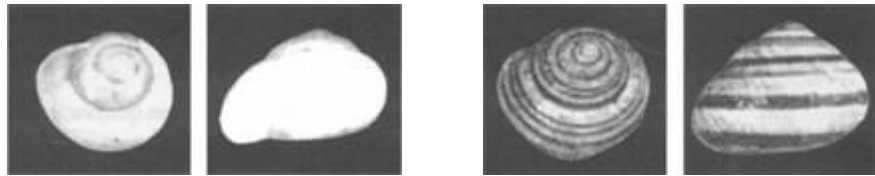
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(5)
(Total 9 marks)

12

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.



Plain

Banded

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.

.....

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.....

(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)

13

Many insecticides contain “active” ingredients called pyrethrins. These are extracted from pyrethrum daisies. These plants are grown in Kenya, a developing country in Africa. They provide income for farmers and valuable exports.

An American biotechnology company has now transferred the gene for making a specific pyrethrin to brewers’ yeast. This can be grown easily, so this pyrethrin can be produced cheaply. However, insect populations can build up resistance to specific pyrethrins.

(a) What are the advantages and disadvantages of using brewers' yeast to produce pyrethrins?

.....

.....

.....

.....

.....

.....

.....

.....

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.....

(6)

(b) Describe, as fully as you can, how a gene for making pyrethrins is transferred from daisy to yeast.

.....

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

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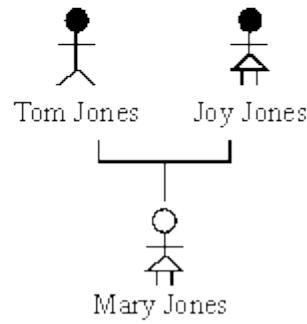
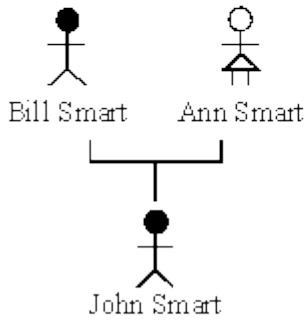
(Total 9 marks)

14

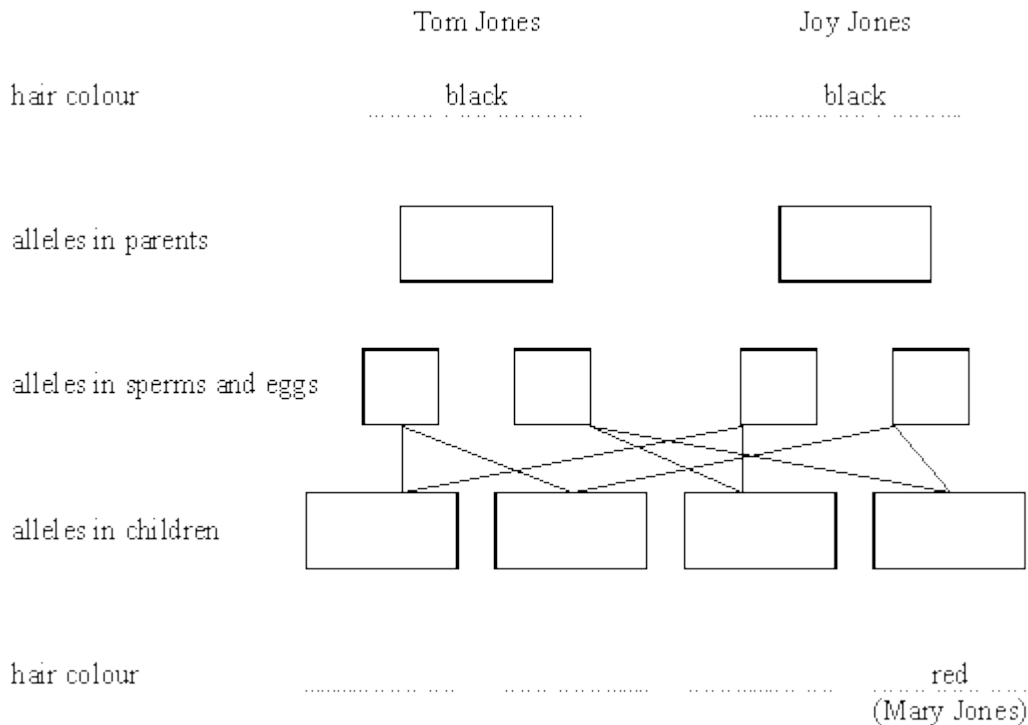
The family trees below show the inheritance of hair colour in two families.

People with black hair are shown as:  

People with red hair are shown as:  



- (a) The allele for black hair is dominant over the allele for red hair.
 Use the letter **B** as the allele for black hair.
 Use the letter **b** as the allele for red hair.
 Complete the diagram below to show the chances of Mary Jones inheriting red hair.



