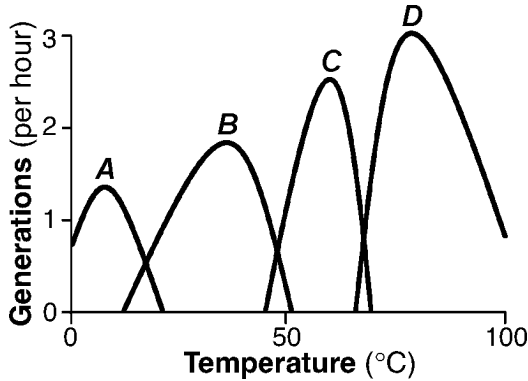


Name: _____

UNIT: BASIC LABORATORY SKILLS

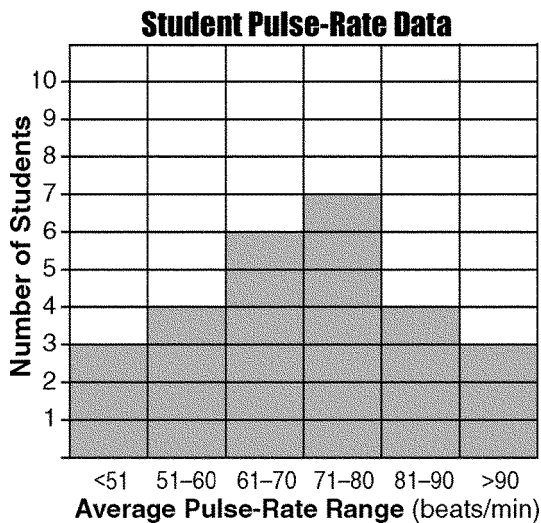
TOPIC: GRAPHING DATA

- 1) The graph below provides information about the reproductive rates of four species of bacteria, A, B, C, and D, at different temperatures.



Which statement is a valid conclusion based on the information in the graph?

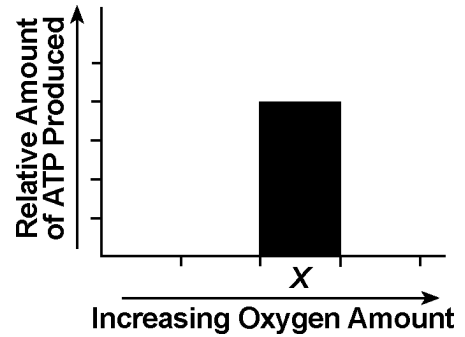
- Individual species reproduce within a specific range of temperatures.
 - Changes in temperature cause bacteria to adapt to form new species.
 - Increasing temperatures speed up bacterial reproduction.
 - Bacteria can survive only at temperatures between 0°C and 100°C.
- 2) Pulse-rate data were collected from some students during their lunch time for the lab activity, *Making Connections*. The data are represented in the histogram below.



The histogram provided shows data from a total of how many students?

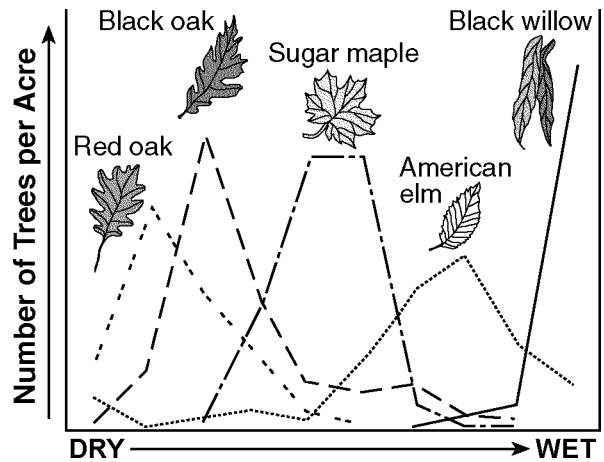
- 6
- 27
- 10
- 7

- 3) A student studied how the amount of oxygen affects ATP production in muscle cells. The data for amount X are shown in the graph below.



If the student supplies the muscle cells with *less* oxygen in a second trial of the investigation, a bar placed on the graph to represent the results of this trial would most likely be

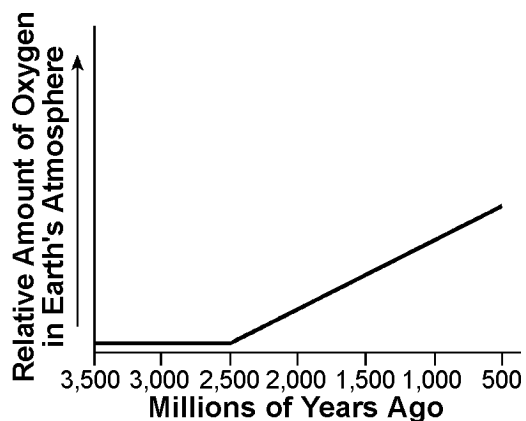
- shorter than bar X and placed to the right of bar X
 - taller than bar X and placed to the left of bar X
 - shorter than bar X and placed to the left of bar X
 - taller than bar X and placed to the right of bar X
- 4) The graph below shows the effect of moisture on the number of trees per acre of five tree species.



Which observation *best* represents information shown in the graph?

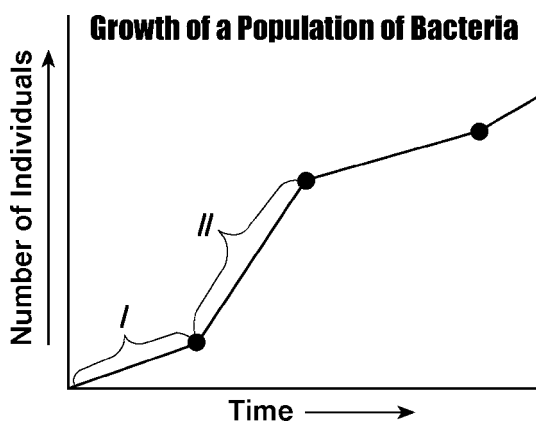
- The American elm grows in the widest range of moisture conditions.
- All five species grow in the same habitat.
- Sugar maples can grow anywhere black oaks can grow.
- Red oaks can grow in wetter conditions than black willows.

