Week 23

IGCSE Biology

Homework bundle for this week

本周作业合集

exercises.lol

Contents 目录

IGCSE Biology Name: _____ Score: _____

1. A gene is:
   - ☐ a section of DNA that codes for a protein
   - ☐ a whole chromosome
   - ☐ a type of cell
   - ☐ a sugar
2. The shape of a DNA molecule is a:
   - ☐ double helix
   - ☐ single straight line
   - ☐ circle
   - ☐ square
3. Mitosis produces daughter cells that are:
   - ☐ genetically identical to the parent
   - ☐ all different
   - ☐ gametes
   - ☐ half the chromosome number
4. Meiosis produces how many cells from one parent cell?
   - ☐ four
   - ☐ two
   - ☐ one
   - ☐ eight
5. An allele is:
   - ☐ a version of a gene
   - ☐ a whole chromosome
   - ☐ a protein
   - ☐ a cell
6. How many chromosomes are in a human body cell?

   _____

7. How many chromosomes are in a human gamete?

_____

8. Mitosis is used for: (Select all that apply.)

   ☐ growth

   ☐ repair of tissue

   ☐ asexual reproduction

   ☐ making gametes

   Tick every correct option.

9. In a Bb x Bb cross, out of 4 offspring, how many show the recessive trait?

_____

10. The order of bases in a gene determines the protein made.

    ☐ True ☐ False

IGCSE Biology

1. **a section of DNA that codes for a protein**

   A gene codes for one protein.

2. **double helix**

   DNA is a double helix — two twisted strands.

3. **genetically identical to the parent**

   Mitosis makes identical copies.

4. **four**

   Meiosis makes four gametes.

5. **a version of a gene**

   Alleles are different versions of a gene.

6. **46**

   Body cells have 46 chromosomes (23 pairs).

7. **23**

   Gametes have half — 23 — so fertilisation restores 46.

8. **growth; repair of tissue; asexual reproduction**

   Gametes are made by meiosis, not mitosis.

9. **1**

   Only bb (1 in 4) shows the recessive trait.

10. **True**

    Base order sets the amino acid order, hence the protein.

IGCSE BIOLOGY • EXERCISE SHEET

17.1 Chromosomes, genes and proteins

Name: _____ Class: _____ Date: _____ **Total: 8 marks**

KEY WORDS proteins 蛋白质 • ribosome 核糖体 • amino acids 氨基酸 • base sequence 碱基序列 • codes 编码

Objective

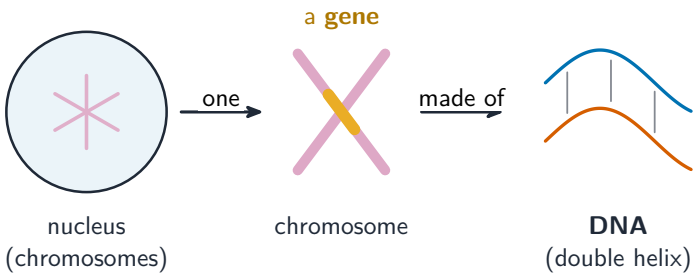
Build the skills to answer exam questions on **chromosomes, genes and proteins** 染色体、基因与蛋白质 — the terms, sex chromosomes, and how DNA controls a cell.

You must be able to:

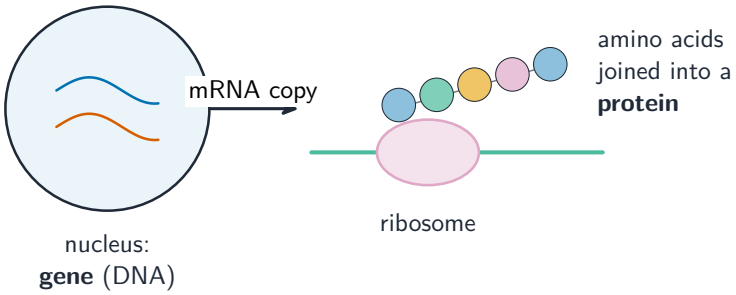
- define chromosome, gene and allele
- explain sex determination (XX/XY)
- describe how a gene's base sequence codes for a protein

1 Worked examples

■ Genes and protein synthesis



A gene is a length of DNA that codes for one protein; an allele is one form of a gene



The base sequence sets the order of amino acids → the protein's shape → its job

- **sex:** XX female, XY male; sperm (X or Y) decides the sex → 1:1 ratio.

2 Practice

2.1 Define a gene. [1]

2.2 State the sex chromosomes of a human female. [1]

3 Exam-style questions

3.1 An allele is: [1]

- **A** a whole chromosome
- **B** an alternative form of a gene
- **C** a protein
- **D** a ribosome

3.2 The sex of a baby is determined at fertilisation.

(a) Explain why the sperm, not the egg, determines the sex. [2]

(b) State the ratio of males to females this produces. [1]

3.3 Explain how the base sequence of a gene determines the protein made. [2]

Solutions

2.1 a length of DNA that codes for one protein.

