# Edexcel IGCSE(9-1) Biology

## Specification Based Exam Questions

### Part 3: Reproduction and Inheritance

This resource is to help you gain exam technique as well as understand what is needed to develop your answers to nearly all the points of the specification. You should use this in conjunction with other revision practices.

Good luck!

# 3 Reproduction and inheritance

## 3.1 understand the differences between sexual and asexual reproduction

(d) Suggest why a flower grower may want his coloured flowers to reproduce asexually.

(2)

(c) State **two** differences between sexual reproduction and asexual reproduction.

(2)

## 3.2 understand that fertilisation involves the fusion of a male and female gamete to produce a zygote that undergoes cell division and develops into an embryo

(c) The passage describes part of the process of reproduction in mice.

Complete the passage by writing a suitable word in each blank space.

(6)

The male mouse produces gametes called ..... that swim to the female gamete. Each gamete has the haploid number of chromosomes, which is 20 in mice.

The gametes join in a process called ..... . The single cell produced is called a ..... and contains the ..... number of chromosomes.

This cell divides by ..... into an embryo. Each cell in the embryo contains ..... chromosomes.

**3.3 describe the structures of an insect-pollinated and a wind-pollinated flower and explain how each is adapted for pollination**

**1** Plants can reproduce sexually or asexually.

Plants that reproduce sexually can be pollinated by insects or by wind.

(a) State three ways in which the structure of insect-pollinated flowers differs from the structure of wind-pollinated flowers.

(3)

1 .....

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2 .....

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3 .....

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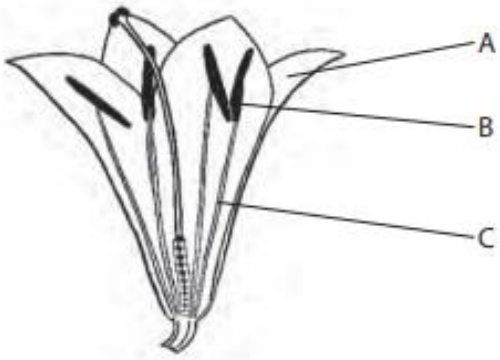
(b) The diagram shows a flower from a plant.




Name the structures labelled on the diagram.

(3)

A .....

B .....

C .....

**3.4 understand that the growth of the pollen tube followed by fertilisation leads to seed and fruit formation**

(c) The flower in the diagram is insect-pollinated.

An insect carrying pollen lands on the flower.

Describe the events that lead to seed formation.

(5)

(c) Describe the events that take place from when pollen lands on the stigma of a flower to when seeds are formed.

**(5)**

## 3.5 *practical: investigate the conditions needed for seed germination*

**2** A student wanted to investigate the conditions required for the germination of seeds.

He set up 5 boiling tubes each containing 10 cress seeds on cotton wool sealed with rubber bungs.

- Tube A contained dry cotton wool and was placed at room temperature in the light.
- Tube B contained moist cotton wool and was placed at room temperature in the light.
- Tube C contained moist cotton wool and was placed in a fridge in the dark.
- Tube D contained moist cotton wool and was placed at room temperature in the dark.
- Tube E contained moist cotton wool and was placed at room temperature in the light and contained alkaline pyrogallol to absorb oxygen.

The student left the tubes for 3 days and then returned to observe the results.

He measured the height of the seedlings and recorded how many had germinated.

Some of his results are shown below.

Tube A no seeds germinated.

Tube B 9 seeds germinated with the following heights: 2.0 cm, 2.1 cm, 3.1 cm, 2.2 cm, 2.1 cm, 1.8 cm, 2.3 cm, 2.7 cm and 2.5 cm.

Tube C one seed germinated with a height of 0.3 cm.

(a) Complete the summary table to show the conditions and the results for tubes A, B and C only.

**(4)**

| Tube | Location | Water | Light | % seeds germinated | Average height in cm |
|---|---|---|---|---|---|
| **A** | room | | yes | | |
| **B** | | yes | | | |
| **C** | | | | | 0.3 |

(b) Explain how the student could tell whether the seeds had germinated.

**(2)**

(c) The student's teacher commented that there were too many different independent variables in his experiment.

Identify the independent variables in the experiment.

**(2)**

(d) Explain what the results would be for tube D.

**(2)**

(e) Explain why the seeds in tube E failed to germinate.

**(1)**

**3.6 understand how germinating seeds utilise food reserves until the seedling can carry out photosynthesis**

**1** Plants can reproduce sexually and produce seeds.

These seeds can remain dormant for long periods of time before germination takes place.

(a) What is meant by the term **germination**?

(1)

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(b) Explain three conditions needed for seeds to germinate.