(4)

- (b) John Smart and Mary Jones grew up, got married and had a child.
What would the chances be that the child had red hair?

.....

(1)

Explain your answer. Use a genetic diagram if it makes your answer clearer.

.....

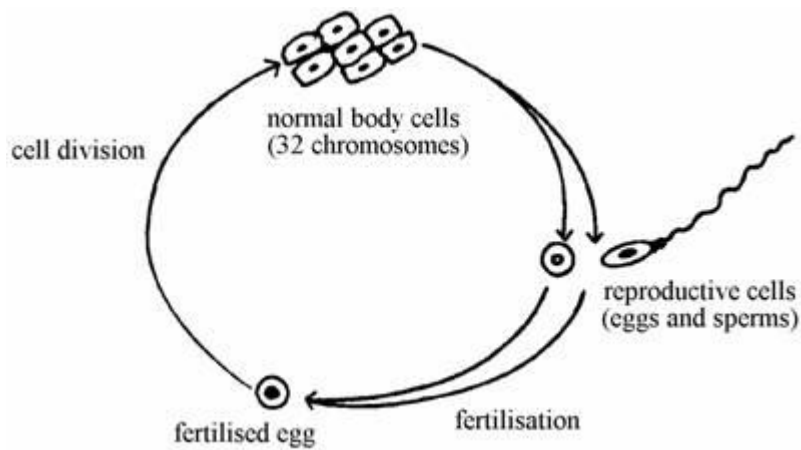
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.....

(3)
(Total 8 marks)

15

The diagram shows three types of cells in a life history of a simple animal.



(a) How do the chromosomes of the body cells compare with the chromosomes in the fertilised egg from which they came?

.....
.....

(1)

(b) Describe what happens to chromosomes in the nucleus of a body cell when it forms reproductive cells.

.....
.....
.....
.....
.....

(4)

(Total 5 marks)

16

Spiders produce a protein thread which is extremely strong compared to man-made fibres of the same diameter.



Spider's web

Explain how genes control the way the protein is made in the spider's body.

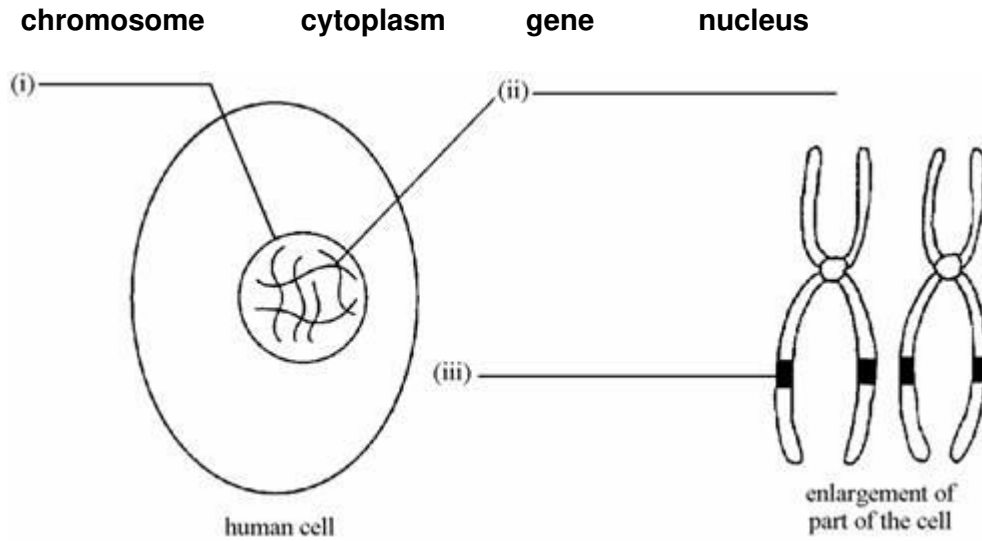
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.....

(Total 4 marks)

17

The diagram shows a human cell and some of its contents.

(a) Choose words from this list to label the diagrams.