2.2 XX.

3.1 B. An allele is an alternative form of a gene.

3.2 (a) the egg always carries an X; the sperm carries either an X or a Y; so whether it is XX or XY depends on the sperm.
(b) 1:1.

3.3 the base sequence sets the order of amino acids in the protein; this gives the protein its shape, which decides its job.

30 Why are lymphocytes the only cells that produce antibody proteins?

A Lymphocytes express all the genes in the nucleus.

B Lymphocytes have twice as many genes as other cells.

C Other cells do **not** have the genes for antibodies.

D The genes for antibodies are only expressed in lymphocytes.

31 During protein synthesis, what is the function of the ribosome?

A It assembles amino acids in a chain.

B It carries a copy of a gene to the cytoplasm.

C It contains the code for the synthesis of a protein.

D It determines the order of bases in the protein.

6 Fig. 6.1 is a diagram of a cell that shows how DNA is involved in protein synthesis.

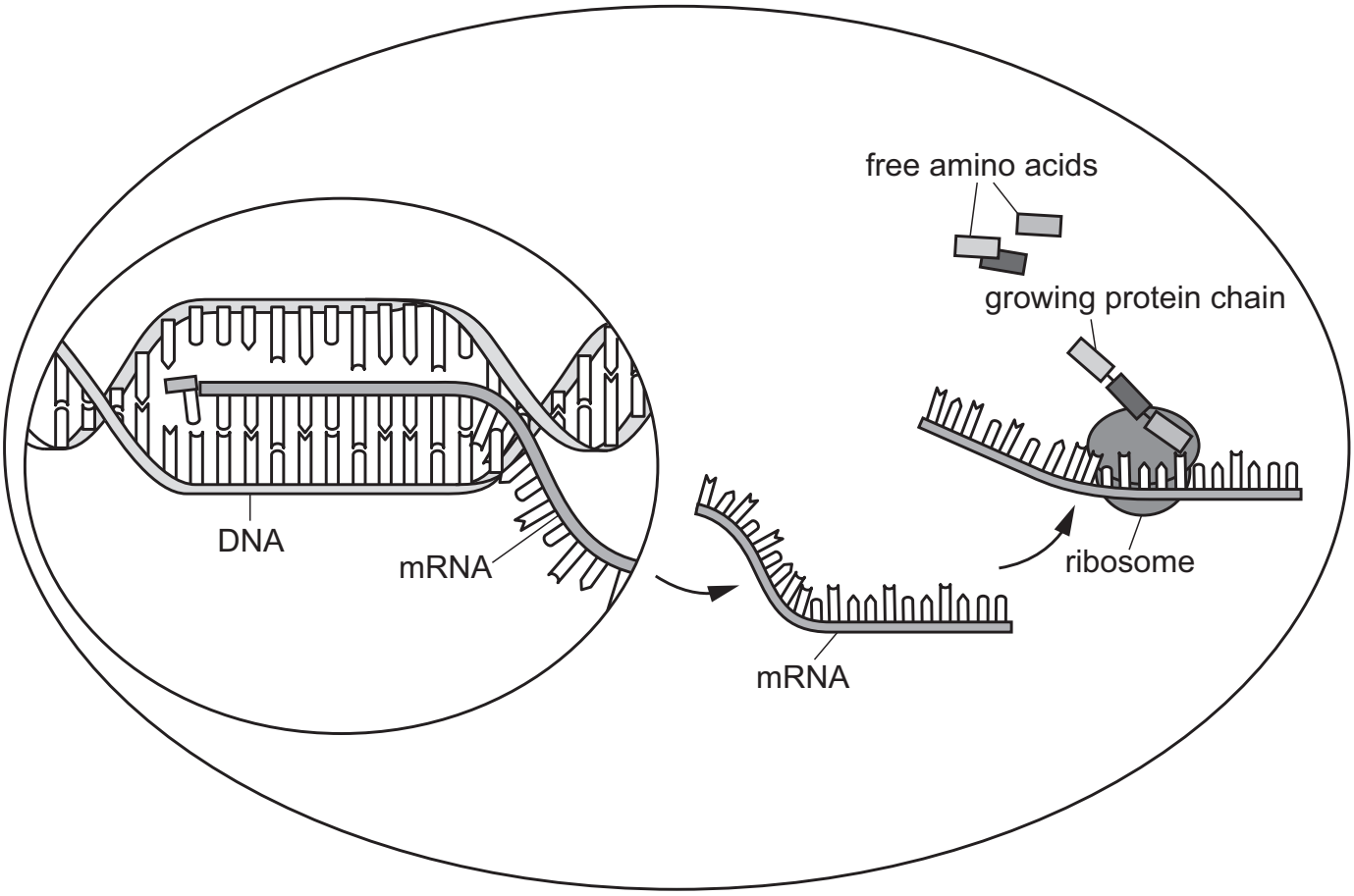


Fig. 6.1

(a) State the name of the part of the cell that contains DNA.