(6)

1 .....

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2 .....

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3 .....

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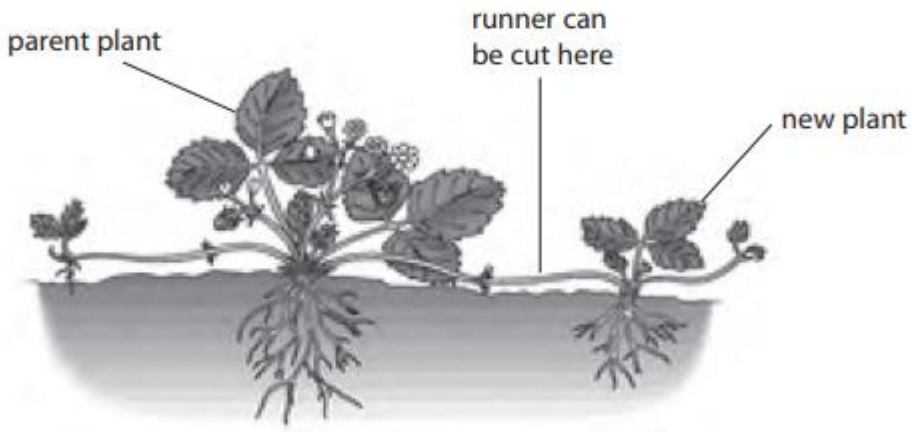
**3.7 understand that plants can reproduce asexually by natural methods (illustrated by runners) and by artificial methods (illustrated by cuttings)**

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

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




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

(1)

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

Suggest advantages of producing new strawberry plants in this way.

(2)

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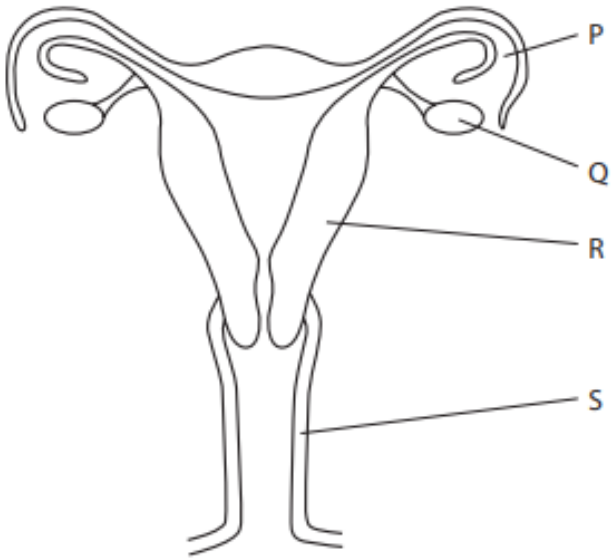
**3.8 understand how the structure of the male and female reproductive systems are adapted for their functions**

**4** The diagram shows the structure of the female reproductive organs.




(a) Name the structures labelled in the diagram.

(4)

P .....

Q .....

R .....

S .....

**10** The passage describes human reproduction.

Complete the passage by writing a suitable word or words in each blank space.

**(10)**

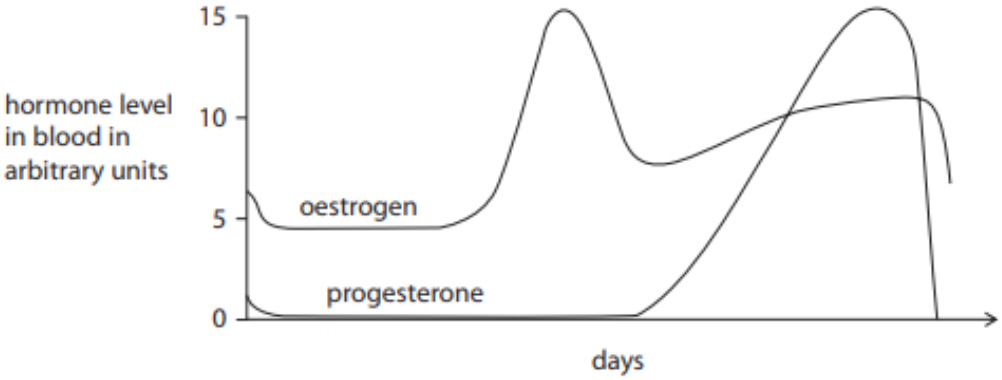
During sexual intercourse the male's ..... is inserted into the vagina. The male gametes, known as ..... , are released from the male urethra into the vagina. The male gametes carry on swimming until one meets a female gamete, known as the ..... . This process is fertilisation and takes place in a tube called the ..... .