- 5) The relative amount of oxygen in the atmosphere of Earth over millions of years is shown in the graph below.



At what point in the history of Earth did autotrophs most likely first appear?

- 1) 1,500 million years ago
 - 2) 500 million years ago
 - 3) 2,500 million years ago
 - 4) 3,500 million years ago
- 6) The graph below shows the growth of a population of bacteria over a period of 80 hours.



Which of the following statements *best* describes section II of the graph?

- 1) The rate of reproduction is slower than in section I.
- 2) The rate of reproduction exceeds the death rate.
- 3) The population is greater than the carrying capacity of the environment.
- 4) The population has reached the carrying capacity of the environment.

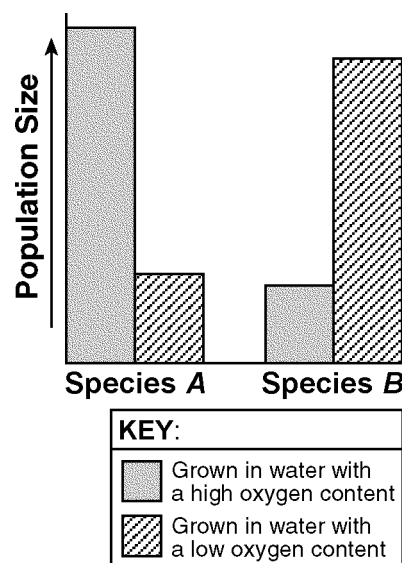
- 7) A biologist collected the data shown in the table below.

DATA TABLE:

Type of Organism	Number of Organisms in a Field		
	MAY	JULY	SEPTEMBER
grasshoppers	100	500	150
birds	25	100	10
spiders	75	200	50

Which statement is supported by the data in the table?

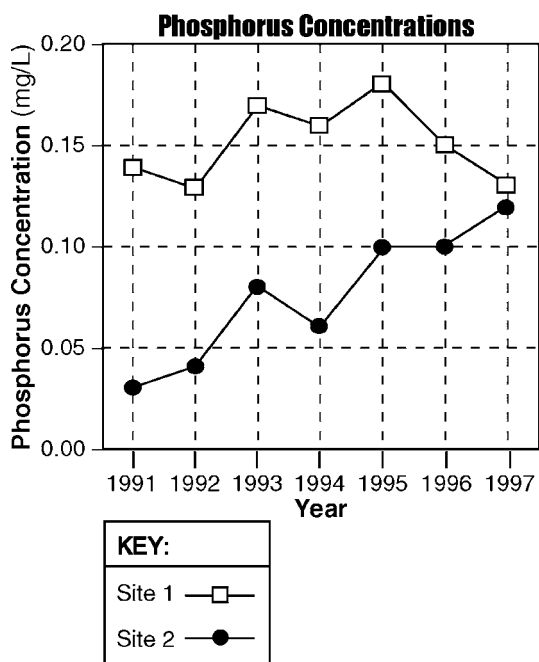
- 1) The populations are highest in September.
 - 2) Populations do not vary from month to month.
 - 3) Seasonal variations may affect populations.
 - 4) The grasshoppers increased in length in July.
- 8) A graph of the population growth of two different species is shown below.



Which conclusion can be drawn from information in the graph?

- 1) Low oxygen concentration does not limit the population size of either species observed.
- 2) Species A requires a high oxygen concentration for maximum population growth.
- 3) Species B requires a high oxygen concentration to stimulate population growth.
- 4) Oxygen concentration affects population sizes of different species in the same manner.

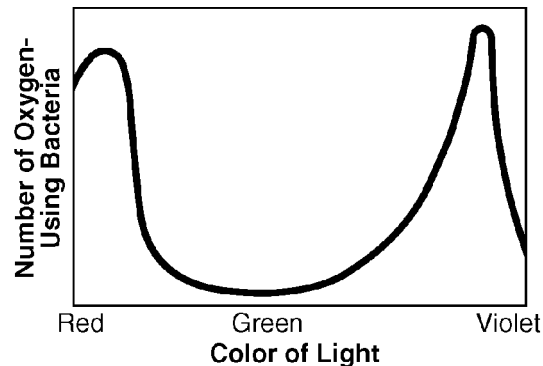
- 9) Compounds containing phosphorus that are dumped into the environment can upset ecosystems because phosphorus acts as a fertilizer. The graph below shows measurements of phosphorus concentrations taken during the month of June at two sites from 1991 to 1997.



Which of the following statements represents a valid inference based on information in the graph?

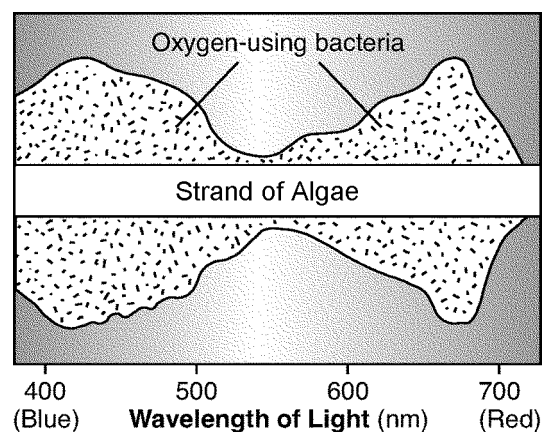
- There was most likely no vegetation present near site 2 from 1993 to 1994.
- There was a greater variation in phosphorous concentration at site 1 than there was at site 2.
- There was no decrease in the amount of compounds containing phosphorus dumped at site 2 during the period from 1991 to 1997.
- Pollution controls may have been put into operation at site 1 in 1995.

- 10) The graph below shows the results of an experiment in which a container of oxygen-using bacteria and strands of a green alga were exposed to light of different colors.



Which statement *best* explains the results of this experiment?

- The rate of photosynthesis is affected by variations in the light.
 - In all environments, light is a vital resource.
 - Uneven numbers and types of species can upset ecosystem stability.
 - The activities of bacteria and algae are not related.
- 11) In 1883, Thomas Engelmann, a German botanist, exposed a strand of algae to different wavelengths of light. Engelmann used bacteria that concentrate near an oxygen source to determine which sections of the algae were releasing the most O_2 . The results are shown below.