..... [1]

(b) DNA controls cell function by controlling the production of proteins.

State the name of **one** type of protein.

..... [1]

(c) Using Fig. 6.1, explain how mRNA is involved in protein synthesis.

.....

.....

.....

.....

.....

.....

..... [3]

[Total: 5]

4 In a DNA molecule, bonds between pairs of bases hold two strands together. High temperatures can break these bonds to form two single strands of DNA.

The base pair C and G is held together more strongly than the base pair A and T.

Two DNA molecules containing the same number of bases were studied.

- In DNA molecule 1, 20% of bases are T.
- In DNA molecule 2, 20% of bases are C.

Which DNA molecule would require the lowest temperature to break into single strands?

A DNA molecule 1, because there are more A bases present.

B DNA molecule 1, because there are more G bases present.

C DNA molecule 2, because there are more A bases present.

D DNA molecule 2, because there are more G bases present.

5 **(a)** Organisms can be classified by their features and by studying the sequence of bases in their DNA.

Fig. 5.1 is a diagram showing the evolutionary relationships between some different groups of organisms.

Each branch shows the point at which organisms developed new features that classify them as a new group.

The point where the branch starts also indicates a common ancestor shared by the new groups.

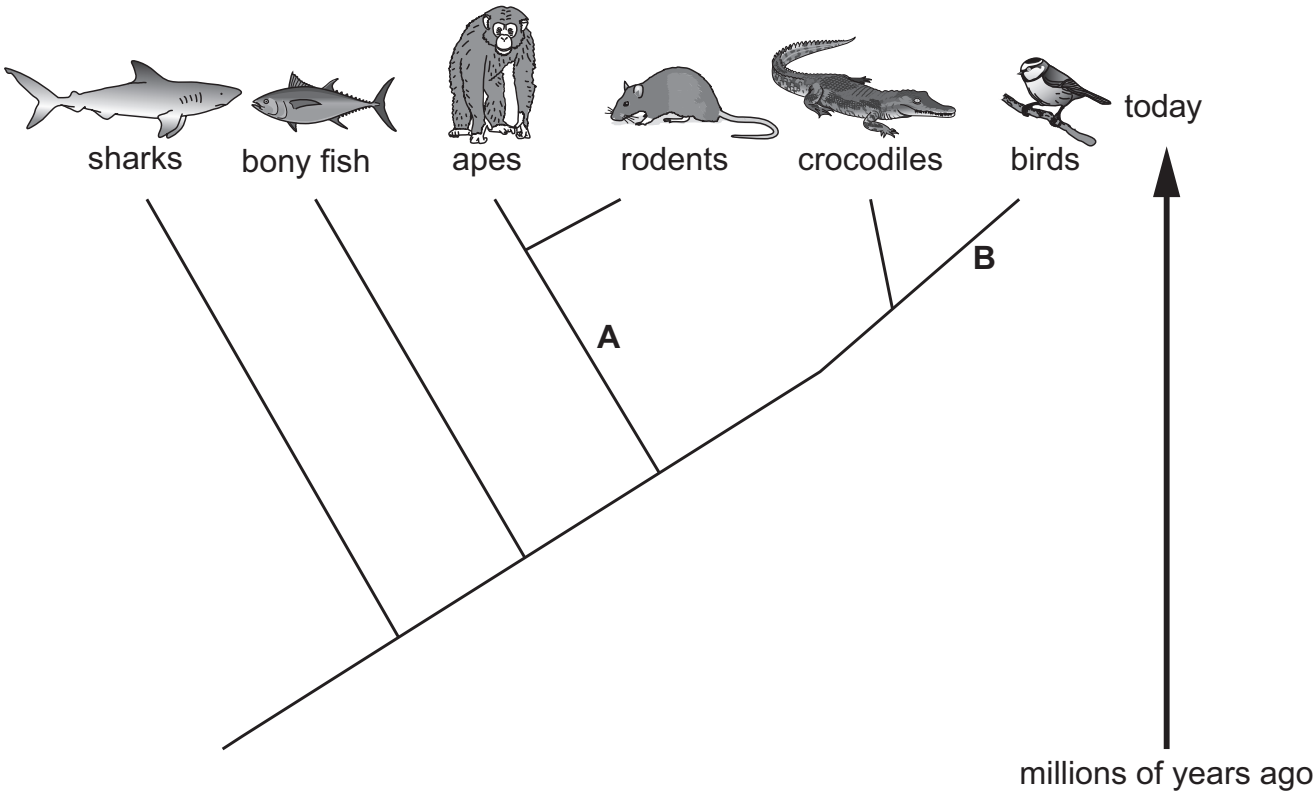


Fig. 5.1

(i) Suggest which visible features have developed at **A** and **B** in Fig. 5.1.

A .....

B .....
[2]

(ii) Identify the names of the **two** groups that share the most recent common ancestor in Fig. 5.1.