The fertilised female gamete, also known as the ..... , moves down this tube. It undergoes the type of cell division called ..... and is now known as an ..... . This structure may then become implanted in the wall of the ..... .

The number of chromosomes in the fertilised female gamete is ..... the number found in the unfertilised gamete and is known as the ..... number.

## 3.9 understand the roles of oestrogen and progesterone in the menstrual cycle

(b) The graph shows changes in the hormones oestrogen and progesterone during a woman's menstrual cycle.




On the graph indicate using

(i) a letter O, the day when ovulation is most likely to occur.

(1)

(ii) a letter M, the day when menstruation is likely to start.

(1)

(iii) Describe the changes that take place in structure R during the menstrual cycle.

(3)

(b) Figure 5 shows the level of progesterone for a female during five different stages of the menstrual cycle.

| days in the menstrual cycle | progesterone level (nmol/l) |
|---|---|
| 1–9 | 1.85 |
| 10–14 | 1.48 |
| 15–17 | 14.28 |
| 18–23 | 35.27 |
| 24–28 | 17.11 |

**Figure 5**

(i) Describe the changes in progesterone levels during the 28-day cycle.

**(2)**

(ii) Explain why progesterone levels changed following day 14.

**(2)**

(iii) Use Figure 5 to explain if the female is pregnant.

**(2)**

**3.10B understand the roles of FSH and LH in the menstrual cycle**

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

The hormone that stimulates the maturation of follicles in the ovary is

(1)

- ☐ **A** FSH
- ☐ **B** LH
- ☐ **C** oestrogen
- ☐ **D** progesterone

**3.11 describe the role of the placenta in the nutrition of the developing embryo**

(c) Describe how the developing embryo is supplied with nutrients.

(3)

(b) The placenta supplies the embryo with nutrients during the gestation period.

Describe the role of the placenta in the development of the embryo.

(4)

**3.12 understand how the developing embryo is protected by amniotic fluid**

(a) Describe the function of the amniotic fluid surrounding the fetus.

(2)

**3.13 understand the roles of oestrogen and testosterone in the development of secondary sexual characteristics**

(d) Describe the role of oestrogen at puberty.

(3)

**3.14 understand that the genome is the entire DNA of an organism and that a gene is a section of a molecule of DNA that codes for a specific protein**

**1** (a) What is meant by the term **gene**?

(2)

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**3.15 understand that the nucleus of a cell contains chromosomes on which genes are located**

The nucleus of a daffodil cell has 46 chromosomes.

(a) (i) State the number of chromosomes in each pollen grain from this daffodil.

(1)

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**3.16B describe a DNA molecule as two strands coiled to form a double helix, the strands being linked by a series of paired bases: adenine (A) with thymine (T), and cytosine (C) with guanine (G)**

**6** (a) DNA is composed of four different DNA nucleotides.

(i) Which diagram represents the arrangement of the sugar, phosphate and the base in a DNA nucleotide?

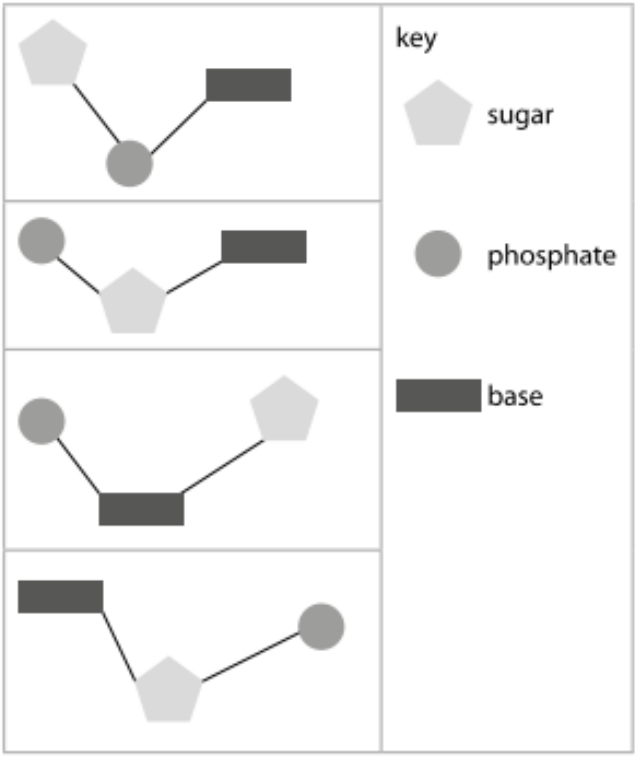
(1)

☐ **A**

☐ **B**

☐ **C**

☐ **D**



(ii) An allele starts with the DNA sequence ATGCATGTACCG.