Which of the following statements is a valid inference based on this information?

- Respiration rate in the bacteria is greatest at 550 nm.
- Photosynthetic rate in the algae is greatest in blue light.
- The algae absorb the greatest amount of oxygen in red light.
- Oxygen production decreases as the wavelength of light increases from 550 to 650 nm.

- 12) A student studied the location of single-celled photosynthetic organisms in a lake for a period of several weeks. The depth at which these organisms were found at different times of the day varied greatly. Some of the data collected are shown in the table below.

DATA TABLE:

Light Conditions at Different Times of the Day	Average Depth of Photosynthetic Organisms (cm)
full light	150
moderate light	50
no light	10

A valid inference based on the data shown in the table is that

- 1) photosynthetic organisms move up and down to increase their rate of carbon dioxide production
- 2) most photosynthetic organisms live below a depth of 150 centimeters
- 3) photosynthetic organisms respond to changing light levels
- 4) oxygen production increases as photosynthetic organisms move deeper in the lake

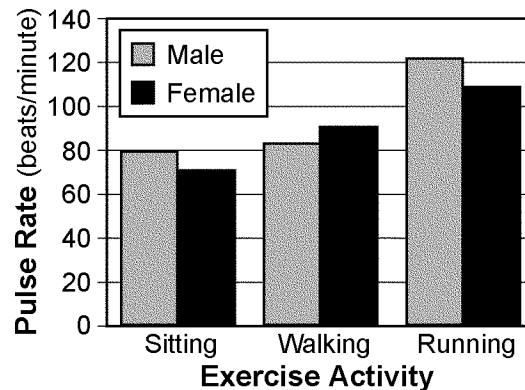
Questions 13 through 15 refer to the following:

It has been hypothesized that a chemical known as BW prevents colds. To test this hypothesis, 20,000 volunteers were divided into four groups. Each volunteer took a white pill every morning for one year. The contents of the pill taken by the members of each group are shown in the chart below.

Group	Number of Volunteers	Contents of Pill	% Developing Colds
1	5,000	5 grams of sugar	20
2	5,000	5 grams of sugar 1 gram of BW	19
3	5,000	5 grams of sugar 3 grams of BW	21
4	5,000	5 grams of sugar 9 grams of BW	15

- 13) Which factor most likely had the *greatest* influence on these experimental results?
- 1) health history of the volunteers
 - 2) number of volunteers in each group
 - 3) color of the pills
 - 4) amount of sugar added

- 14) Which statement is a valid inference based on the results?
- 1) BW is always effective in the prevention of colds.
 - 2) Sugar increased the number of colds.
 - 3) Sugar reduced the number of colds.
 - 4) BW may not be effective in the prevention of colds.
- 15) Which group served as the control in this investigation?
- 1) 1
 - 2) 2
 - 3) 3
 - 4) 4
- 16) In an investigation, 28 students in a class determined their pulse rates after performing each of three different activities. Each activity was performed three times during equal time intervals. The average results are shown in the graph below.



After the experiment described, some students concluded that males always have a higher pulse rate than females. Does the graph support this conclusion? [*Justify your answer.*]

- 17) A student squeezes and releases a clothespin as often as possible for 2 minutes and then takes his pulse for 20 seconds. After a 2-minute rest, he repeats the procedure. This pattern is repeated one more time. The student's 20-second pulse counts were 23, 26, and 21.

Based on the information in the reading passage, complete the "Pulse/Min" column in the data table below for all three trials as well as the average pulse rate per minute.

Pulse Rate After Activity

Trial	20-Second Pulse Counts	Pulse/Min
1	23	
2	26	
3	21	
Average		

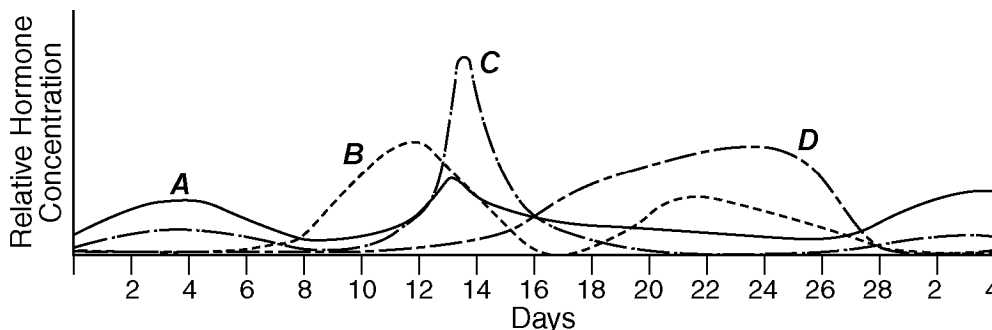
18) Information concerning the diet of crocodiles of different sizes is contained in the table below.

Percentage of Different Length Crocodiles and Their Food Sources

Food Source	Group A 0.3–0.5 Meter	Group B 2.5–3.9 Meters	Group C 4.5–5.0 Meters
mammals	0	18	65
reptiles	0	17	48
fish	0	62	38
birds	0	17	0
snails	0	25	0
shellfish	0	5	0
spiders	20	0	0
frogs	35	0	0
insects	100	2	0

Which of the following statements is *not* a valid conclusion based on the data?

- 1) Spraying insecticides would have the most direct impact on group A.
 - 2) The smaller the crocodile is, the larger the prey.
 - 3) Group B has no preference between reptiles and birds.
 - 4) Overharvesting of fish could have a negative impact on group C.
- 19) The graph below shows the different concentrations of female reproductive hormones A, B, C, and D over a 28-day cycle.