..... and ..... [1]

(iii) Suggest the groups with the most similar and least similar DNA base sequences to crocodiles in Fig. 5.1.

most similar .....

least similar .....
[2]

(b) Describe the structure of a DNA molecule.

.....

.....

.....

.....

.....

.....

.....

.....

..... [4]

(c) Outline how the base sequences in DNA control cell function.

.....

.....

.....

.....

.....

.....

..... [3]

[Total: 12]

29 Which term is defined as a length of DNA that codes for a protein?

A amino acid

B chromosome

C gene

D mutation

IGCSE BIOLOGY • EXERCISE SHEET

17.2 Mitosis

Name: _____ Class: _____ Date: _____ **Total: 6 marks**

KEY WORDS mitosis 有丝分裂 • daughter cell 子细胞 • stem cells 干细胞 • diploid 二倍体 • asexual reproduction

Objective

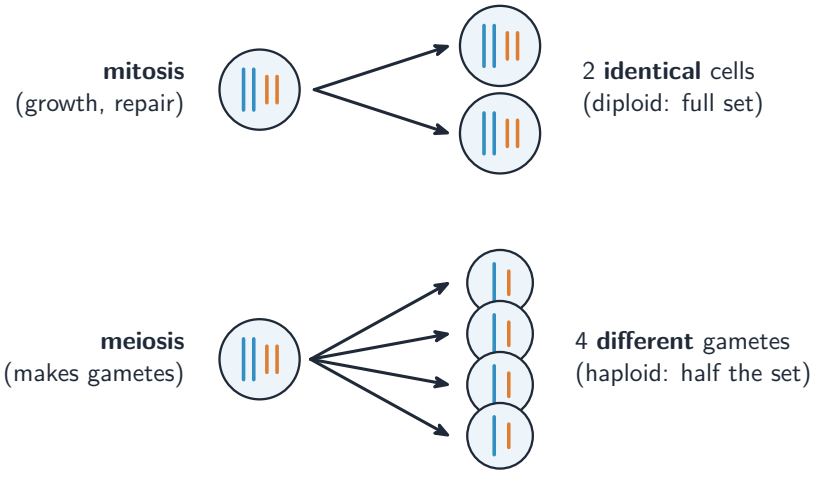
Build the skills to answer exam questions on **mitosis** 有丝分裂 — what it produces, when it is used, and **stem cells** 干细胞.

You must be able to:

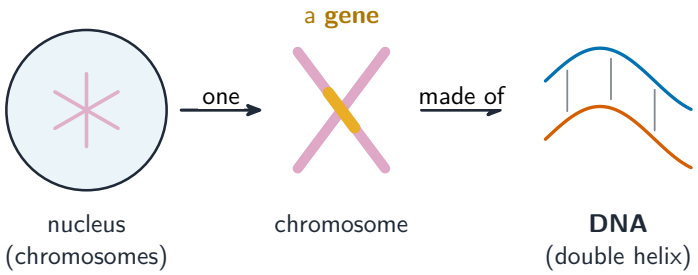
- describe mitosis (two genetically identical diploid cells)
- state where mitosis is used
- describe stem cells

1 Worked examples

Mitosis



Mitosis makes two genetically identical diploid daughter cells



Chromosomes carry the genes copied in mitosis

- chromosomes are copied (replication) first, so each daughter keeps the full number.
- used for **growth, repair, replacing cells and asexual reproduction**.
- **stem cells** are unspecialised cells that divide by mitosis.

2 Practice

2.1 State how the daughter cells of mitosis compare with the parent. [1]

2.2 State one use of mitosis in the body. [1]

3 Exam-style questions

3.1 Mitosis produces cells that are: [1]

- **A** haploid and different
- **B** diploid and identical
- **C** haploid and identical
- **D** diploid and different

3.2 Mitosis is important for growth and repair.

(a) Explain why the chromosomes are copied before mitosis. [2]

(b) State what a stem cell is. [1]

Solutions

2.1 they are genetically identical to the parent.

2.2 any of: growth; repair; replacing cells; asexual reproduction.

3.1 B. Mitosis produces diploid, genetically identical cells.

3.2 (a) so each daughter cell receives a full, identical set of chromosomes; keeping the diploid number.
(b) an unspecialised cell that divides by mitosis (and can become specialised).

33 What are stem cells?

A specialised cells that divide by meiosis to produce daughter cells

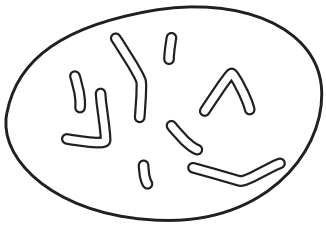
B specialised cells that divide by mitosis to produce daughter cells

C unspecialised cells that divide by meiosis to produce daughter cells

D unspecialised cells that divide by mitosis to produce daughter cells

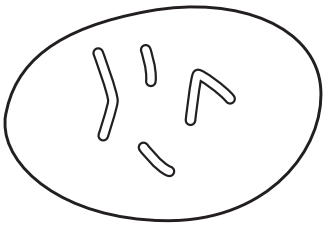
IGCSE Biology: **s25 21**

29 The diagram shows the chromosomes in the nucleus of a cell that divides by mitosis.

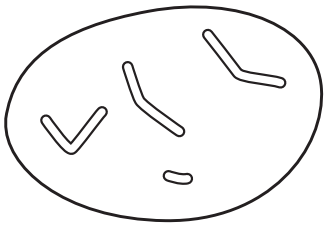


Which diagram shows the chromosomes in the nucleus of one of the daughter cells produced?

