LT: I can collect and analyze data that describes the amount of time cells require to complete different stages of mitosis.
Standard: 4.1d

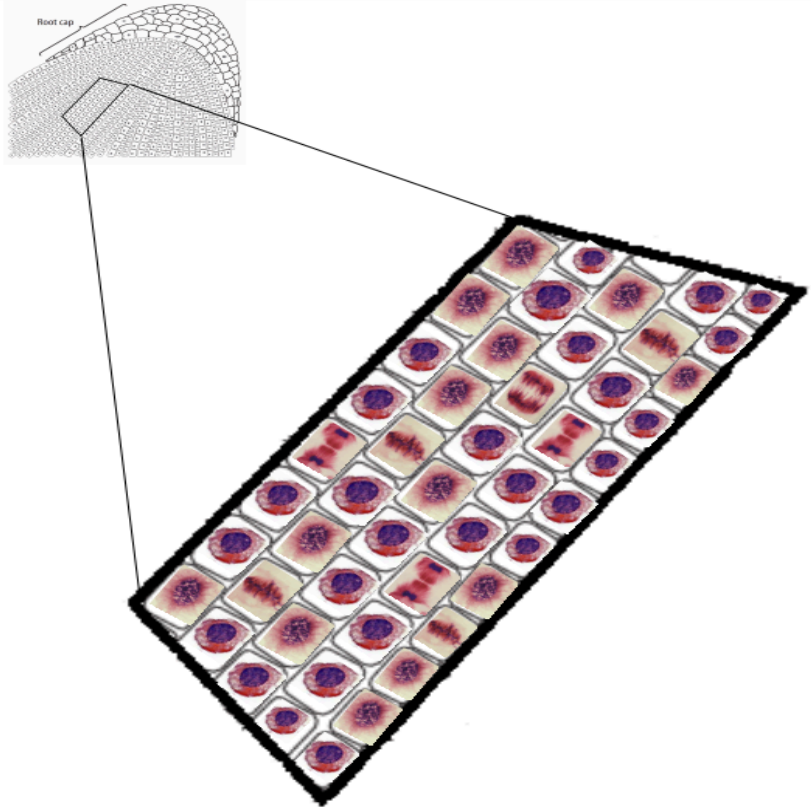
Introduction

Do all phases of mitosis require the same amount of time for completion? This question can be answered by counting the number of onion root tip cells in the four phases of mitosis and in interphase. Many cells in one specific phase indicate that a long period of time is required for completion of that phase. Few cells in a specific phase indicate a short period of time is required for completion of that phase.

Procedure A: Observe and Record

Part A. Locating and Counting Cells in Mitosis

1. Locate the cells that are in the root cap field view. Count the number of cells in each mitotic phase and in interphase.
2. Use Figure 1 as a guide to the phases of mitosis.
3. Total the number of cells counted in each phase and interphase. Record this figure in the column marked "Number of Cells in Each Phase" of Table 1
4. Add the number of cells viewed in each phase and interphase together to get the total of all cells counted.



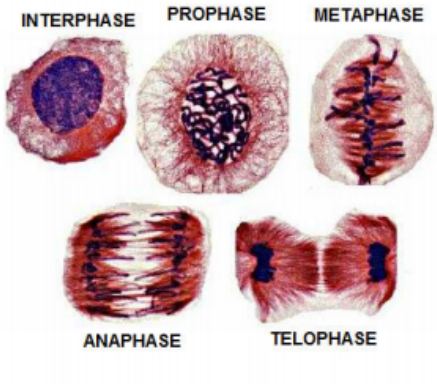


Figure1

Procedure B: Calculations

Part B. Determining the Time Required for Each Phase
Assume that the number of cells in a phase is an indication of the time spent in that phase during mitosis. Time spent in a mitotic phase and in interphase can be calculated if the total time for mitosis is known. Onion cells require 12 hours (720 minutes) to complete mitosis (from interphase to interphase).

The amount of time needed for a phase can be calculated using the formula:

$$\text{time for a phase} = \frac{\text{number of cells in a phase}}{\text{total number of cells counted}} \times \text{720 minutes}$$

For example: If 109 cells were counted in metaphase and 980 total cells were counted, then:

$$\frac{109}{980} \times 720 \text{ minutes} = 80 \text{ minutes}$$

Calculate the time required for each phase of mitosis using your data. Assume that the total time for mitosis is 720 minutes.

Record the times in Table 1.

Procedure C: Graph

Using your data from Table 1 and the graph outline, prepare a circle graph which shows the number of minutes that onion cells spend in each phase of mitosis. The following suggestions may aid you in preparing your graph.

a. Graph your data using the "Time in minutes" column from Table 1.