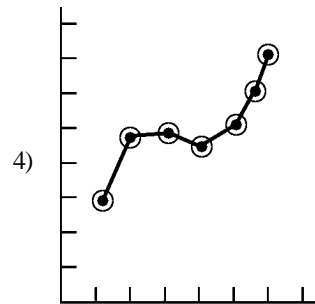
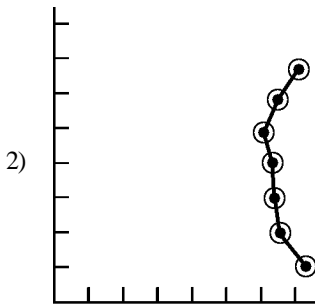
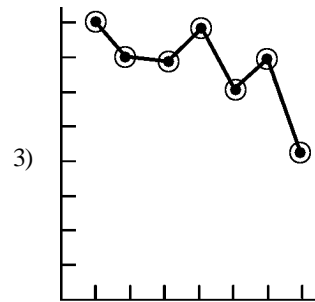
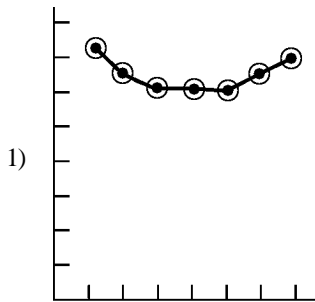
Although the data used to make this graph was originally entered in a data table, most scientists prefer to see the information in the form of a graph because

- 1) it is easier to see relationships between variables in a graph than in a data table
- 2) the information in a graph is more accurate than the information in a data table
- 3) it is possible to put more information in a graph than in a data table
- 4) only graphs can be used to predict future trends

- 20) As part of an experiment, the heart rate of a person at rest was measured every hour for 7 hours. The data are shown in the table below.

Hour	Heart Rate (beats/min)
1	72
2	63
3	61
4	61
5	60
6	63
7	68

Which graphed line *best* represents this data?

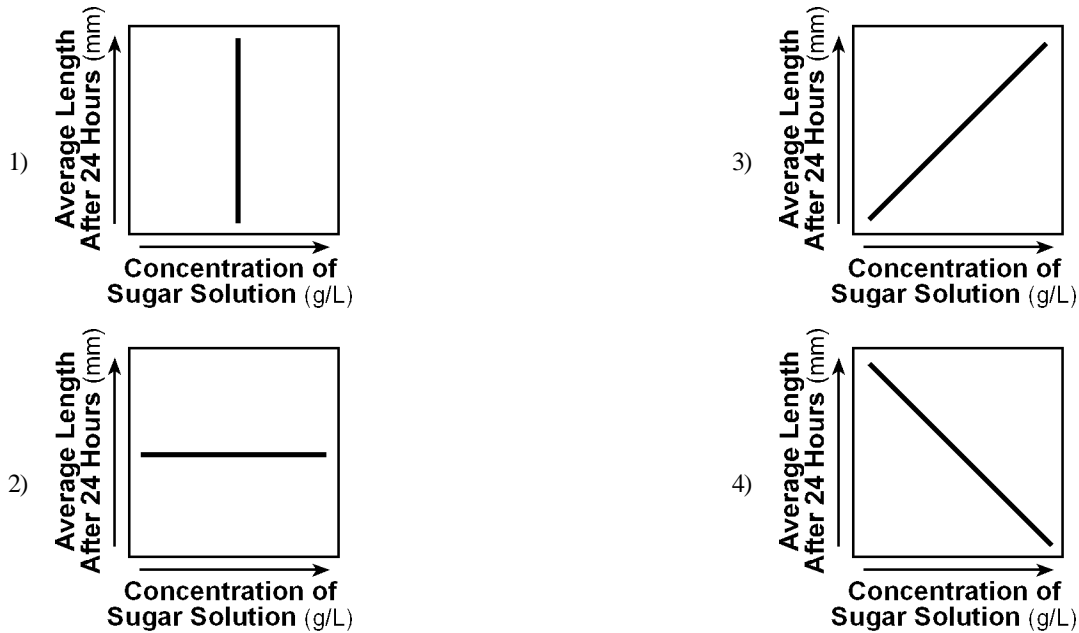


21) Students cut 20 rod-shaped pieces of potato of the same diameter and length. Five pieces of potato were placed into each of four beakers containing different concentrations of sugar solutions. Each potato piece was measured again after 24 hours. The table below shows the results of their experiment.

Change in Length

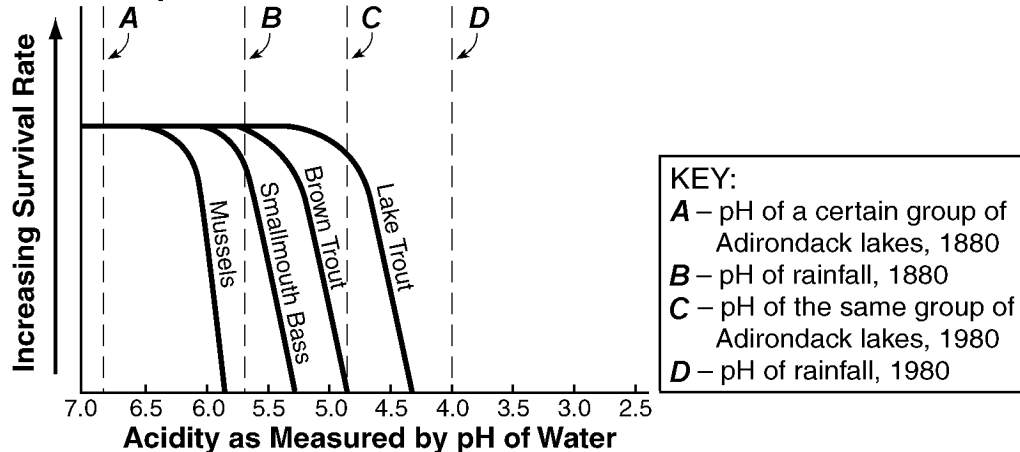
Concentration of Sugar Solution (grams per liter)	Original Length of Potato Pieces (cm)	Average Length After 24 Hours (mm)
0	50.0	52.0
5	50.0	44.0
8	50.0	43.5
10	50.0	42.5

Which graph *best* represents the information in the data table?



Questions 22 and 23 refer to the following:

The Effect of pH on Survival Rates of Selected Species in Certain Adirondack Lakes



22) State how the pH of the Adirondack lakes represented in the chart changed between 1880 and 1980.

23) Based on the chart, state the effect that the pH change in the Adirondack lakes had on lake trout, brown trout, small mouth bass, and mussels.

24) Insecticides are used by farmers to destroy crop-eating insects. Recently, scientists tested several insecticides to see if they caused damage to chromosomes. Six groups of about 200 cells each were examined to determine the extent of chromosome damage after each group was exposed to a different concentration of one of two insecticides. The results are shown in the data table below.