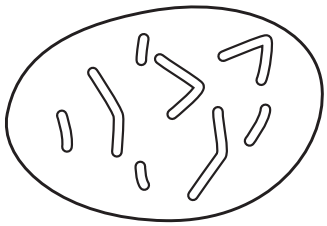
A



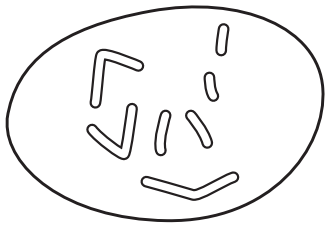
B



C



D



IGCSE Biology: **s25 23**

31 The diagram shows the cells of a mammalian embryo shortly after fertilisation.

What is the correct description of these cells?

A embryo cells undergoing meiosis

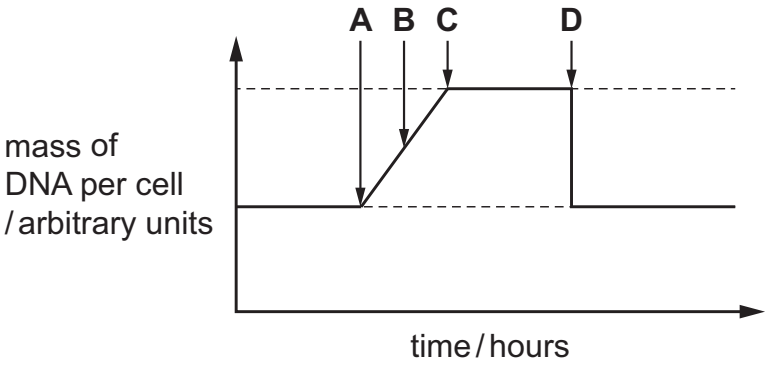
B gametes undergoing mitosis

C stem cells undergoing mitosis

D zygote undergoing meiosis

31 The graph shows how the mass of DNA changes during a mitotic cell division.

Where on the graph are **two** cells formed?



IGCSE BIOLOGY • EXERCISE SHEET

17.3 Meiosis

Name: _____ Class: _____ Date: _____ **Total: 7 marks**

KEY WORDS meiosis 减数分裂 • gametes 配子 • haploid 单倍体 • mitosis 有丝分裂 • division 分裂

Objective

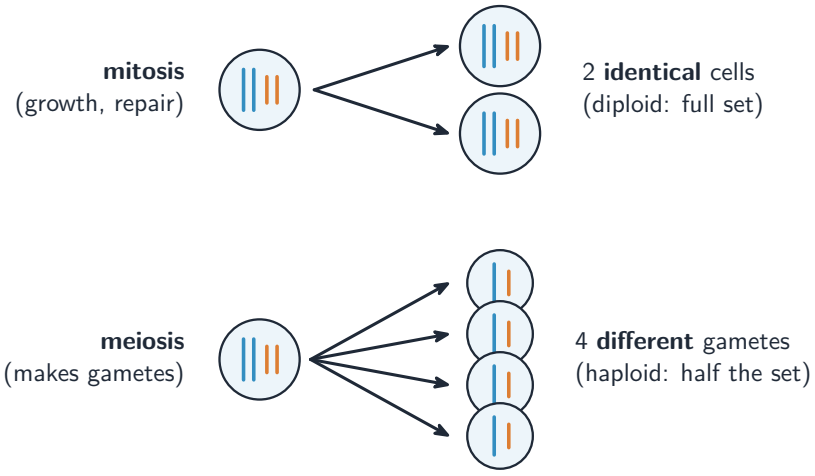
Build the skills to answer exam questions on **meiosis** 减数分裂 — what it produces, and how it differs from mitosis.

