

Exercise walk-through

2.3

Mitosis, the cell cycle and mitotic index (statements 3.14–3.16, core practical 6)

Pearson Edexcel · International A-Level · Biology

A eukaryotic cell is a set of compartments

Structure	Function
Nucleus	stores DNA behind a double membrane
Rough ER	folds and transports proteins from its ribosomes
Golgi	modifies, packages and exports proteins
Mitochondrion	aerobic respiration and ATP

Mitosis preserves chromosome number

Prophase : chromosomes condense, spindle forms



Metaphase : chromosomes line up on the equator



Anaphase : chromatids pulled to opposite poles



Telophase : nuclear membranes reform

Check yourself

Your turn

A pond sample has counts 60, 20, 15 and 5. What is the index of diversity?

- A. $N(N-1)$ over the sum of $n(n-1)$: 9900 over $4150 = 2.39$
- B. add the species counts first, then divide by four
- C. the largest count over the smallest count
- D. species richness times total individuals

Exercises 2.1·2.3

2.1 Name the stage of mitosis in which chromosomes first condense, and the stage in which chromatids separate. [2]

2.2 State two roles of mitosis in a plant. [2]

2.3 A tissue sample of 600 cells shows 42 in mitosis. Calculate the mitotic index. [1]

Exercises 2.1·2.3

2.1 Name the stage of mitosis in which chromosomes first condense, and the stage in which chromatids separate. [2]

2.1 Prophase; anaphase.

2.2 State two roles of mitosis in a plant. [2]

2.2 Any two of growth, repair of damaged tissue, asexual reproduction.

2.3 A tissue sample of 600 cells shows 42 in mitosis. Calculate the mitotic index. [1]

2.3 $42/600 = 0.07$.

Exercise 3.1

3.1 Describe what happens to chromosomes and to the spindle in metaphase and anaphase of mitosis, and state one difference you would see under the microscope between a cell in anaphase and one in telophase. [5]

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3.1 Metaphase: chromosomes, each of two chromatids joined at the centromere, line up on the equator attached to the spindle by their centromeres. Anaphase: spindle fibres shorten and pull the chromatids apart to opposite poles. In telophase two new nuclear membranes reform around each group, while anaphase cells show one cell with two separating groups and no reformed membranes.

Exercises 3.2·3.3

3.2 The table shows the mitotic index of two tissue samples taken from a patient.

Sample	Cells counted	Cells in mitosis
A (skin)	500	25
B (biopsy)	500	210

Calculate both mitotic indices, state which sample is more likely to be tumour tissue, and explain what a high index means about the proportion of cells in interphase. [4]

3.3 A student prepares a root-tip squash to observe mitosis. Describe how the root tip should be treated before observation, why the cells can be seen without cutting sections, and how the student should decide which stage a cell is in. [5]

Exercises 3.2-3.3

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3.2 A: $25/500 = 0.05$; B: $210/500 = 0.42$. B – a far higher fraction dividing. Only 58% of B's cells are in interphase, against 95% in A: the tumour tissue has proportionally left the resting stage.

3.3 A student prepares a root-tip squash to observe mitosis. Describe how the root tip should be treated before observation, why the cells can be seen without cutting sections, and how the student should decide which stage a cell is in. [5]

3.3 Treat with a stain and a dilute acid to soften the tissue, then press the cover slip to squash the tip to a single layer of cells so light passes through without sectioning. Identify the stage by the chromosomes' state: condensed and equatorial = metaphase; chromatids separating toward poles = anaphase.