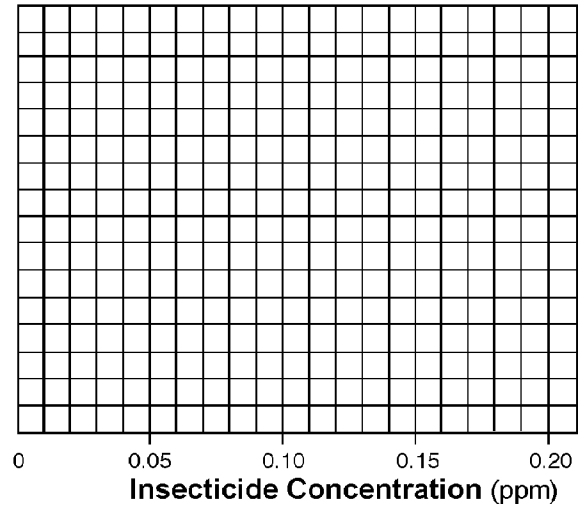
Cell Damage After Exposure to Insecticide

Insecticide	Insecticide Concentration (ppm)	Number of Cells with Damaged Chromosomes
Methyl parathion	0.01	7
	0.10	15
	0.20	30
Malathion	0.01	3
	0.10	4
	0.20	11

Number of Cells with Damaged Chromosomes

KEY:
 ● = Methyl parathion
 ▲ = Malathion

Cell Damage After Exposure to Insecticide



- (a) On the grid provided, mark an appropriate scale on the axis labeled "Number of Cells with Damaged Chromosomes."
- (b) On the grid provided, plot the data for methyl parathion on the grid. Surround each point with a small circle and connect the points.

EXAMPLE:

- (c) Plot the data for malathion on the grid. Surround each point with a small triangle and connect the points.

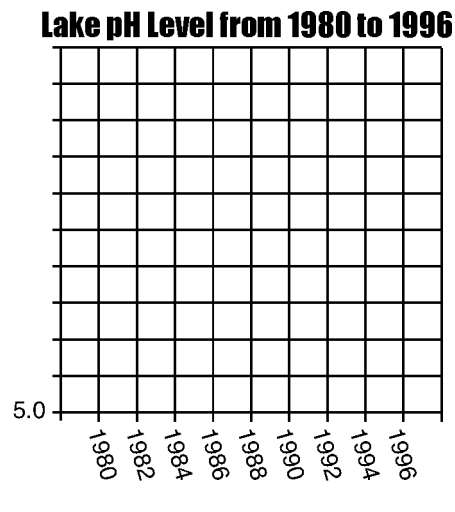
EXAMPLE:

- (d) Which insecticide has a more damaging effect on chromosomes? [Support your answer.]

Questions 25 through 27 refer to the following:

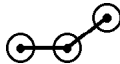
The table shows data collected on the pH level of an Adirondack lake from 1980 to 1996.

Year	pH Level
1980	6.7
1984	6.3
1986	6.4
1988	6.2
1990	5.9
1992	5.6
1994	5.4
1996	5.1



- 25) Using the information in the data table, construct a line graph on the grid provided following the directions below.
- Label the axes.
 - Mark an appropriate scale on the y-axis. The scale has been started for you.
 - Plot the data from the data table. Surround each point with a small circle and connect the points.
- 26) Describe the trend in pH level in the lake over the 16-year period recorded in the given table.
- 27) For the given water study, identify *one* factor that should have been kept constant each time water samples were collected from the lake.

EXAMPLE:



Questions 28 and 29 refer to the following:

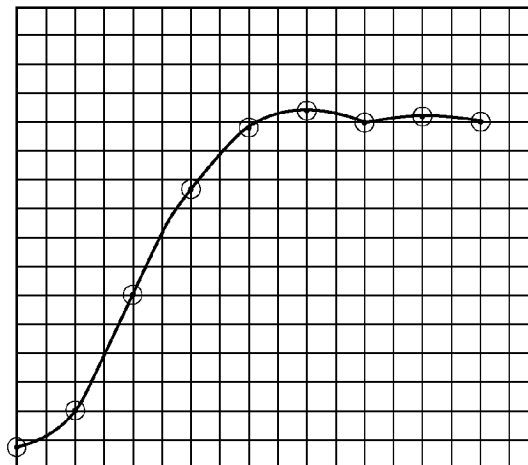
A student grew two separate cultures of single-celled organisms. One culture contained *Paramecium caudatum* and the other contained *Paramecium aurelia*. The cultures were grown under the same conditions and the number of paramecia (per drop) in each culture was estimated every 2 days for a period of 16 days. The results are shown in the data table below.

Growth of *Paramecium aurelia* and *Paramecium caudatum* in Individual Cultures

Days	Number of <i>Paramecium caudatum</i> (per drop)	Number of <i>Paramecium aurelia</i> (per drop)
0	4	4
2	10	10
4	30	46
6	48	66
8	58	70
10	62	69
12	60	71
14	61	71
16	60	71

Number of Paramecia (per drop)

Growth of *Paramecium aurelia* and *Paramecium caudatum* in Individual Cultures



KEY:
 ○ = *Paramecium caudatum*
 △ = *Paramecium aurelia*

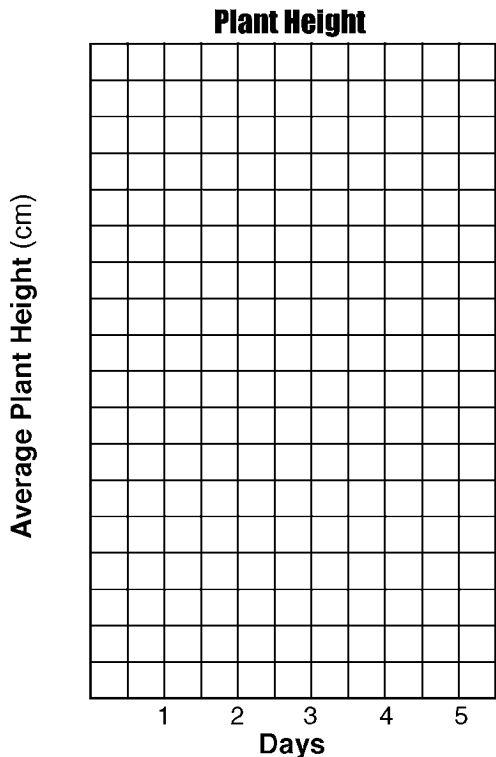
- 28) Using the information in the data table shown, construct a line graph on the grid provided, following the directions below.
- (a) Mark a scale on each labeled axis appropriate for the data for *Paramecium caudatum* that has already been plotted on the grid.
 - (b) Plot the data for *Paramecium aurelia* on the grid. Surround each point with a small triangle and connect the points.