(3)

(b) Choose words from this list to complete the sentence.

a body cell an egg cell a gamete a sperm cell

In the cell above, the chromosomes are found in pairs so this cell must be

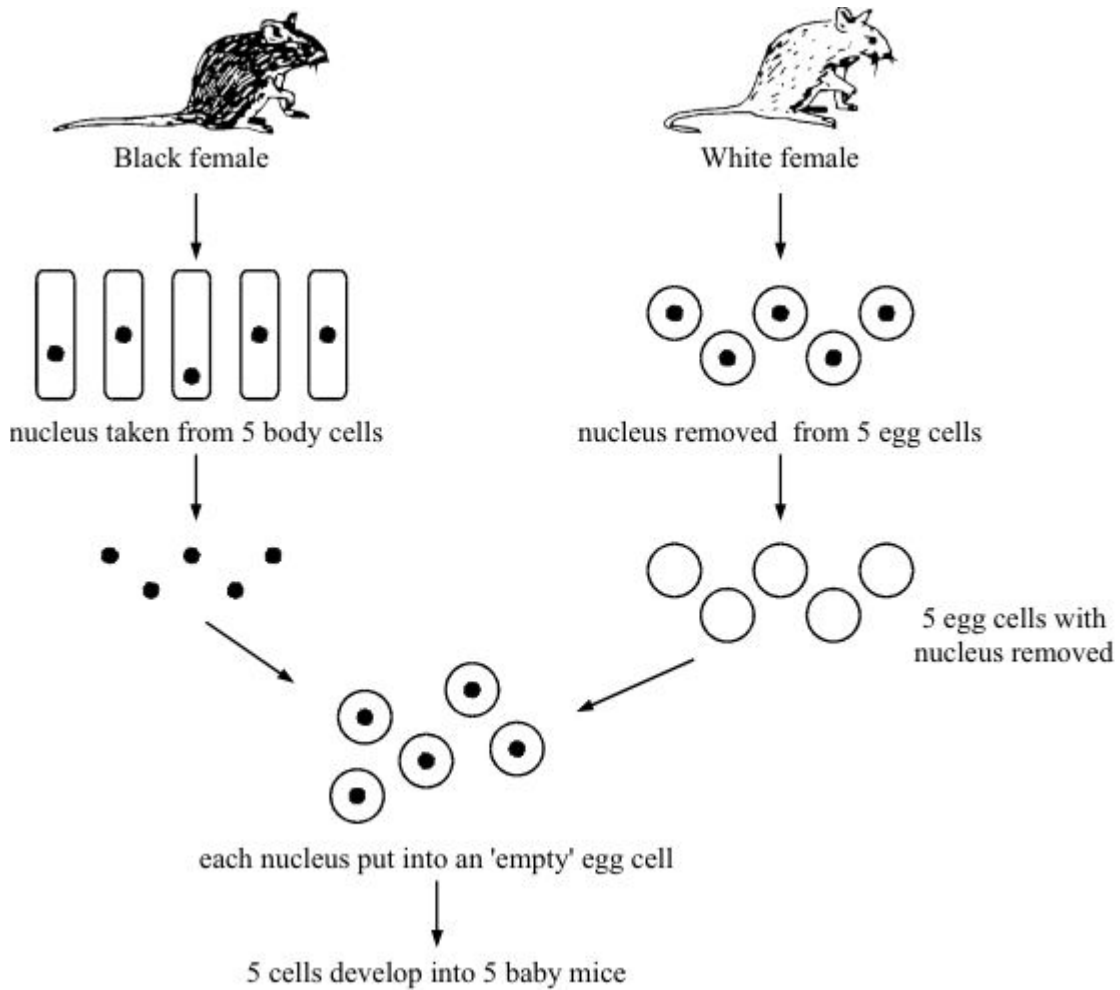
.....

(1)

(Total 4 marks)

18

The diagram shows how you can breed mice without using male sex cells.



(a) (i) What type of reproduction is shown above?

.....

(1)

(ii) Which part of the nucleus carries the information to make a mouse black or white?

.....

(1)

(iii) Carefully describe how the baby mice

(A) compare with each other,

.....

(B) compare with the parent mice

.....

(3)

(b) Mice normally reproduce in a similar way to humans.

(i) Which organs in the white mouse released the five egg cells?

.....

(1)

(ii) What treatment could you give the white mouse to make her release more eggs?

.....

.....

(1)

(Total 7 marks)

19

For many years scientists studied the organisms in an area of grassland.

One of the animals was a species of black fly. In this population only one allele **B** existed for colour. All the flies were homozygous **BB**.

A mutation occurred which produced a new recessive allele **b** which could produce a green colour.

(a) Draw **two** genetic diagrams to show how the single **b** allele in just one fly was able to produce homozygous **bb** green flies in two generations.

First generation

Second generation

(4)

(b) Although this new allele was recessive and the mutation only occurred once, a large proportion of the fly population was soon green.

Suggest in terms of natural selection why the recessive **b** allele was able to spread through the population.

.....

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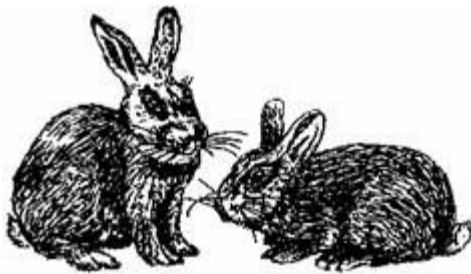
.....

