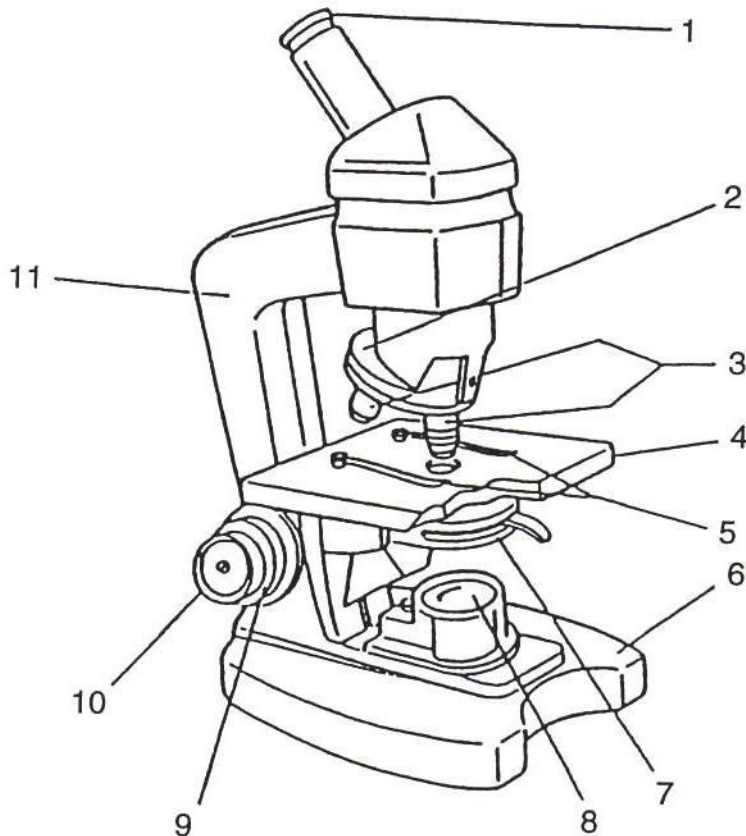


BIO-PROCESS LAB – PRACTICE ACTIVITIES

PARTS OF THE MICROSCOPE: For each of the following parts of the microscope, give the letter representing it's function and the number representing it's location.

PART	FUNCTION
___ ocular	A. holds slide in place
___ coarse adjustment	B. foundation to keep scope stable
___ fine adjustment	C. controls the amount of light to specimen
___ arm	D. supports slide and specimen
___ nosepiece	E. lens that form initial image of specimen
___ objectives	F. holds objectives - allows changing power
___ stage	G. used for initial & low power focusing
___ stage clips	H. supports ocular, objectives & body tube
___ diaphragm	I. source of light
___ illuminator	J. magnifies image formed by objective
___ base	K. used for fine tuning & high power focusing

LOCATION



BIO-PROCESS LAB –PRACTICE ACTIVITIES

PARTS OF THE MICROSCOPE: For each of the following parts of the microscope, give the letter representing it's function and the number representing it's location.