- 29) (a) Describe the change in the two populations between days 0 and 8 for the data shown.
- (b) State *one* possible reason for the difference in the rates of change in the two populations of paramecia between days 0 and 8.

Questions 30 and 31 refer to the following:

A number of bean seeds planted at the same time produced plants that were later divided into two groups, *A* and *B*. Each plant in group *A* was treated with the same concentration of gibberellic acid (a plant hormone). The plants in group *B* were not treated with gibberellic acid. All other growth conditions were kept constant. The height of each plant was measured on 5 consecutive days, and the average height of each group was recorded in the data table below.



Data Table

	Average Plant Height (cm)				
	Day 1	Day 2	Day 3	Day 4	Day 5
Group A	5	7	10	13	15
Group B	5	6	6.5	7	7.5

KEY:

●	Group A
▲	Group B

30) Using the information in the data table, construct a line graph on the grid provided, following the directions below.

- (a) Mark an appropriate scale on the axis labeled "Average Plant Height (cm)."
- (b) Plot the data for the average height of the plants in group *A*. Surround each point with a small circle and connect the points.

EXAMPLE:

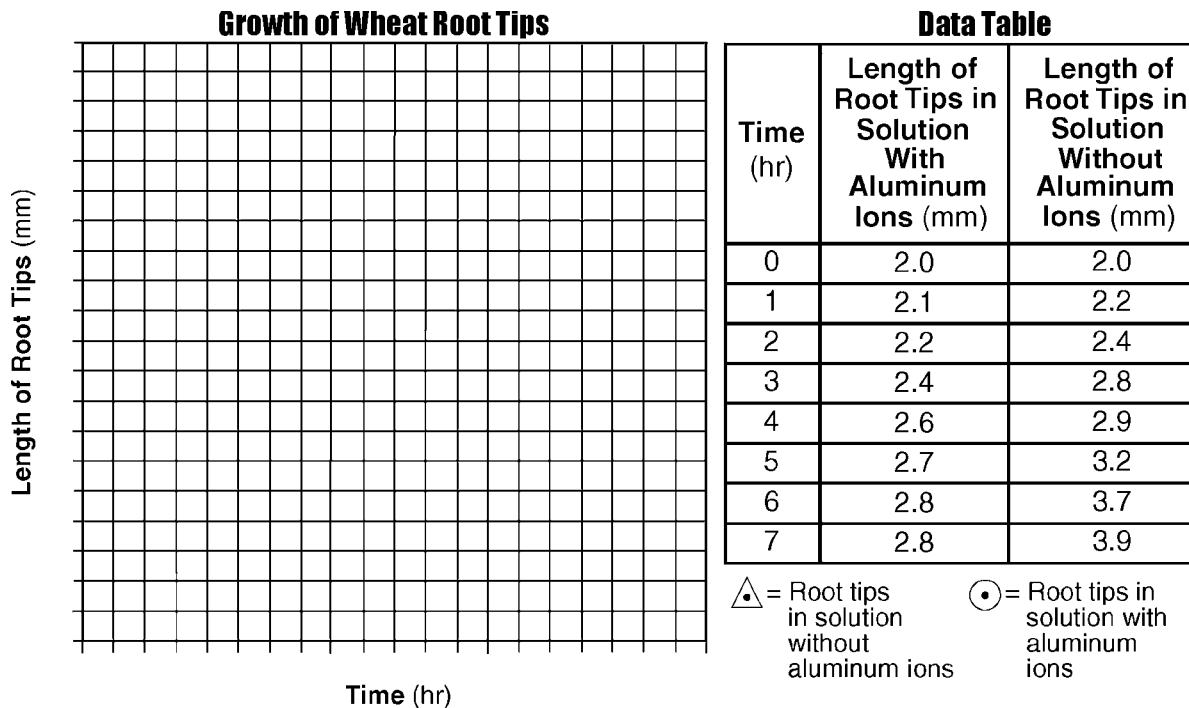
- (c) Plot the data for the average height of the plants in group *B*. Surround each point with a small triangle and connect the points.

EXAMPLE:

31) Based on the data shown, state a valid conclusion that can be drawn concerning the effect of gibberellic acid on bean plant growth.

Questions 32 and 33 refer to the following:

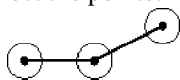
Biologists investigated the effect of the presence of aluminum ions on root tips of a variety of wheat. They removed 2-mm sections of the tips of roots. Half of the root tips were placed in a nutrient solution with aluminum ions, while the other half were placed in an identical nutrient solution without aluminum ions. The length of the root tips, in millimeters, was measured every hour for seven hours. The results are shown in the data table below.



32) Using the information in the data table, construct a line graph on the grid provided, following the directions below.

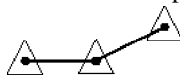
- (a) Mark an appropriate scale on each labeled axis.
- (b) Plot the data for root tips in the solution with aluminum ions on the grid. Surround each point with a small circle and connect the points.

EXAMPLE:



- (c) Plot the data for root tips in the solution without aluminum ions on the grid. Surround each point with a small triangle and connect the points.