.....

(3)
(Total 7 marks)

20

These young rabbits look like their parents. This is because information about characteristics such as fur colour is passed from parents to their young.



Choose words from this list to complete the sentences below.

- body** **chromosomes** **clones** **cytoplasm**
genes **nucleus** **sex**

Information is passed from parents to their young in cells.

Each characteristic, e.g. fur colour, is controlled by

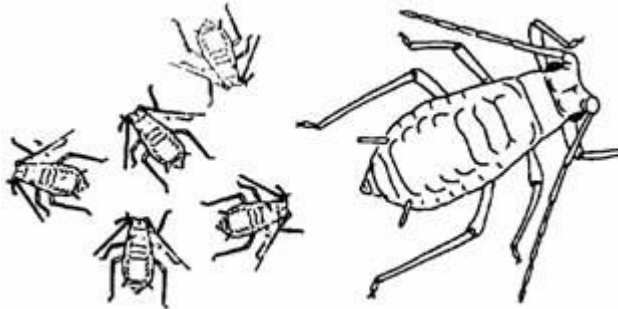
The structures which carry information for a large number of characteristics are called

The part of the cell which contains these structures is called the

(Total 4 marks)

21

The bean aphid is a type of black-fly which lives on broad bean plants in summer. In the autumn, males and females mate and produce eggs.



(a) Name the type of reproduction which produces the eggs.

.....

(1)

(b) In spring these eggs hatch. The young aphids are all female. Explain why they are all similar but not identical to each other.

.....

(1)

(c) These females are then able to produce offspring without needing any males.

(i) Name the type of reproduction where females do **not** need males to produce offspring.

.....

(1)

(ii) How will the offspring from one of these females:

A compare with each other

.....

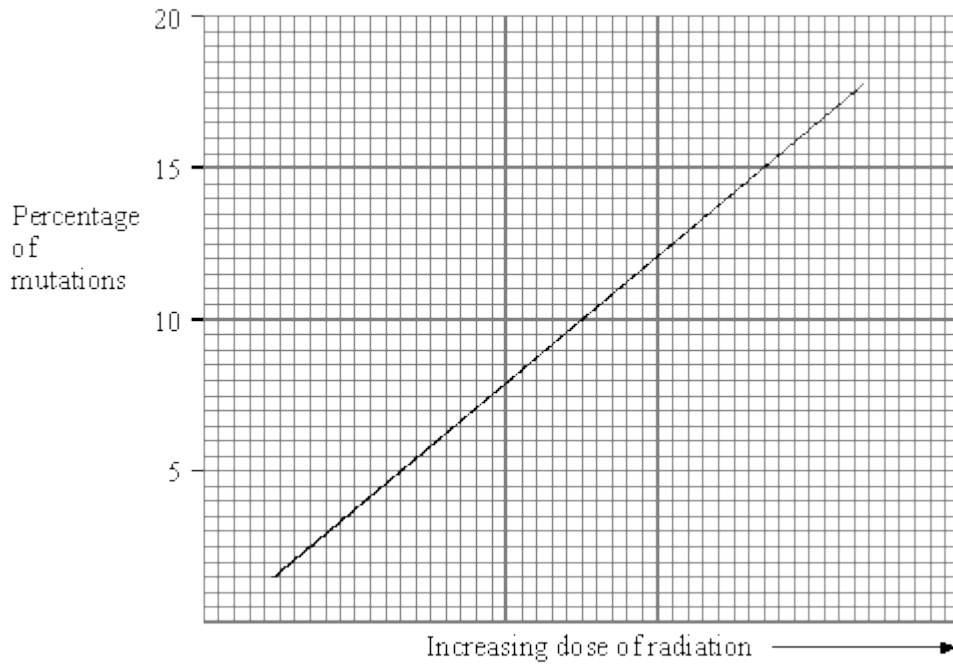
B compare with the offspring from other females?

.....

(2)

(d) Some scientists investigated mutations in these aphids. They exposed the aphids to X-rays.

They plotted their results.



(i) What was the connection between the dose of X-rays and the percentage of mutations?

.....

(1)

(ii) Name **one** other possible cause of mutations.

.....

(1)

(Total 7 marks)

22

Cystic fibrosis is an inherited disease which causes the tubes in the lungs to be blocked with sticky mucus. Two parents who do not have the disease can still produce children who do have the disease.

- (a) Explain how children can inherit this disease from parents who do not have it (use a genetic diagram in your answer if you want to).

.....

.....

.....

.....

.....

(4)

- (b) Mucus contains protein. The information for the production of this protein is stored in a gene.

Explain how a change in a gene causes a different protein to be produced.

.....

.....

.....

.....

(3)

(Total 7 marks)