Give the sequence of the complementary DNA sequence.

(1)

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Describe the structure of DNA.

(3)

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(b) A gene is made from 1000 base pairs. The table shows the percentage of each base found in the gene.

(i) Complete the table by giving the name of the missing base.

(1)

| Percentage of base | Name of base |
|---|---|
| 29 | adenine |
| 21 | |
| 29 | thymine |
| 21 | cytosine |

(ii) Calculate how many cytosine bases you would expect to find in this gene.

(1)

Answer .....

**3.17B understand that an RNA molecule is single stranded and contains uracil (U) instead of thymine (T)**

(c) The diagram shows part of one DNA strand.

(i) Complete the empty boxes to show the mRNA strand coded for by this DNA strand.

(2)

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| DNA strand | G | G | C | T | A | G | T | T | G |
| mRNA strand | | | | | | | | | |

**3.18B describe the stages of protein synthesis including transcription and translation, including the role of mRNA, ribosomes, tRNA, codons and anticodons**

(c) Information in a DNA strand can be transcribed to make a strand of mRNA.

Describe how this mRNA strand is then used to make proteins.

(4)

(c) The diagram shows part of one DNA strand.

(i) Complete the empty boxes to show the mRNA strand coded for by this DNA strand.

(2)

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| DNA strand | G | G | C | T | A | G | T | T | G |
| mRNA strand | | | | | | | | | |

(ii) State the maximum number of amino acids that are coded for by this DNA strand.

(1)

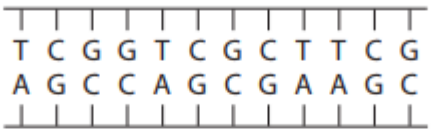
.....

(d) Name the structure where translation occurs.

(1)

.....

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




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

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

(1)

☒ **A** 2

☒ **B** 3

☒ **C** 4

☒ **D** 12

**3.19 understand how genes exist in alternative forms called alleles which give rise to differences in inherited characteristics**

(ii) Give **one** way in which a second allele for eye colour might be different.

(1)

.....

.....

**3.20 understand the meaning of the terms: dominant, recessive, homozygous, heterozygous, phenotype, and genotype**

(c) What is meant by the term **dominant allele**?

(1)

(i) What is meant by the term **homozygous**?

(1)

(c) Explain how two parents with a dominant phenotype can produce offspring expressing a recessive characteristic.

(2)

**3.21B understand the meaning of the term codominance**

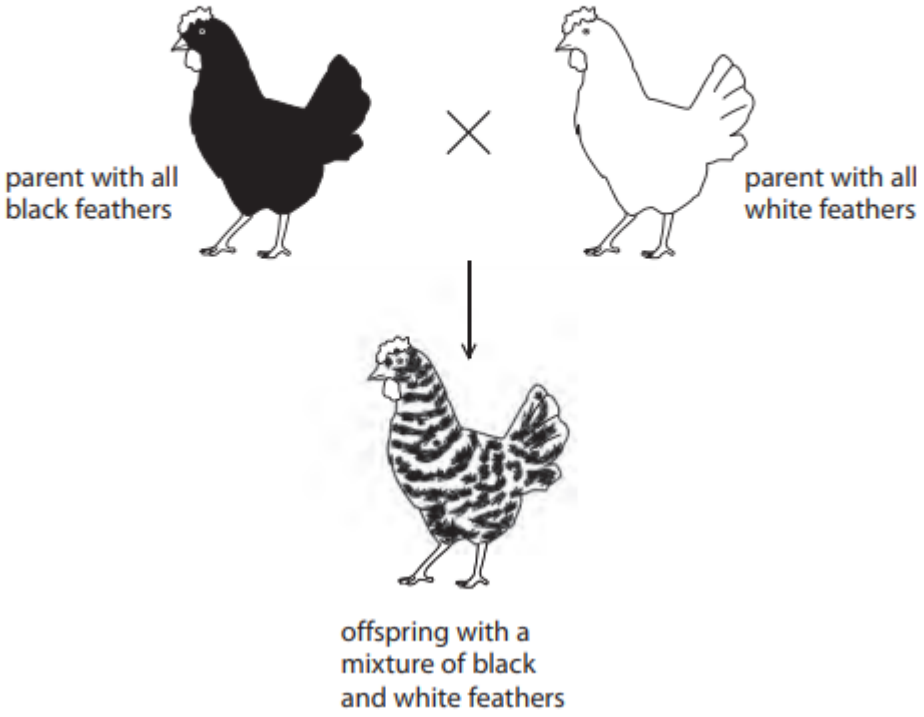
(d) Some phenotypes are controlled by codominant alleles.

