

GCSE Biology

Mitosis and Meiosis

Spies and Trains

Instructions and answers for teachers

These instructions should accompany the OCR resource 'Mitosis and Meiosis' activity which supports OCR GCSE Biology.

A Level Biology
Lesson Element

A Level Biology
Mitosis and Meiosis

Spies and Trains
Student Information Sheet 1

Mitosis Information Sheet

All 46 of the chromosomes grow thicker prior to replicating.

The chromosomes are replicated (copies are made) and become visible as X shapes.

Spindle fibres form at each pole of the cell and chromosomes line up along the equator.

The chromosomes are pulled apart by the spindle fibres. One half of the chromosome goes to each pole.

The cell splits into two new cells. Each cell contains the same 46 chromosomes as the original.

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The Activity:

Learning outcomes:

- To understand the outcomes of the processes of mitosis and meiosis
- Be able to deconstruct a model to help them to understand and describe the processes



This activity offers an opportunity for English skills development.



This activity offers an opportunity for maths skills development.

Associated materials:

Mitosis and Meiosis Lesson Element Student Task Sheet and Information Sheets.

Introduction

The activity is about mitosis and meiosis in animal cells. This activity is designed to access higher order thinking, analysing and creating skills. Learners should know that nucleus of a cell contains genetic information. They should be aware what a gene, chromosome and DNA are. They should also have knowledge of sexual reproduction and gametes.

A common problem that learners face is that diagrams for both mitosis and meiosis are similar and easily confused. Some do not show all of the chromosomes, so it can be unclear that all chromosomes can be replicating and dividing. This modelling activity will assist in overcoming this, as the analogy will describe this. Learners find it difficult to just compare and contrast the two processes.

Activity 1:

The teacher should split the class into two. Half will be given the Student Information Sheets 1 and 2, and half will be given the Student Information Sheets 3 and 4. The latter meiosis activity is more difficult so this could also be used for differentiation.

Learners should work in pairs or small groups for this activity. They should be given the information sheet detailing the stages of mitosis or meiosis and make sure they are familiar with each step. They should then compare it to the analogy of the process of mitosis or meiosis.

Learners are then to:

- Link as many of the stages to the analogy as possible- highlighting where they can be found
- Identify stages which are omitted
- Answer the follow up questions to the process which increase in demand

Each mitosis group should then pair up with a meiosis group and share their information with one another.

Extension ideas:

Learners could add in the omitted stages to the story or devise their own analogy for this or the other process. They could analyse the models provided and identify the strengths or weaknesses.

Suggested mitosis analogy task answers:

Spies On A Wire

00:00 Two stealth helicopters carrying special agent 1 and special agent 2 arrive at **Cellattle bank headquarters**. They check the perimeter is clear. **(the cell)**

00:10 Special agent 1 laser cuts the **East skylight** entrance **(pole of the cell)**

00:10 Special agent 2 laser cuts the **West skylight** entrance **(pole of the cell)**

00:12 Zip wires are secured and commence **zip wire** travel into the main vault area **(spindle fibres)**

00:19 Special agent 1 to commence **copying of the 46 electronic documents** from the bank network onto electronic device A. **(replication of the chromosomes)**

00:24 Special agent 1 to hand over electronic device A to special agent 2 who should now secure the device to the zip line.

00:24 Special agent 1 now removes the **original 46 documents** from the network and saves them onto a further electronic device B. **(demonstrating replication)**

00:25 Special agent 1 and 2 ensure permanent deletion of the documents has occurred

00:27 Special agent 1 and 2 are now secured to the **zip wire**. **(spindle fibres)**

00:29 Special agent 1 to exit out of the **East skylight**. Special agent 2 to exit out of the **West skylight**. **(moving of chromosomes to the poles)**

00:30 Commence stealth helicopter travel to the two undisclosed locations where the information will be decrypted and secured on **two new networks**. **(Two new identical cells)**

Stages that are omitted from the analogy:

The chromosomes growing thicker prior to replication

The chromosomes do not line up along the equator

Suggested meiosis analogy task answers:

The Mount Sisemio Train Incident

The train (original one cell) contained forty six passengers (original chromosomes) with pre booked assigned seating going up Mount Sisemio in one carriage. There had been a week of monsoon rain and the ground was wet and slippery. The train began to struggle at the first stop so the driver called for backup. Shortly another train arrived at station Gamete and twenty three passengers were selected (separation of chromosomes into new cell) to get off the original train and board train two. Officials looked at the carriages in each train and reorganised the seating (exchanging of genes) to ensure that all carriages were equal in weight. Some groups were separated and were unhappy.

The Sisemio mountain trains shortly reached the peak behind schedule. The weather had taken a turn for the worse and the Sisemio mountain authorities declared the peak as unsafe. Amid the grumbling of the passengers Sisemio train officials placed forty six passengers from the top station slope onto the two trains. (chromosomes replicating)

The two Sisemio trains begin their descent down the slope. Again it was soon realised that the additional passengers were causing a problem and were causing too much acceleration which could have led to derailing. The trains could not deal with forty six passengers in the weather conditions present on the day in question.

It was decided that the trains would be uncoupled into four carriages

It was decided that the trains would be uncoupled into four carriages, (cells splitting) which would prevent further acceleration down the slope. Each of the four trains transported twenty three passengers and had its own steam engine.

The passengers all arrived at the bottom of the Sisemo slope safely without serious incident on board the four trains. (four cells produced)

Stages that are omitted from the analogy:

The chromosomes growing thicker prior to replication

Chromosomes lining up along the equator

Genes are not pairing up in the analogy

There are no spindle fibres pulling the information to poles

Suggested guidance for extension activities:

Possible strengths of the analogies:

Both show clearly the number of chromosomes at all stages of the processes

They show the number of cells at all stages of the processes

Both of the models demonstrate replication

Possible weaknesses of the analogies:

Not all stages are shown

The analogies are not scientific

Require higher order thinking skills

Activity 2:

Learners can be given the Student Task Sheet to help to consolidate the modelling activities. The questions could also be presented as a quiz or posed to learners with answers being given on mini-whiteboards to check understanding.

Suggested answers to Student Task Sheet

What Have We Learnt?

1 How many cells are produced in mitosis?

2

2 How many chromosomes does each cell produced in mitosis have?

46

3 How many cells are produced in meiosis?

4

4 How many chromosomes does each cell produced in meiosis have?

23

5 There are genetic differences in the cells produced by mitosis and meiosis. What are these?

The cells produced in mitosis are genetically identical to the original, whereas the cells in meiosis are genetically different.

6 Why is it important that the chromosomes are replicated at various stages in mitosis and meiosis?

To ensure the required number of chromosomes are present for each division stage. E.g. during mitosis without replication, each daughter cell would result in 23 chromosomes.

7 Each body cell has forty six chromosomes; however sex cells only have twenty three. Which process would be used to produce sex cells?

Meiosis

8 When do you think mitosis would be used in the body?

Growth and repair of cells.

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