You must be able to:

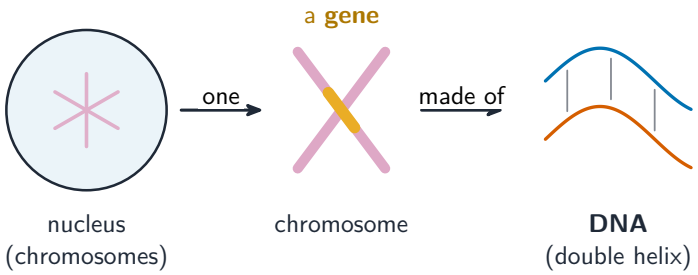
- describe meiosis (a reduction division making gametes)
- state that the gametes are haploid and genetically different
- contrast meiosis with mitosis

1 Worked examples

Meiosis



Meiosis halves the chromosome number (diploid → haploid) and makes four genetically different gametes



Meiosis halves the chromosome number

2 Practice

2.1 State what cells meiosis produces. [1]

2.2 State why meiosis is called a reduction division. [1]

3 Exam-style questions

3.1 The gametes made by meiosis are: [1]

- **A** diploid and identical
- **B** haploid and genetically different
- **C** diploid and different
- **D** haploid and identical

3.2 Meiosis differs from mitosis.

(a) State two differences between meiosis and mitosis. [2]

(b) Explain why making genetically different gametes is useful. [2]

Solutions

2.1 gametes (sex cells).

2.2 it halves the chromosome number (diploid → haploid).

3.1 B. Gametes are haploid and genetically different.

3.2 (a) any two of: meiosis halves the chromosome number (mitosis keeps it); meiosis makes 4 cells (mitosis 2); meiosis makes different cells (mitosis identical).
(b) it produces variation in the offspring, which helps the species survive if the environment changes.

28 Which statement describes the effect of meiosis on chromosome number?

A A diploid parent cell produces diploid daughter cells.

B A diploid parent cell produces haploid daughter cells.

C A haploid parent cell produces diploid daughter cells.

D A haploid parent cell produces haploid daughter cells.

33 Four features of cell division are listed.

1 Haploid cells are produced.

2 New cells are genetically identical.

3 It is a reduction division.

4 It results in variation.

Which features would be associated with meiosis?

A 1, 2 and 3 **B** 1, 2 and 4 **C** 1, 3 and 4 **D** 2, 3 and 4

3 **(a)** Fig. 3.1 shows one stage involved in plant reproduction after pollination.

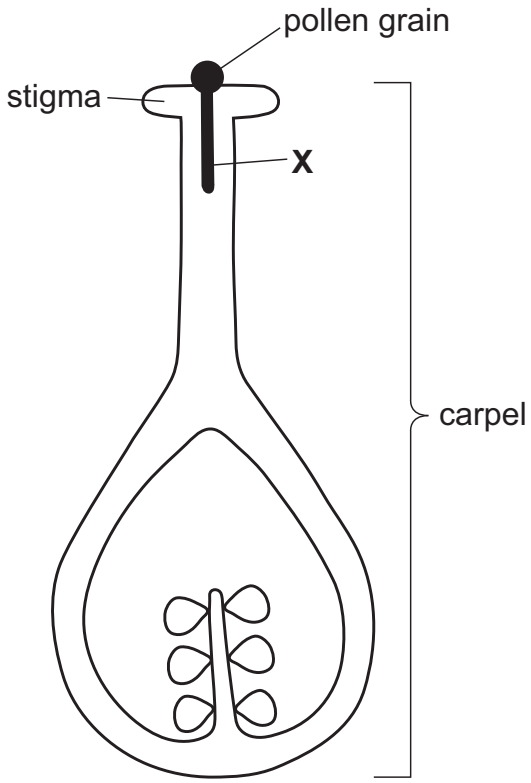


Fig. 3.1

(i) State the name of the part labelled **X** in Fig. 3.1.

..... [1]

(ii) Describe the events that occur after the stage shown in Fig. 3.1 that result in fertilisation.

.....

.....

.....

.....

.....

.....

..... [3]

(b) A species of plant can use self-pollination and cross-pollination.

(i) Suggest reasons for this species of plant to use self-pollination rather than cross-pollination.

.....

.....

.....

.....

.....

.....

..... [3]

(ii) Discuss the potential effects of only using self-pollination in a population of plants.

.....

.....

.....

.....

.....

.....

..... [3]

(c) Meiosis produces gametes and is a source of genetic variation.

State **two other** sources of genetic variation in populations.

1 .....

2 .....

[2]

(d) Describe mitosis and its roles in organisms.

.....

.....

.....

.....

.....

.....

.....

.....

..... [4]

(e) State the name of the unspecialised cells that divide by mitosis.

..... [1]

[Total: 17]

IGCSE BIOLOGY • EXERCISE SHEET

17.4 Monohybrid inheritance

Name: _____ Class: _____ Date: _____ **Total: 7 marks**

KEY WORDS heterozygous 杂合子 • recessive 隐性 • genotype 基因型 • inheritance 遗传 • dominant 显性

Objective

Build the skills to answer exam questions on **monohybrid inheritance** 单基因遗传 — the key terms, **Punnett squares** 庞纳特方格, and ratios.

