SCIENCE FOUNDATIONS

Meiosis

Difficulty level: Advanced

Science Foundations

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Overview of the concept

This is how a mother and father each pass on half their genetic instructions, so a child gets a unique mix of both parents instead of a copy of either one. Without halving the instructions first, each generation would end up with twice as many as the last. A breeder crossing two plants counts on this shuffling to produce new combinations in the seeds. Knowing meiosis tells you why siblings share parents but are not identical, and why every child is a fresh mix.

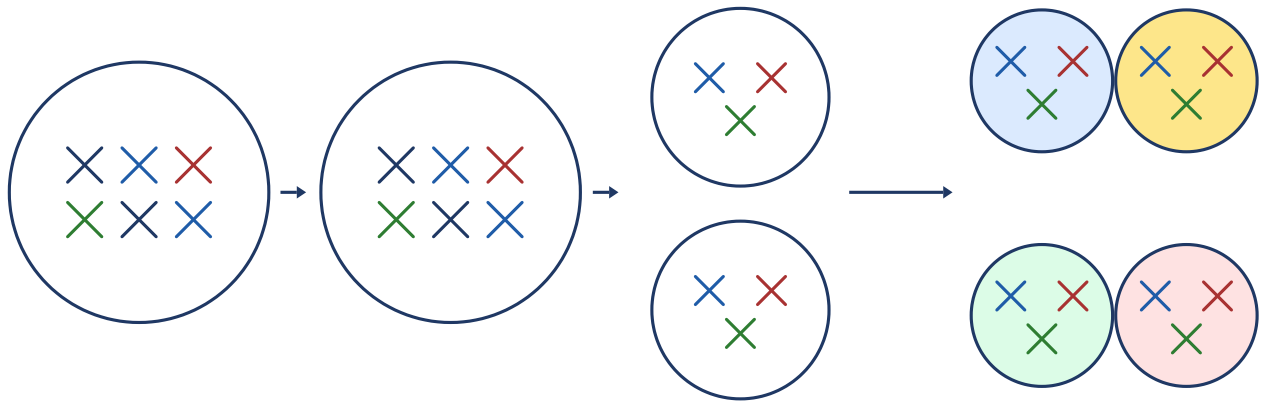


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Worked examples

EXAMPLE 1

Q Trace meiosis: one diploid cell with 6 chromosomes.



SOLUTION

Copy first: chromosomes duplicate, still one cell.

Divide twice: first homologous pairs separate, then chromatids separate.

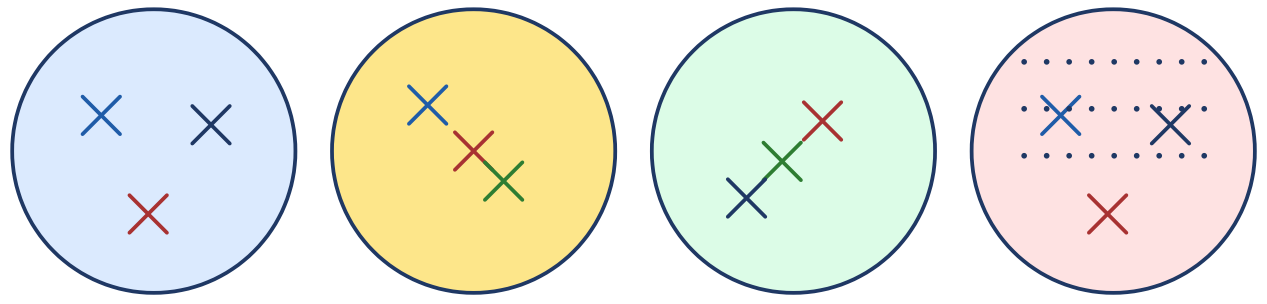
Count: four cells, each with 3 chromosomes, all different.

The result is four haploid cells, each with 3 chromosomes.

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EXAMPLE 2

Q How many cells does meiosis make, and are they identical?



SOLUTION

Count the products: meiosis makes four cells.

Compare: crossing over and independent assortment shuffle genes.

Conclude: four different haploid cells.

The result is four genetically different haploid cells.

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Practice questions

1 **Trace meiosis in a diploid cell with 10 chromosomes. How many cells form, how many chromosomes does each have, and are they identical?**

- **A** Four haploid cells, each with 5 chromosomes, all genetically different
- **B** Two identical cells, each with 10 chromosomes
- **C** Four haploid cells, each with 10 chromosomes
- **D** Two haploid cells, each with 5 chromosomes

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2

Trace meiosis in a diploid cell with 8 chromosomes. How many cells form, and how many chromosomes does each have?

A Two identical cells, each with 8 chromosomes

B Four haploid cells, each with 4 chromosomes

C Four haploid cells, each with 8 chromosomes

D Two haploid cells, each with 4 chromosomes

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3

Why are the four cells from meiosis genetically different from each other?

A The chromosomes are copied twice

B Crossing over and independent assortment shuffle the genes

C Each cell gets a full set of chromosomes

D The cells divide only once

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4

How many cells does meiosis make, and are they identical to the parent cell? Explain.

A Two cells, each with the parent's chromosome number

B Four cells, each with the parent's chromosome number

C Four cells, each with half the parent's chromosome number

D Two cells, each with half the parent's chromosome number

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5

What is crossing over, and when does it happen?

A Chromosomes copying, in interphase

B Exchange of gene sections between homologous chromosomes, in prophase I

C Cells splitting, in telophase

D Chromatids pulling apart, in anaphase

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6 How many divisions are there in meiosis, and how many times are the chromosomes copied?

- **A** One division, one chromosome copy step
- **B** Two divisions, two copy steps
- **C** Two divisions, one chromosome copy step
- **D** One division, two copy steps

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7 A diploid cell has 10 chromosomes. After meiosis, how many chromosomes does each gamete have?

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8 Meiosis or mitosis: which makes gametes?

- A Meiosis
- B Mitosis

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9 What is a gamete?

- A A haploid sex cell
- B A diploid body cell
- C A cell with two copies of each chromosome
- D A cell that never divides

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10 **A diploid cell has 6 chromosomes. After the first division of meiosis only, how many cells are there, and how many chromosomes does each have?**

- **A** Two cells, each with 3 chromosomes
- **B** Four cells, each with 3 chromosomes
- **C** Two cells, each with 6 chromosomes
- **D** Four cells, each with 6 chromosomes

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ANSWER KEY

1. Four haploid cells, each with 5 chromosomes, all genetically different

2. Four haploid cells, each with 4 chromosomes

3. Crossing over and independent assortment shuffle the genes

4. Four cells, each with half the parent's chromosome number

5. Exchange of gene sections between homologous chromosomes, in prophase I

6. Two divisions, one chromosome copy step

7. 5

8. Meiosis

9. A haploid sex cell

10. Two cells, each with 3 chromosomes

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