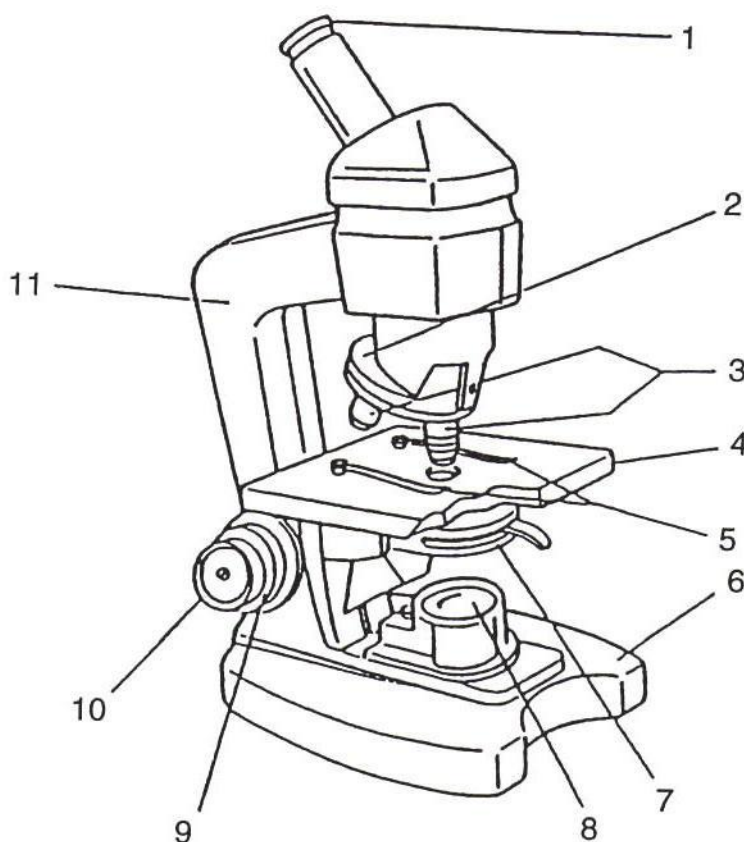
PART

FUNCTION

- 1. J ocular
- 9. G coarse adjustment
- 10. K fine adjustment
- 11. H arm
- 2. F nosepiece
- 3. E objective
- 4. D stage
- 5. A stage clips
- 7. C diaphragm
- 8. I illuminator
- 6. B base

- A. holds slide in place
- B. foundation to keep scope stable
- C. controls the amount of light to specimen
- D. supports slide and specimen
- E. lens that forms initial image of specimen
- F. holds objectives - allows changing power
- G. used for initial & low power focusing
- H. supports ocular, objectives & body tube
- I. source of light
- J. magnifies image formed by objective
- K. used for fine tuning & high power focusing

LOCATION



MICROSCOPE USAGE

Equipment: a compound microscope with scanning power (4-5X), low power (10X) and high power objectives (40-45X)

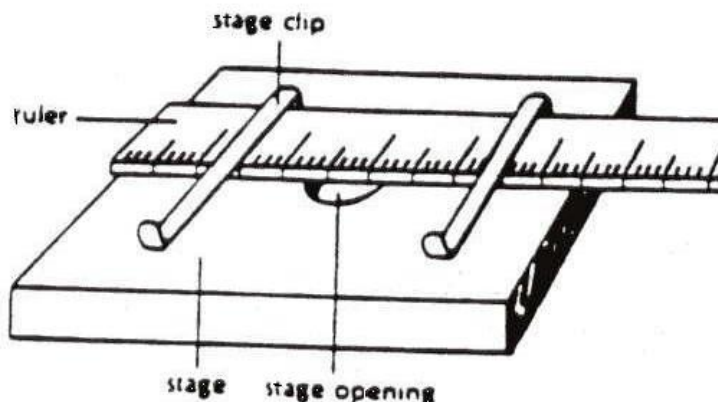
Use the microscope to answer the following questions.

1. What is the power of the ocular or eye piece of this microscope?
2. List the powers of each objective for this microscope.
3. What is the range of magnification (lowest to highest) of this microscope?

Place the transparent millimeter ruler on the stage in the normal reading position and examine it with the scanning power objective (4X or 5X).

Hint: the ruler is not as thick as a slide so applying gentle pressure to one end may make it easier to focus.

4. Find the number 5 on the ruler. Draw how it looks when viewing ruler on the stage and how it looks when viewed using the ocular. How do the two images compare?
5. Arrange the ruler so the metric scale is visible (see diagram below). Measure the diameter of the field of view in millimeters. Now convert the millimeters to micrometers.
6. Examine the transparent millimeter ruler with the low power objective (10X) and again measure the diameter of the field in millimeters. Now convert the millimeters to micrometers.
7. Assume that the high power field is $\frac{1}{4}$ of the diameter of the low power field. What is its diameter?
8. What is the ratio of the diameter of scanning power to low power?



MICROSCOPE USAGE

Equipment: a compound microscope with scanning power (4-5X), low power (10X) and high power objectives (40-45X)

Use the microscope to answer the following questions.