What is meant by the term **codominant alleles**?

**(2)**

(c) The photograph shows a chicken with a mixture of black feathers and white feathers.

In chickens the inheritance of feather colour is controlled by codominant alleles. The allele for black feathers is $C^B$, and the allele for white feathers is $C^W$. The diagram shows a parent with all black feathers and a parent with all white feathers. It also shows one of their offspring with a mixture of black and white feathers.




(i) Complete the table by writing the genotype of the chickens shown in the diagram.

(1)

| Chicken | Genotype |
|---|---|
| parent with all black feathers | |
| parent with all white feathers | |
| offspring with a mixture of black and white feathers | |

(ii) Two of the offspring with a mixture of black and white feathers mated. What is the probability that their offspring would also have a mixture of black and white feathers?

(1)

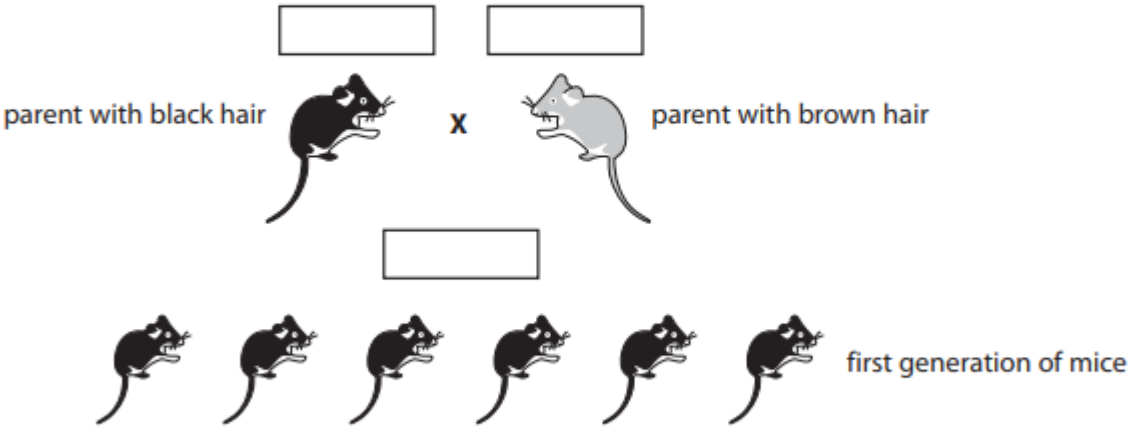
**3.22 understand that most phenotypic features are the result of polygenic inheritance rather than single genes**

## 3.23 describe patterns of monohybrid inheritance using a genetic diagram

**1** Mice can have black hair or brown hair in their fur.

The allele for black hair (B) is dominant to the allele for brown hair (b).

A homozygous black haired mouse mated with a homozygous brown haired mouse to produce the first generation of offspring. The cross is shown in the diagram.




(a) Complete the diagram by writing the genotype of each parent and the offspring in the boxes.

**(2)**

(b) The first generation mice mated with each other and produced a second generation.

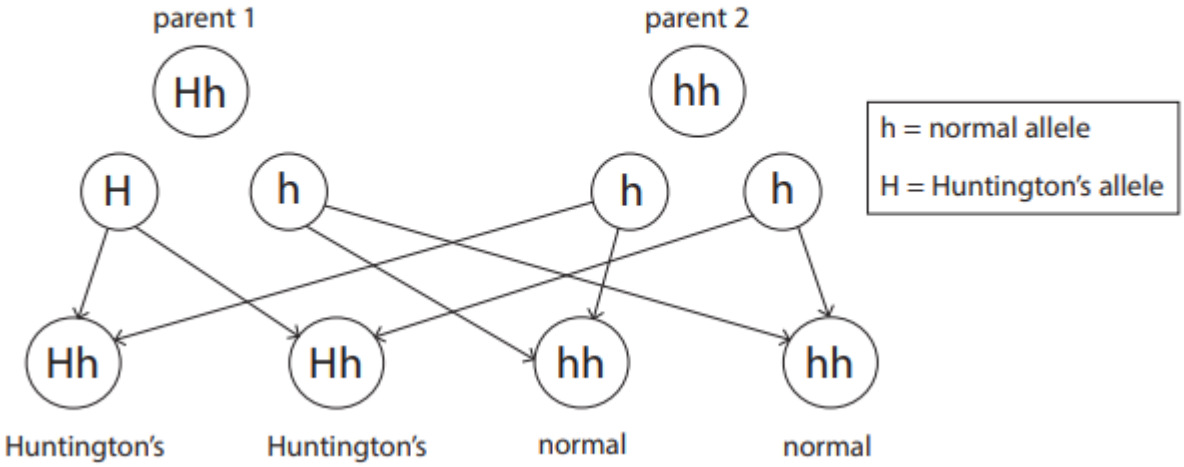
Complete the Punnett square to show the gametes involved and the genotypes of the possible second generation mice.

