



## Mitosis Questions and Answers (PDF)

Mitosis is a type of cell division that results in two genetically identical daughter cells, each containing the same number of chromosomes as the parent cell. It is essential for growth, tissue repair, and asexual reproduction in multicellular organisms. Mitosis occurs in somatic (non-reproductive) cells and is part of the larger cell cycle, which includes interphase (when the cell grows and DNA is replicated) and the mitotic phase. Mitosis is divided into several stages: prophase, metaphase, anaphase, and telophase, followed by cytokinesis, where the cytoplasm is divided. This highly regulated process ensures that genetic material is accurately distributed to daughter cells. This article is about Mitosis Questions and Answers. You can download the questions and answers as PDF from the download link provided below.

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### Mitosis Questions and Answers

#### 1. What are the main stages of mitosis?

Mitosis is divided into four key stages: prophase, metaphase, anaphase, and telophase. In prophase, chromosomes condense, and the mitotic spindle begins to form. During metaphase, chromosomes align at the metaphase plate. In anaphase, sister chromatids separate and move toward opposite poles. Finally, in telophase, nuclear envelopes reform around the separated chromosomes, which are followed by cytokinesis, the division of the cytoplasm.

## 2. How does prophase contribute to mitosis?

In prophase, the chromatin condenses into visible chromosomes, each consisting of two sister chromatids held together by a centromere. The nuclear envelope begins to break down, and the mitotic spindle, composed of microtubules, starts to form. Centrosomes, which organize the spindle fibers, move to opposite poles of the cell, setting up the framework necessary for chromosome segregation.

## 3. What is the significance of metaphase in mitosis?

Metaphase is crucial for ensuring that chromosomes are properly aligned before they are separated. During metaphase, the chromosomes line up along the metaphase plate, an imaginary plane at the cell's equator. Each sister chromatid is attached to spindle fibers from opposite poles, ensuring that when separation occurs, each daughter cell will receive an identical set of chromosomes.

## 4. What happens during anaphase, and why is it important?

Anaphase is the stage where sister chromatids, which are identical copies of each chromosome, are pulled apart by the spindle fibers. The centromeres split, allowing the chromatids to move to opposite poles of the cell. This ensures that each daughter cell will receive an equal and complete set of chromosomes, which is critical for maintaining genetic stability.

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### **5. How does telophase differ from anaphase?**

Telophase is the final stage of mitosis, during which the separated chromatids (now individual chromosomes) arrive at the poles and begin to de-condense back into chromatin. The nuclear envelope re-forms around each set of chromosomes, creating two distinct nuclei. This stage contrasts with anaphase, where the chromatids are actively being pulled apart, while in telophase, the focus shifts to the re-establishment of nuclear organization.

### **6. What role does cytokinesis play in cell division?**

Cytokinesis is the process that physically divides the cytoplasm of the parental cell into two daughter cells. In animal cells, it involves the formation of a contractile ring that pinches the cell in two, creating a cleavage furrow. In plant cells, a cell plate forms, which eventually becomes the cell wall. Cytokinesis ensures that each daughter cell receives not only genetic material but also sufficient cytoplasmic components to function independently.

### **7. How do mitotic spindle fibers ensure accurate chromosome segregation?**

Mitotic spindle fibers, composed of microtubules, are responsible for attaching to chromosomes and pulling them apart during mitosis. They form from centrosomes, which migrate to opposite poles of the cell. During metaphase, spindle fibers attach to the centromere of each chromosome via structures called kinetochores. This attachment ensures that when the chromatids are pulled apart in anaphase, they are equally distributed between the two daughter cells.

### **8. What is the role of the centromere during mitosis?**

The centromere is the region of a chromosome where the two sister chromatids are held together until they are separated in anaphase. It serves as the attachment site for spindle fibers via kinetochores. The centromere is crucial for the proper segregation

of chromatids, as it ensures that each daughter cell receives one copy of each chromosome during cell division.

### **9. What are checkpoints in the cell cycle, and why are they important in mitosis?**

Checkpoints are control mechanisms in the cell cycle that ensure processes such as DNA replication and chromosome segregation occur accurately. The G<sub>2</sub>/M checkpoint ensures that DNA has been properly replicated before mitosis begins, while the metaphase checkpoint ensures that all chromosomes are properly attached to the spindle fibers before anaphase. These checkpoints are critical for preventing errors in cell division that could lead to aneuploidy or cancer.

### **10. How does mitosis differ from meiosis?**

Mitosis produces two genetically identical diploid daughter cells, while meiosis produces four genetically unique haploid gametes. Mitosis occurs in somatic cells and is responsible for growth, tissue repair, and asexual reproduction. Meiosis, on the other hand, occurs in germ cells and is involved in sexual reproduction. Mitosis involves one round of division, while meiosis involves two rounds of division and includes processes such as crossing over, which increases genetic diversity.

### **11. Why is mitosis important for multicellular organisms?**

Mitosis is essential for growth, development, and tissue repair in multicellular organisms. It allows for the generation of new cells that are genetically identical to the parent cell, maintaining the organism's genetic continuity. Mitosis also plays a role in asexual reproduction for organisms that reproduce without gametes. Without mitosis, cells could not divide and replace those lost to injury or aging.

### **12. What is the significance of the mitotic index?**

The mitotic index is a measure of the proportion of cells in a tissue undergoing mitosis at a given time. It is used as an indicator of cell proliferation and is often measured in cancer research. A high mitotic index suggests a high rate of cell division, which can

indicate tumor growth or tissue regeneration. Conversely, a low mitotic index may indicate slow cell division or cell cycle arrest.

### **13. How do cancer cells bypass the normal regulatory mechanisms of mitosis?**

Cancer cells often bypass normal regulatory mechanisms of mitosis through mutations in genes that control cell cycle checkpoints. For example, mutations in tumor suppressor genes like p53 or oncogenes like Ras can lead to uncontrolled cell division. These mutations allow cells to proliferate without the normal checks for DNA damage or proper chromosome alignment, resulting in abnormal growth and tumor formation.

### **14. What are spindle assembly checkpoint (SAC) proteins, and what is their function?**



Spindle assembly checkpoint (SAC) proteins ensure that all chromosomes are properly attached to spindle microtubules before anaphase begins. They prevent the premature separation of chromatids by inhibiting the activity of the anaphase-promoting complex (APC) until all chromosomes are correctly aligned at the metaphase plate. SAC proteins are essential for preventing chromosome mis-segregation, which can lead to aneuploidy and contribute to diseases like cancer.

### **15. How do chromosomal abnormalities arise during mitosis, and what are the consequences?**

Chromosomal abnormalities during mitosis, such as nondisjunction or chromosome mis-segregation, arise when chromosomes fail to separate properly during anaphase. This can lead to daughter cells with an incorrect number of chromosomes, a

condition known as aneuploidy. Consequences of such abnormalities can include cell death, developmental disorders, or cancer if the affected cells continue to proliferate unchecked.

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