Name _____ Date _____

Time For Mitosis

18

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.

In this investigation, you will

(a) use prepared slides of onion root tip cells to locate cells in mitosis and interphase.
(b) count the number of cells in each of the phases of mitosis and in interphase.
(c) compute the length of time in minutes needed to complete each phase.
(d) compare data of the time needed for normal cells to complete each phase with that of abnormal cancer cells.

Materials

microscope
prepared slides of onion root tip *(Allium)*, longitudinal section

Procedure

Part A. Locating and Counting Cells in Mitosis

• Locate under the microscope on an onion root tip slide an area with cells in the process of mitosis. After locating the cells under low power, switch to high power.

• Count and record in Table 1 the number of cells in each mitotic phase and in interphase. Count all cells in the field of view. Use Figure 1 as a guide to the phases of mitosis.

• Move the slide so you are looking at a new area of cells.

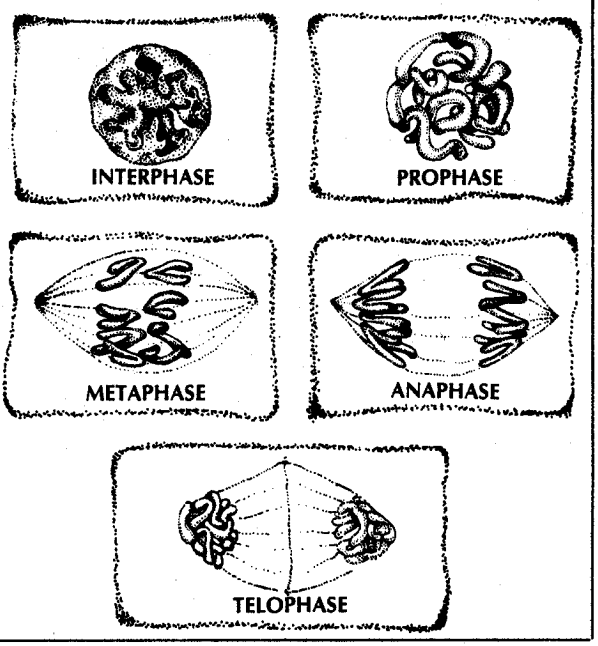
• Count and record the number of cells in each mitotic phase and in interphase for this area.

• Repeat for a third new area.

• Total the number of cells counted in each phase and interphase for the three areas. Record this figure in the column marked "Total Number of Cells in Each Phase" of Table 1.

• Add the total number of cells viewed in each phase and interphase together to get the total of all cells counted. Record this number in Table 1.

FIGURE 1



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:

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

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. Use the total of the three areas counted. Assume that the total time for mitosis is 720 minutes.

- Record the times in Table 1.

TABLE 1. RESULTS OF COUNTING CELLS IN EACH PHASE OF MITOSIS AND INTERPHASE

PHASE	FIRST AREA	SECOND AREA	THIRD AREA	TOTAL NUMBER OF CELLS IN EACH PHASE	TIME IN MINUTES
Interphase					
Prophase					
Metaphase					
Anaphase					
Telophase					
			Total number		

Analysis

1. Which phase requires the longest time for completion? _____

2. Which phase requires the next longest time for completion? _____

3. Which phase requires the shortest time for completion? _____

4. The following table shows average times required for normal and diseased chicken stomach cells to complete mitosis.
   (a) In normal chicken cells, which phase requires the longest time for completion? _____

   _____

   (b) In normal chicken cells, which phase requires the next longest time for completion? _____

   _____

   (c) How do your answers to questions 4a and 4b compare with answers to questions 1 and 2?