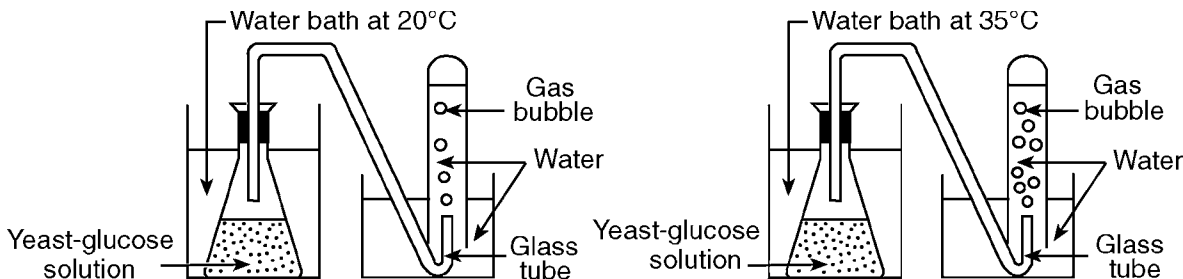
EXAMPLE:



33) Based on the data shown, describe the effect of aluminum ions on the growth of the root tips of wheat.

Questions 34 through 36 refer to the following:

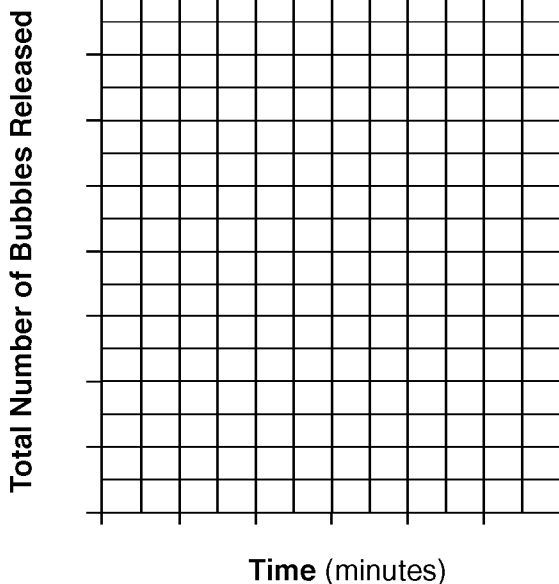
The laboratory setups represented below were used to investigate the effect of temperature on cellular respiration in yeast (a single celled organism). Each of two flasks containing equal amounts of a yeast-glucose solution was submerged in a water bath, one kept at 20°C and one kept at 35°C. The number of gas bubbles released from the glass tube in each setup was observed and the results were recorded every 5 minutes for a period of 25 minutes. The data are summarized in the table below.



Effect of Temperature on Yeast Respiration

DATA TABLE:

Time (minutes)	Total Number of Bubbles Released	
	20°C	35°C
5	0	5
10	5	15
15	15	30
20	30	50
25	45	75

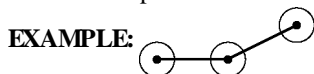


KEY:

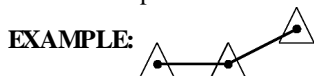
- Yeast respiration at 20°C
- △ Yeast respiration at 35°C

34) Using the information in the data table, construct a line graph on the grid provided, following the directions below.

- (a) Mark an appropriate scale on each axis.
- (b) Plot the data for the total number of bubbles released at 20°C on the grid. Surround each point with a small circle and connect the points.



- (c) Plot the data for the total number of bubbles released at 35°C on the grid. Surround each point with a small triangle and connect the points.



35) Based on the data provided, state one relationship between temperature and the rate of gas production in yeast.



- 36) Identify the gas that would be produced by the process taking place in *both* laboratory setups represented.

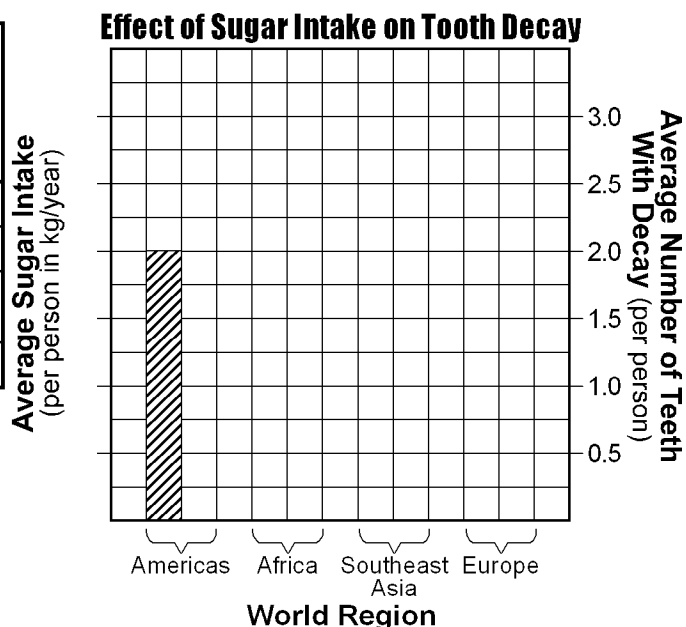
Questions 37 and 38 refer to the following:



Tooth decay occurs when bacteria living in the mouth produce an acid that dissolves tooth enamel (the outer, protective covering of a tooth). The data table below shows the effect of sugar intake on tooth decay in different regions of the world.

World Regions	Average Sugar Intake (per person in kg/year)	Average Number of Teeth With Decay (per person)
Americas	40	3.0
Africa	18	1.7
Southeast Asia	14	1.6
Europe	36	2.6

KEY:

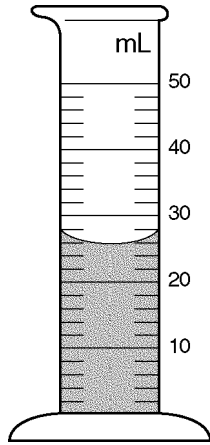
	Average Sugar Intake (per person)
	Average Number of Teeth With Decay (per person)



- 37) Using the information in the data table, construct a bar graph on the grid provided, following the directions below.
- Mark an appropriate scale on the axis labeled "Average Sugar Intake per Person."
 - Construct vertical bars in the bracketed area for each world region to represent the "Average Sugar Intake per Person." Place the bars on the left side of each bracketed region and shade the bars with the  pattern. (The bar for Americas has been done for you.)
 - Construct vertical bars in the bracketed area for each world region to represent the "Average Number of Teeth with Decay per Person." Place the bars on the right side of each bracketed region and shade in each bar with the  pattern.
- 38) Based on the given information, which statement is a valid conclusion regarding tooth decay?
- The greater the sugar intake, the faster a tooth decays.
 - The greater the sugar intake, the greater the average number of decayed teeth.
 - As sugar intake increases, tooth decay increases in Europe and the Americas, but not in Africa and Southeast Asia.
 - As sugar intake increases, the acidity in the mouth decreases, reducing tooth decay.

