

Mitosis and the cell cycle

4.1.2.2 · Cell biology · revision notes

The three stages of the cell cycle, what happens in mitosis, and why mitosis matters for growth, development and repair. Expect 'describe the stages' questions, questions asking you to spot where mitosis is happening, and data questions on dividing cells.

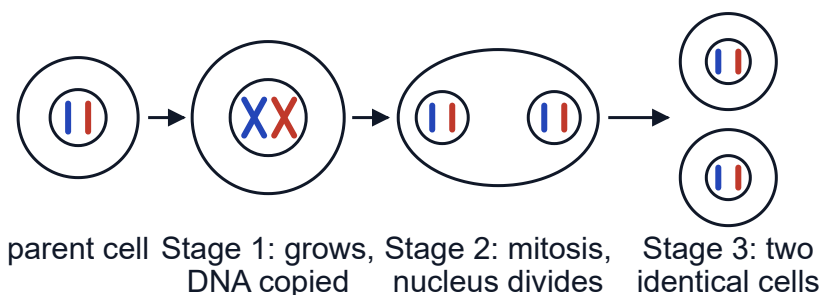
Key facts

- Cell cycle stage 1: cell grows, more ribosomes and mitochondria, DNA replicates
- Stage 2, mitosis: one set of chromosomes pulled to each end; nucleus divides
- Stage 3: cytoplasm and cell membrane divide
- Mitosis → two genetically identical cells with the same number of chromosomes as the parent
- Mitosis is for growth, development, repair and replacement (and asexual reproduction)

Notes

The cell cycle

- Body cells divide in a series of stages called the **cell cycle**. The genetic material is doubled, then divided between two identical cells.
- Stage 1: growth and DNA replication.** The cell grows and increases the number of sub-cellular structures, such as ribosomes and mitochondria. The DNA replicates, forming two copies of each chromosome.
- Stage 2: mitosis.** One set of chromosomes is pulled to each end of the cell, and the nucleus divides.
- Stage 3: cell division.** The cytoplasm and cell membrane divide to form two identical cells.



The cell cycle: each new cell gets one copy of every chromosome (blue from one parent, red from the other).

- You do not need to know the names of the phases within mitosis.

The result

- Mitosis produces two cells that are **genetically identical** to each other and to the parent cell.
- Each new cell has the same number of chromosomes as the parent cell: 46 in a human body cell.

Why mitosis matters

- **Growth and development** of multicellular organisms, e.g. an embryo developing or a root getting longer.
- **Repair and replacement** of damaged or worn-out cells, e.g. healing a cut or replacing skin cells.
- Asexual reproduction in some organisms, e.g. strawberry plants growing new plants on runners.
- Mitosis does not make gametes (sperm and egg cells): they are made by a different type of cell division, meiosis.

How to answer each type of question

Recognise where mitosis is happening

1 to 2 marks

Grade 5

1. Look for cells being made to grow, repair or replace tissue: that is mitosis.
2. Making sperm or egg cells is not mitosis.

Example. Which **two** of these involve cell division by mitosis?

Tick (✓) **two** boxes.

- ☐ A cut in the skin healing
- ☐ Egg cells being made in an ovary
- ☐ A seedling's root getting longer
- ☐ Sperm cells being made in the testes

Model answer. A cut in the skin healing (1)

A seedling's root getting longer (1)

Describe the stages of the cell cycle

3 to 4 marks

Grade 5

1. Go in order: growth, mitosis, division of the cell.
2. In stage 1 mention growth, more sub-cellular structures and DNA replication.
3. In mitosis, say one set of chromosomes is pulled to each end and the nucleus divides.
4. Finish with the cytoplasm and cell membrane dividing to form two identical cells.

Example. Describe what happens during the cell cycle. [4 marks]

Model answer. The cell grows and the number of sub-cellular structures, such as mitochondria and ribosomes, increases (1). The DNA replicates / each chromosome is copied (1). One set of chromosomes is pulled to each end of the cell and the nucleus divides (1). The cytoplasm and cell membrane divide to form two identical cells (1).

Don't lose marks

- ✗ Leaving out DNA replication, or putting it after mitosis. The DNA is copied **before** the nucleus divides.
- ✗ Saying mitosis makes gametes. Gametes are made by meiosis.
- ✗ Saying the new cells have half the number of chromosomes. Mitosis keeps the number the same.

- ✗ Using 'mitosis' to mean the whole cell splitting. Mitosis is the division of the nucleus; the cytoplasm and membrane divide afterwards.
- ✗ Writing that the chromosomes 'split in half'. Say one set of chromosomes is pulled to each end of the cell.

More tips

Memory tricks

- Order of the stages: Grow and copy, then split the nucleus, then split the cell.
- MiTosis makes **T**wo identical cells; mEiosis makes **E**ggs (and sperm).
- Sense check: after mitosis each human body cell still has 46 chromosomes.

Exam technique

- For 'describe' questions, give the stages in order and use the key phrases: 'DNA replicates', 'nucleus divides', 'two identical cells'.
- In context questions (a cut healing, a root growing), look for new cells being made for growth or repair.
- Show each step of a cell cycle calculation, including the percentage and any unit conversion.

What each grade needs

What you need to be able to do, from the first marks up to the top grade.

Grade 3

State what mitosis produces

Two genetically identical cells.

Grade 4

Name the three stages of the cell cycle

Growth and DNA replication; mitosis; division of the cytoplasm and cell membrane.

Grade 5

Describe what happens in each stage

The cell grows, copies its sub-cellular structures and DNA, divides its nucleus, then splits in two.

Grade 5

State why mitosis is important

For the growth and development of multicellular organisms, and to repair and replace cells.

Grade 5

Recognise where mitosis is happening

e.g. a root tip growing, a cut healing, an embryo developing.

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