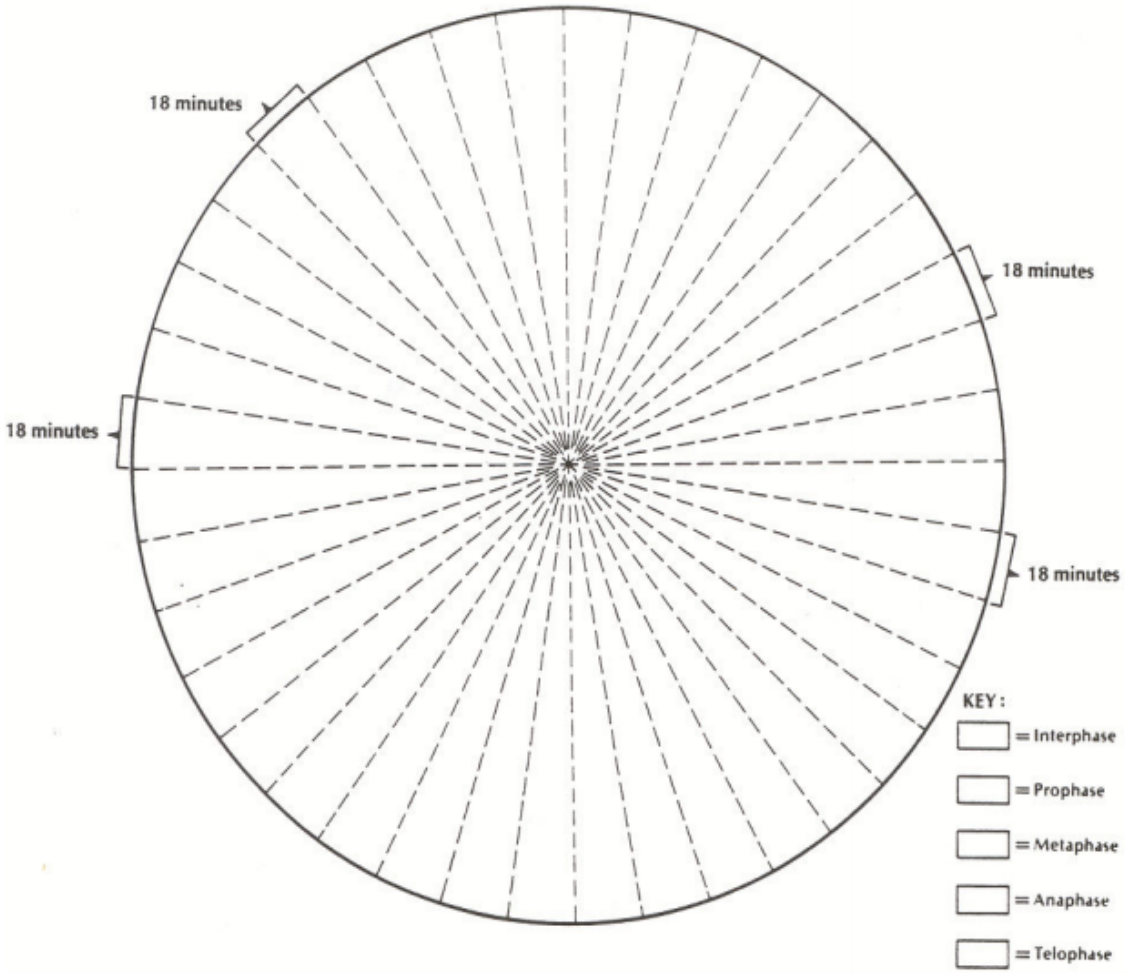
b. The circle is divided into 18-minute sections. Each section of the graph equals 18 minutes. If a phase is not exactly 18 minutes long (or some interval close to a multiple of 18 minutes), approximate the position of the line on the graph.

c. Shade each phase on your graph with **colored pencils** or various degrees of pencil shading.

d. Identify each phase by shading the key to correspond with the shading on your graph.

Data Table 1

Stage	Cells Counted	Math to determine time in each stage	Time (in minutes) for each stage
Interphase			
Prophase			
Metaphase			
Anaphase			
Telophase			
Total Counted Cells			



Analysis

1. Which phase requires the longest time for completion? Next longest time for completion? Shortest time for completion?

Table 2 (Below) shows the length of time (in minutes) needed for mitosis to occur in Normal chicken stomach cells and cancerous chicken stomach cells

Phase	Normal Chicken Stomach Cells in Minutes	Cancerous Chicken Stomach Cells in Minutes
Interphase	540	380
Prophase	60	45
Metaphase	10	10
Anaphase	3	3
Telophase	12	10

2. In normal chicken cells, which phase requires the longest time for completion? Next longest time for completion?

3. How do your answers to 1 compare to 2?

4. What is the total time needed for a normal chicken stomach cell to complete mitosis? (Total up the time in minutes for each phase.)

5. What is the total time needed for a cancerous chicken stomach cell to complete mitosis?

6. How do cancer cells differ from normal cells in total time required for mitosis?

7. How do cancer cells differ from normal cells in time spent for each phase?

Table 3 (Below) shows the length of time (in minutes) needed for mitosis to occur in 2 different normal living organisms.

Species	Prophase	Metaphase	Anaphase	Telophase	Total Cells
Salamander kidney cells	60	50	6	70	186
Pea root cells	80	40	4	12	136

8. Which organism, salamander or pea, shows time needed to complete mitosis most like the data you recorded in Table 1?

9. Why might the time required for these two organisms to complete mitosis be similar?
(HINT: Where did the cell material you used in Part A come from?)