You must be able to:

- use genotype/phenotype, dominant/recessive, homo-/heterozygous
- complete a Punnett square and predict ratios
- interpret a test cross / pedigree

1 Worked examples

A monohybrid cross

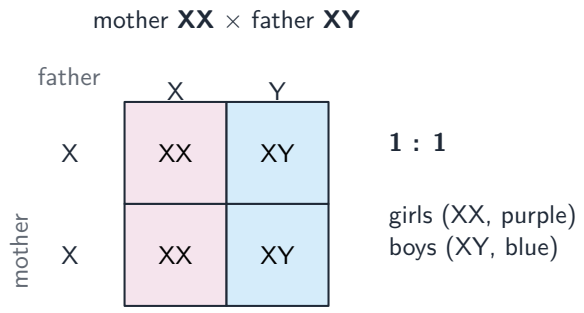
Bb × **Bb** (both parents)

gametes	B	b
B	BB	Bb
b	Bb	bb

3 : 1

3 dominant (blue)
1 recessive (orange)

Bb × Bb → BB, Bb, Bb, bb → a 3:1 ratio of dominant to recessive



A Punnett square also predicts sex determination

- **dominant** shows with one copy (capital); **recessive** needs two copies (lower-case).
- **homozygous** = two same alleles; **heterozygous** = two different.

2 Practice

2.1 Define a recessive allele. [1]

2.2 State the genotype of a heterozygous organism for a gene with alleles B and b. [1]

3 Exam-style questions

3.1 Crossing two heterozygous parents (Bb × Bb) gives a phenotype ratio of: [1]

- **A** 1:1
- **B** 3:1
- **C** 1:2:1
- **D** all dominant

3.2 In rabbits, black fur (B) is dominant to white (b). A heterozygous black rabbit is crossed with a white rabbit.

(a) Complete a Punnett square for this cross. [3]

(b) State the ratio of black to white offspring expected. [1]

Solutions

2.1 an allele shown in the phenotype only when no dominant allele is present.

2.2 Bb.

3.1 B. Bb × Bb gives a 3:1 ratio.

3.2 (a) parents Bb × bb; gametes B,b and b,b; offspring Bb, Bb, bb, bb.
(b) 1:1 (black : white).

27 Which statements describe the sex chromosomes in human gametes?

1 Egg cells contain either an X or a Y chromosome.

2 Egg cells contain only X chromosomes.

3 Sperm cells contain either an X or a Y chromosome.

4 Sperm cells contain only Y chromosomes.

A 1 and 3 **B** 1 and 4 **C** 2 and 3 **D** 2 and 4

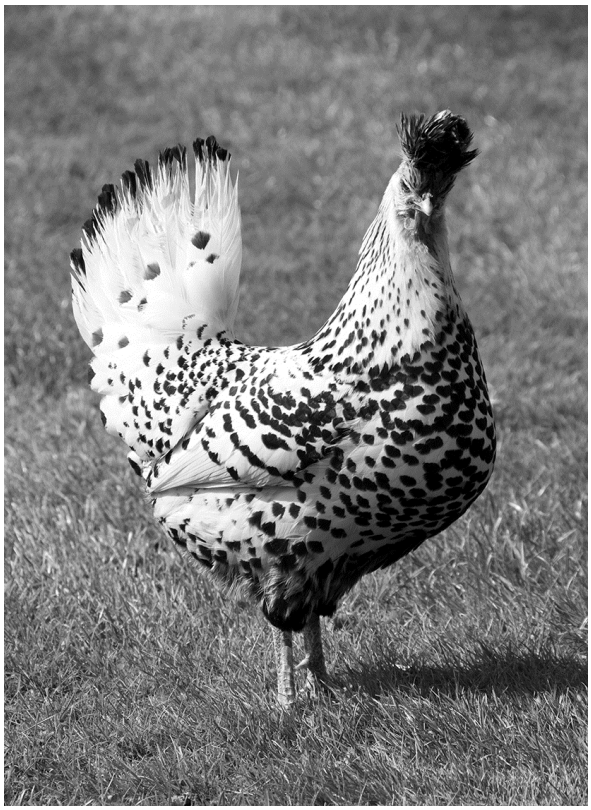
29 A female with red-green colour blindness has a child with a male who does **not** have red-green colour blindness. The child is male.

What is the chance of this child having red-green colour blindness?

A 0% **B** 25% **C** 50% **D** 100%

32 The photograph shows a speckled chicken.

Speckled chickens have white feathers and black feathers.



When a chicken with only white feathers and a chicken with only black feathers are crossed, all of the offspring are speckled.

What would be the expected phenotypic ratio if a speckled chicken was crossed with a chicken with only white feathers?

A all offspring have only white feathers

B all offspring are speckled

C 1 white feathers only : 1 speckled

D 3 white feathers only : 1 speckled

30 What are alleles?

A a pair of chromosomes

B different versions of the same gene

C the total number of genes on one chromosome

D two genes side by side on the same chromosome

31 Polydactyly in cats is a dominant condition that causes affected cats to be born with extra toes.

What is the probability of two cats that are heterozygous for polydactyly having an offspring with **no** extra toes?

A 0.125 **B** 0.25 **C** 0.50 **D** 0.75

32 Which statement describes red-green colour blindness?

A It is an example of codominance.

B It is more common in females than in males.