**(2)**

| male \ female | | |
|---|---|---|
| | | |
| | | |

**1** Huntington's disease is a genetic disorder.

The genetic diagram shows the inheritance of this disorder.




(a) (i) Use words or letters from the box to complete the following sentences.

**(2)**

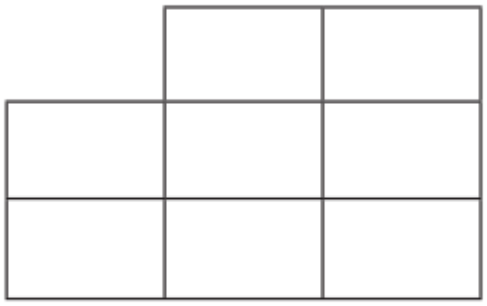
| dominant | recessive | phenotype |
|---|---|---|
| h | HH | hh |

Huntington's disease is caused by a ..... allele.

People with Huntington's disease can have the genotype Hh or ..... .

(ii) Complete the Punnett square to show the potential offspring of two parents heterozygous for Huntington's disease.

**(2)**



(iii) State the probability that a child of two parents, heterozygous for Huntington's disease, will have the disease.

**(1)**

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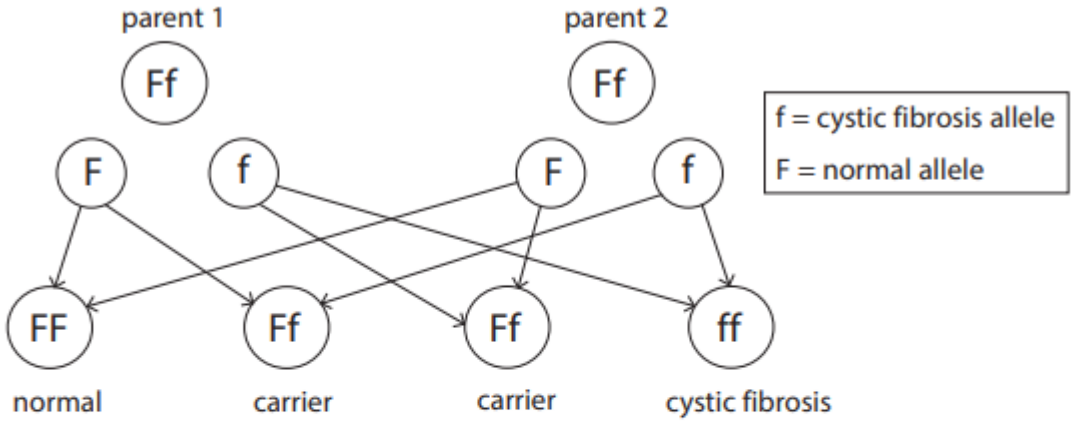
(b) The genetic diagram shows the inheritance of cystic fibrosis.




(i) Explain why, if both sets of parents are heterozygous, the chance of inheriting Huntington's disease is greater than the chance of inheriting cystic fibrosis.

**(2)**

**3.24 understand how to interpret family pedigrees**

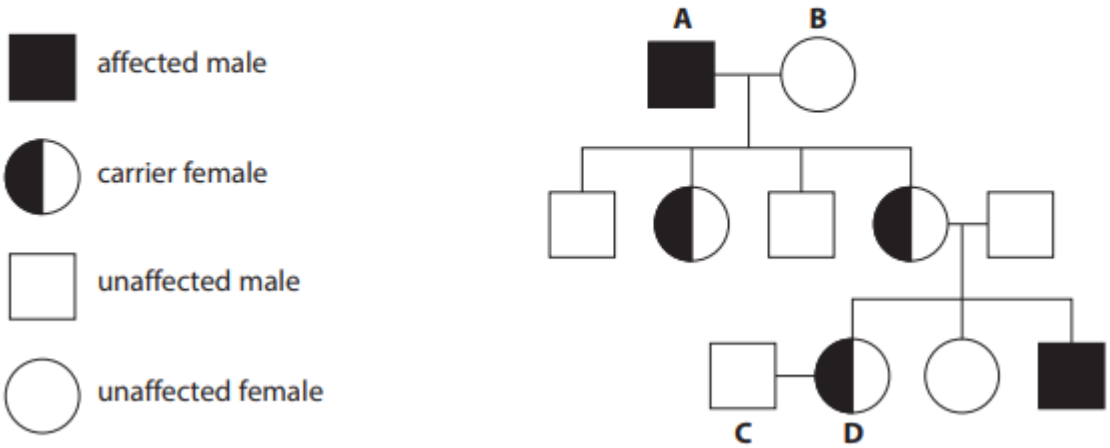
(c) Many genetic disorders are caused by a recessive allele rather than a dominant allele.