   _____

Name _____ *Date* _____

TABLE 2. TIME FOR MITOSIS OF NORMAL AND CANCEROUS CHICKEN STOMACH CELLS (IN MINUTES)		
	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

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

(b) 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? _____

_____

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

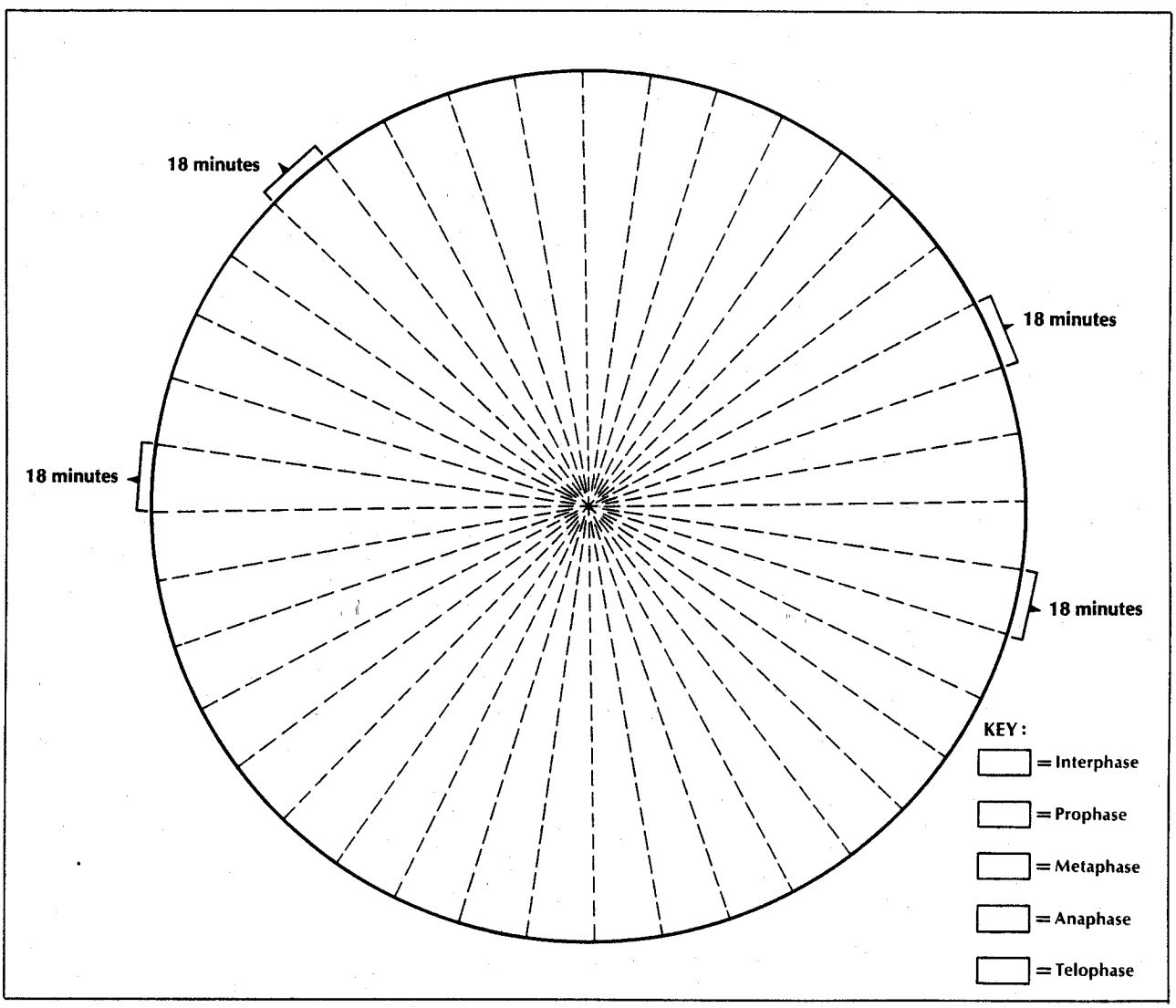
(a) Which organism, salamander or pea, shows time needed to complete mitosis most like the data you recorded in Table 1? _____

(b) 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?) _____

_____

TABLE 3. TIMES NEEDED FOR MITOSIS					
	PROPHASE	METAPHASE	ANAPHASE	TELOPHASE	TOTAL
Salamander kidney cells	60	50	6	70	186
Pea root cells	80	40	4	12	136

9. Using your data from Table 1 and the outline below, 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.



10. Refer to the outline graph above when answering the following questions.
   (a) What important changes occur in the nucleus and cell during the longest phase of mitosis?

_____

_____

   (b) Why do you think so much time is spent in this phase? _____

_____

_____