1. What is the power of the ocular or eye piece of this microscope?
Depends on microscope (10X or 12X most common)
2. List the powers of each objective for this microscope.
4X, 10X, 40X most common
3. What is the range of magnification (lowest to highest) of this microscope?
40X to 400X most common

Place the transparent millimeter ruler on the stage in the normal reading position and examine it with the scanning power objective (4X or 5X).

Hint: the ruler is not as thick as a slide so applying gentle pressure to one end may make it easier to focus.

4. Find the number 5 on the ruler. Draw how it looks when viewing ruler on the stage and how it looks when viewed using the ocular. How do the two images compare?

Image will be inverted and reversed

5. Arrange the ruler so the metric scale is visible (see diagram below). Measure the diameter of the field of view in millimeters. Now convert the millimeters to micrometers.

Depends upon microscope usually about 3 mm or 3000 mcm

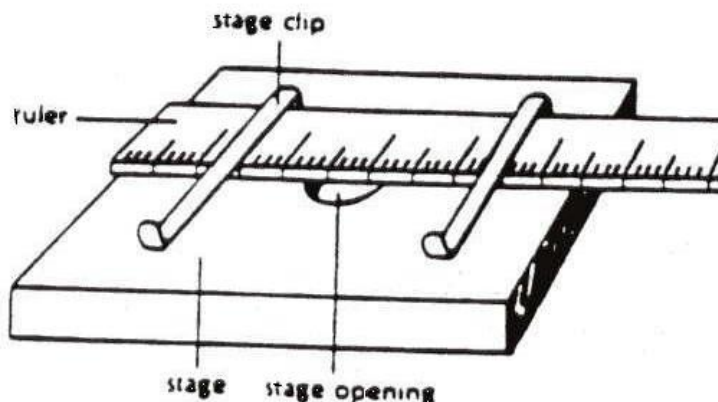
6. Examine the transparent millimeter ruler with the low power objective (10X) and again measure the diameter of the field in millimeters. Now convert the millimeters to micrometers.

Depends upon microscope usually about 1.5 mm or 1500 mcm

7. Assume that the high power field is $\frac{1}{4}$ of the diameter of the low power field. What is its diameter?

Depends upon microscope usually about 3.5 - 4 mm or 350 -400 mcm

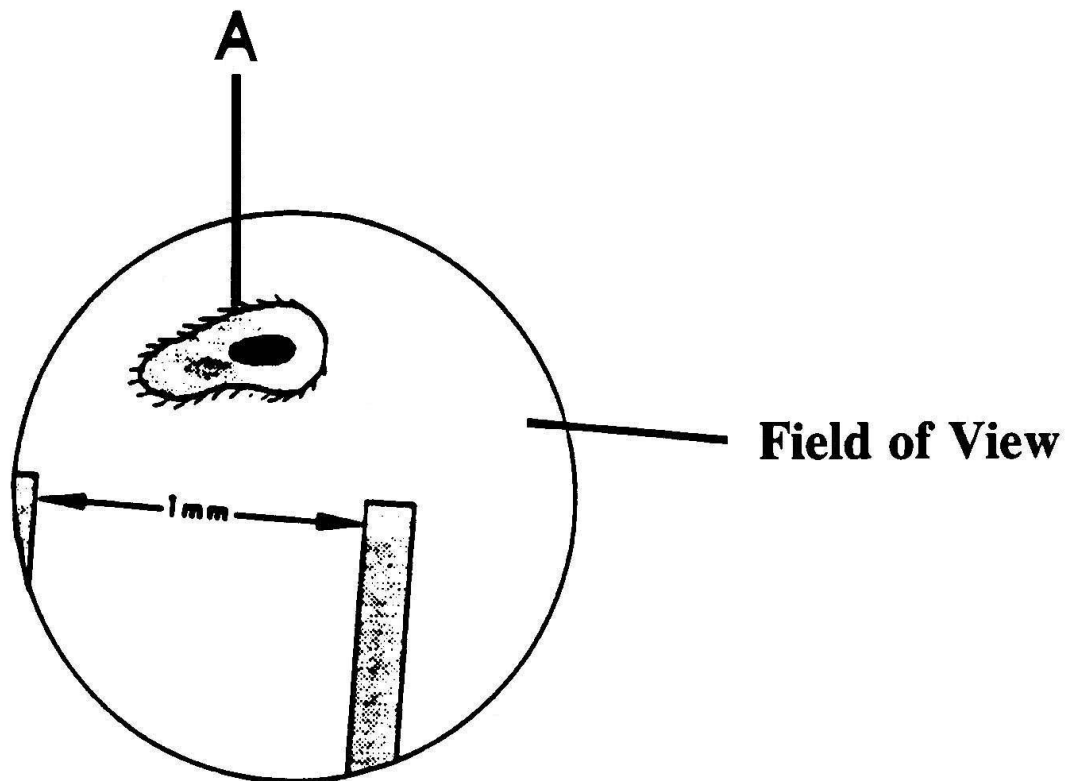
8. What is the ratio of the diameter of scanning power to low power?
Scanning power is usually about twice the diameter of low power