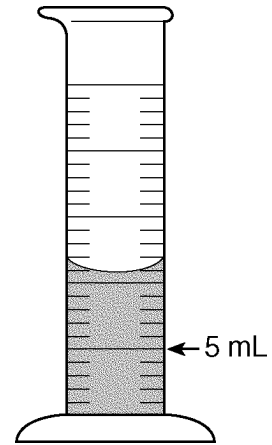
TOPIC: MEASUREMENT

39) What is the volume of the liquid in the graduated cylinder shown below?



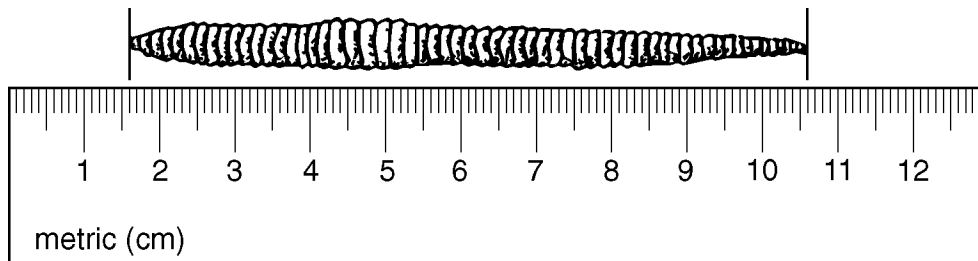
- 1) 28 mL
- 2) 27 mL
- 3) 23 mL
- 4) 26 mL

40) How much water should be removed from the graduated cylinder shown below to leave 5 milliliters of water in the cylinder?



- 1) 6 mL
- 2) 11 mL
- 3) 12 mL
- 4) 7 mL

41) What is the approximate length of the earthworm shown in the diagram below?



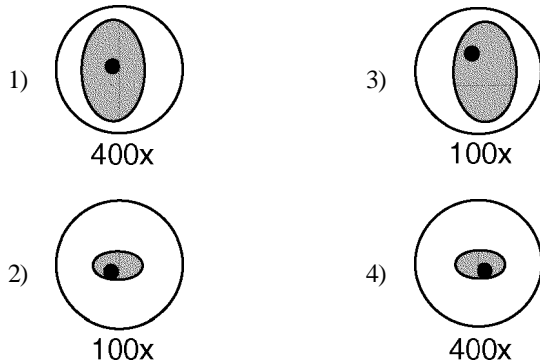
- 1) 9 mm
- 2) 10.6 cm
- 3) 90 mm
- 4) 106 cm

TOPIC: USING THE COMPOUND LIGHT MICROSCOPE

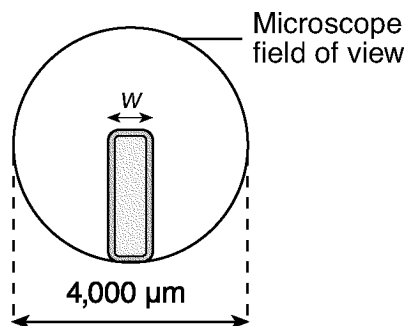
- 42) While viewing a specimen under high power of a compound light microscope, a student noticed that the specimen was out of focus. What part of the microscope should the student turn to obtain a clearer image under high power?

- 1) fine adjustment
- 2) coarse adjustment
- 3) eyepiece
- 4) nosepiece

- 43) The diagrams below show four different one-celled organisms (shaded) in the field of view of the same microscope using different magnifications. Which illustration shows the *largest* one-celled organism?



- 44) A plant cell in a microscopic field of view is represented below.



The width (w) of this plant cell is *closest* to

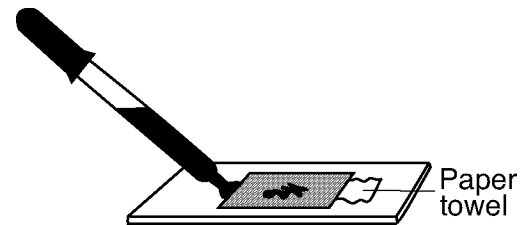
- 1) 200 μm
- 2) 1,600 μm
- 3) 800 μm
- 4) 1,200 μm

- 45) A student prepared a slide of pollen grains from a flower. First the pollen was viewed through the low power objective lens and then, without moving the slide, viewed through the high power objective lens of a compound light microscope.

Which statement *best* describes the relative number and appearance of the pollen grains observed using these two objectives?

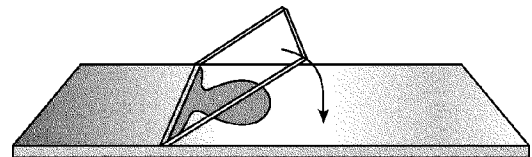
- 1) low power: 100 large pollen grains
high power: 25 small pollen grains
- 2) low power: 25 large pollen grains
high power: 100 small pollen grains
- 3) low power: 25 small pollen grains
high power: 100 large pollen grains
- 4) low power: 100 small pollen grains
high power: 25 large pollen grains

- 46) Which laboratory procedure is represented in the diagram below?



- 1) removing a coverslip from a slide
- 2) adding stain to a slide without removing the coverslip
- 3) placing a coverslip over a specimen
- 4) reducing the size of air bubbles under a coverslip

- 47) The diagram below shows how a cover slip should be lowered onto some single-celled organisms during the preparation of a wet mount.



Why is this a preferred procedure?

- 1) The possibility of breaking the coverslip is reduced.
- 2) The coverslip will prevent the slide from breaking.
- 3) The organisms will be more evenly distributed.
- 4) The possibility of trapping air bubbles is reduced.

- 48) What activity might lead to damage of a microscope and specimen?

- 1) focusing with low power first before moving the high power into position
- 2) using the coarse adjustment to focus the specimen under high power
- 3) adjusting the diaphragm to obtain more light under high power
- 4) cleaning the ocular and objectives with lens paper