Explain how examining a family pedigree would enable you to tell if a condition was caused by a recessive allele.

(3)

**2** Haemophilia is a recessive sex-linked disorder.

This family pedigree shows the inheritance of haemophilia.




(a) (i) State the sex chromosomes of person **B**.

(1)

(ii) Explain why the male offspring from **A** and **B** do not have haemophilia.

(2)

## 3.25 predict probabilities of outcomes from monohybrid crosses

Polydactyly is a genetic disorder in which people inherit an extra digit.

Polydactyly is caused by a dominant allele (D). The table describes the different genotypes for polydactyly.

(b) The table lists possible matings between parents. Complete the table by writing the probability of each mating producing a child with polydactyly. One has been done for you.

(2)

| Parent genotypes | Probability of child with polydactyly |
|---|---|
| Dd × DD | |
| Dd × dd | 0.5 |
| Dd × Dd | |

**4** (a) Nile tilapia are fish. Their body colour is controlled by a single gene.

The allele N produces normal body colour and the allele n produces pink body colour.

Diagram 1 shows the phenotypes and the genotypes of Nile tilapia.

normal body colour (NN) normal body colour (Nn) pink body colour (nn)

**Diagram 1**

Diagram 2 shows all the possible crosses between the phenotypes and genotypes of Nile tilapia parents.

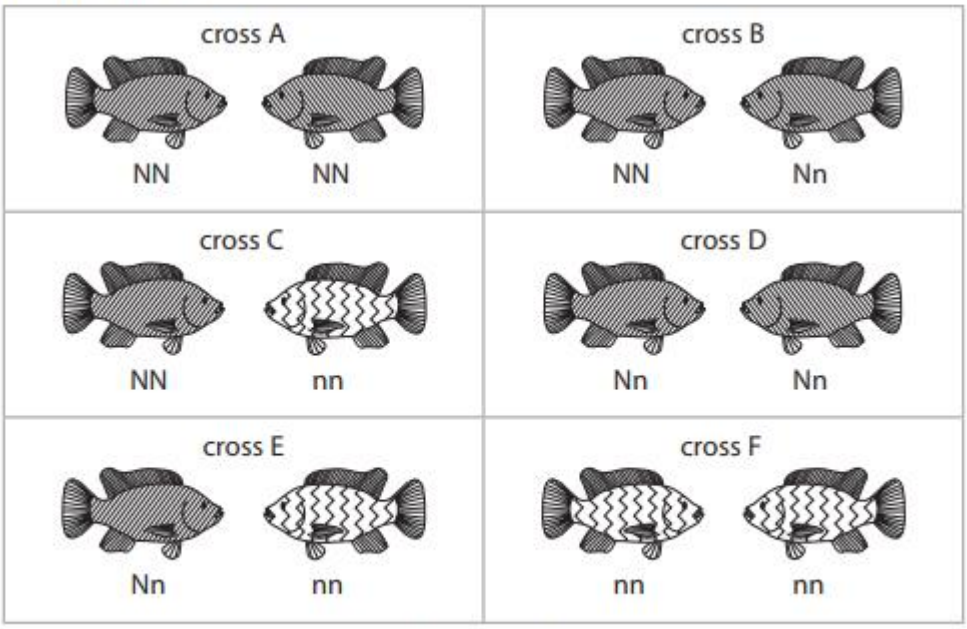



**Diagram 2**

The table gives some descriptions of offspring.

Complete the table by giving the number of crosses that would produce each description of offspring. The first one has been done for you.

(3)

| Description of offspring | Number of crosses |
|---|---|
| all are homozygous | 2 |
| 50% are heterozygous | |
| show a phenotype ratio of 1:1 | |
| have a genotype ratio of 1:1 | |

**3.26 understand how the sex of a person is controlled by one pair of chromosomes, XX in a female and XY in a male**

**4** (a) A student reads the following statement.

"the father determines the sex of a baby"

Explain why this statement is true.

(2)

**3.27 describe the determination of the sex of offspring at fertilisation, using a genetic diagram**

**3.28 understand how division of a diploid cell by mitosis produces two cells that contain identical sets of chromosomes**

(d) Name the type of cell division that produces an embryo from an individual cell.