C It only occurs in males.

D The recessive allele is located on an X chromosome.

30 A farmer bred together male cattle with white hair and female cattle with red hair. All the offspring produced had roan hair (a mixture of red and white).

He then repeatedly bred together two roan cattle, and the offspring were in the ratio of 1 red : 2 roan : 1 white.

What explains why the farmer obtained this ratio?

A The red phenotype is dominant to the white phenotype.

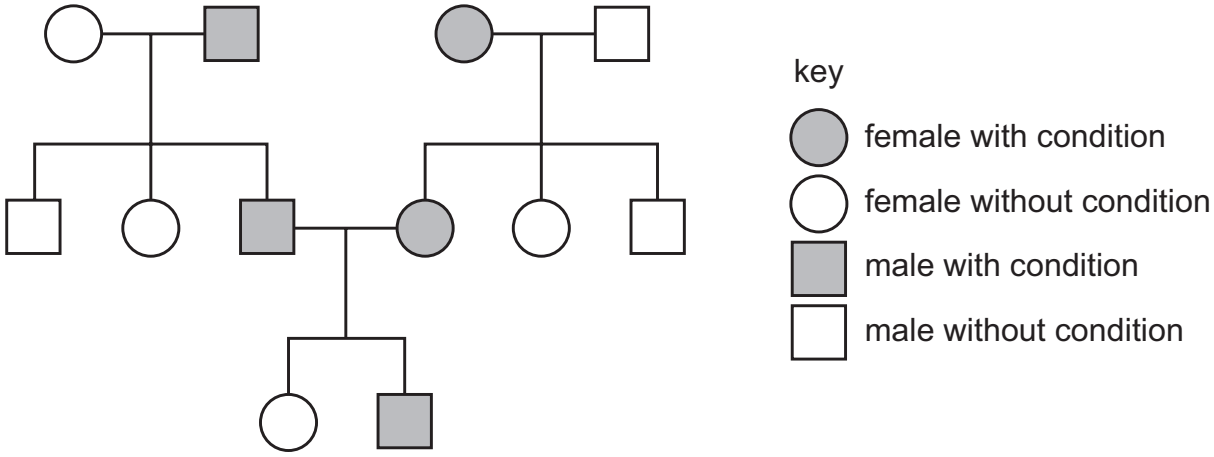
B The roan phenotype is an example of codominance.

C The roan phenotype is dominant to the red phenotype and the white phenotype.

D The white phenotype is dominant to the red phenotype.

IGCSE Biology: **s25 22**

31 The diagram shows the inheritance of a genetic condition in one family.



What can be concluded about this genetic condition?

A The alleles for the condition must be codominant.

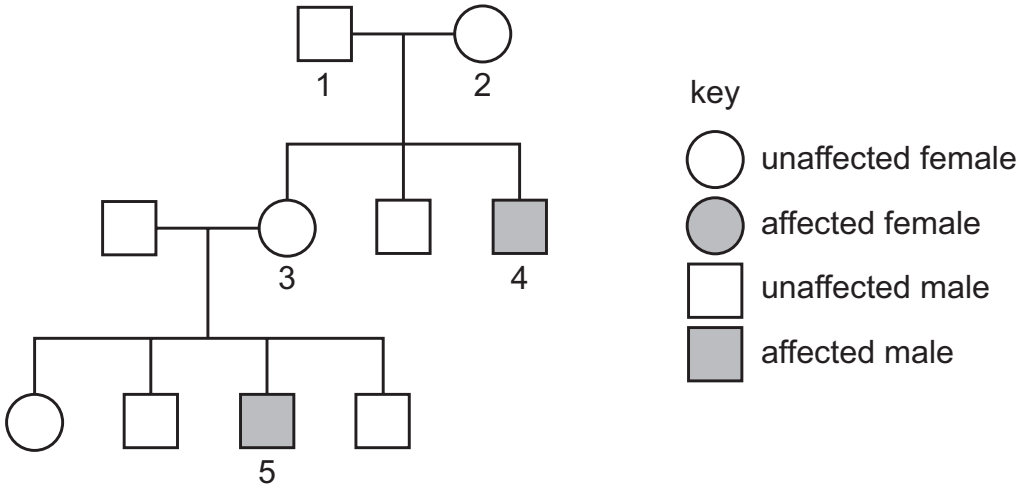
B It is caused by a dominant allele.

C It is caused by recessive alleles.

D The alleles for the condition must be sex-linked.

IGCSE Biology: **s25 23**

32 The diagram shows the inheritance, in one family, of a sex-linked recessive disease.



Which individuals in the diagram are heterozygous for this disease?

A 1 and 2 **B** 1 only **C** 2 and 3 **D** 4 and 5

IGCSE Biology: **m25 22**

32 A man with blood group A and genotype I^AI^o has a child with a woman who has blood group B and genotype I^BI^o.

What is the probability of the child having blood group O?

A 0.00 **B** 0.25 **C** 0.50 **D** 1.00