(1)

**3.29 understand that mitosis occurs during growth, repair, cloning and asexual reproduction**

*(d) Mitosis and meiosis are types of cell division.

Compare these two types of cell division.

(6)

**3.30 understand how division of a cell by meiosis produces four cells, each with half the number of chromosomes, and that this results in the formation of genetically different haploid gametes**

(c) Cell division in an organism can take place by mitosis or by meiosis.
Give three ways in which mitosis differs from meiosis.

(3)

1

2

3

**3** (a) Sperm cells and egg cells are needed for human sexual reproduction.

Describe in detail the type of cell division that produces sperm cells.

(4)

**3.31 understand how random fertilisation produces genetic variation of offspring**

**3.32 know that in human cells the diploid number of chromosomes is 46 and the haploid number is 23**

**3.33 understand that variation within a species can be genetic, environmental, or a combination of both**

**3.34 understand that mutation is a rare, random change in genetic material that can be inherited**

**3.35B understand how a change in DNA can affect the phenotype by altering the sequence of amino acids in a protein**

(c) The diagram shows an enzyme and three amino acids.


This enzyme catalyses the reaction that joins amino acids to form proteins.

Explain how a gene mutation could reduce the rate of activity of this enzyme.

(2)

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**3.36B understand how most genetic mutations have no effect on the phenotype, some have a small effect and rarely do they have a significant effect**

**3.37B understand that the incidence of mutations can be increased by exposure to ionising radiation (for example, gamma rays, x-rays and ultraviolet rays) and some chemical mutagens (for example, chemicals in tobacco)**

**3.38 explain Darwin's theory of evolution by natural selection**

(b) Give **two** ways in which natural selection differs from selective breeding.

(2)

1 .....

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2 .....

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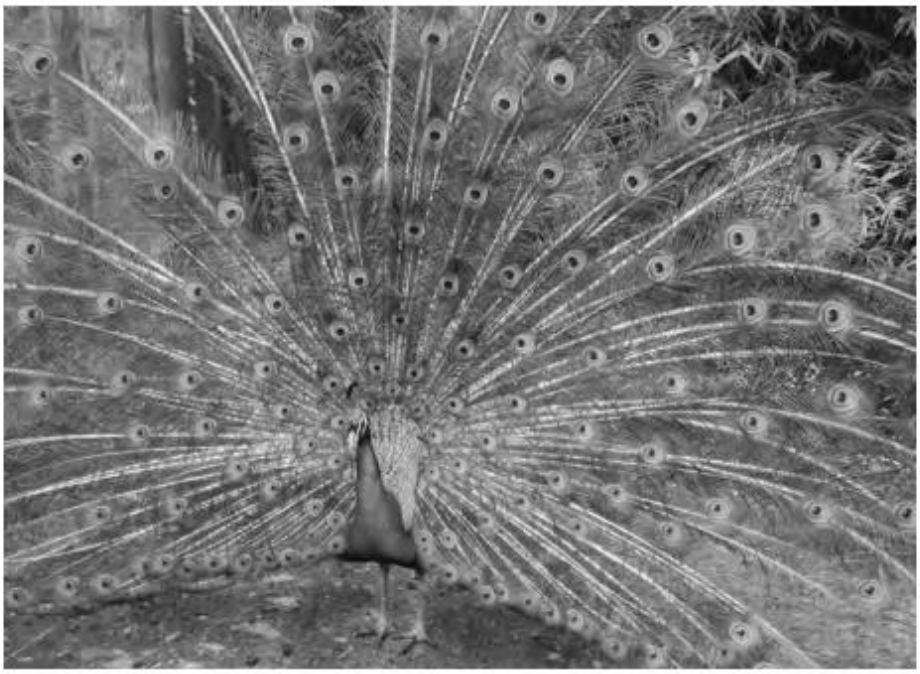
**2** The peacock is a bird found in the jungle in India.

The male has a large, colourful tail that he displays during courtship to attract a female to mate with.



Use your knowledge of natural selection to suggest how the peacock's tail has evolved.

**(5)**

**3.39 understand how resistance to antibiotics can increase in bacterial populations, and appreciate how such an increase can lead to infections being difficult to control**

**5** (a) Antibiotics are chemicals used to kill pathogens that cause infections.

(i) Name the type of organism that make antibiotics.

(1)

(ii) Name the type of pathogen that is killed by antibiotics.

(1)

(b) Some antibiotics are no longer effective in killing pathogens. Use your knowledge of natural selection to explain why.

(5)

**6** The use of a pesticide may result in an increase in the number of pest organisms that are resistant to the pesticide.

Use your knowledge of natural selection to explain the increase in the number of pest organisms that are resistant to the pesticide.

**(5)**