PROPERTIES OF MICROSCOPY

Materials: Microscope with 10X ocular and 5X, 10X, and 40X objectives, clear mm ruler, photo of protozoan.

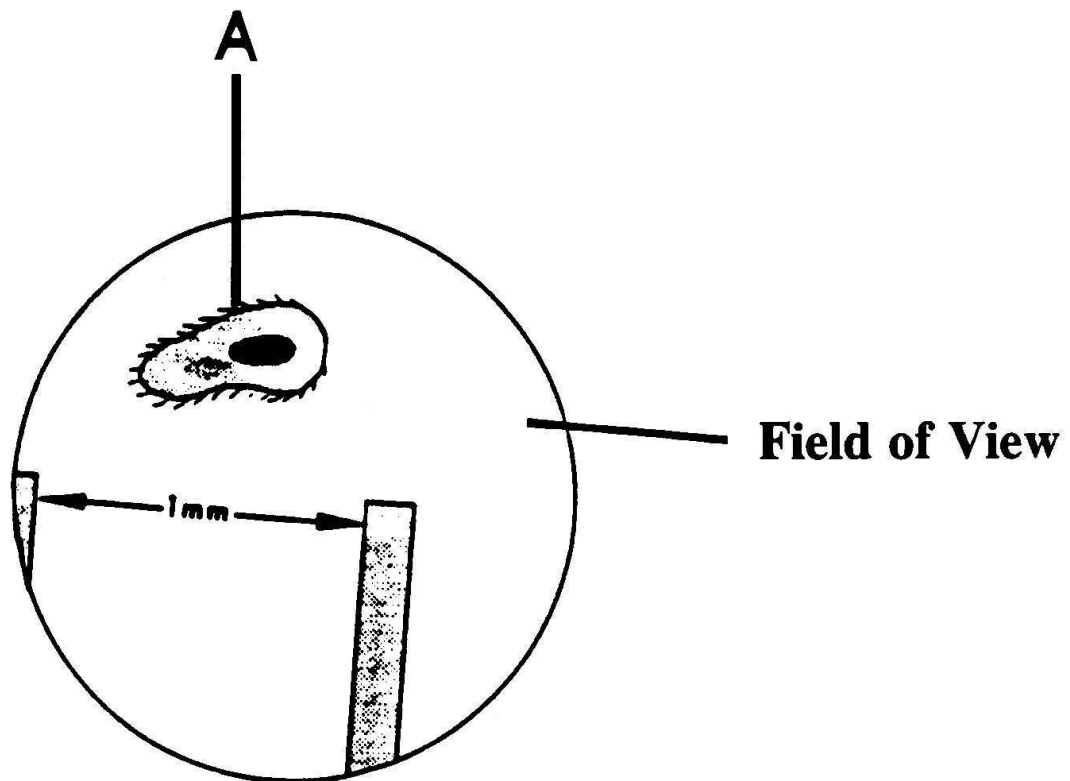
1. A student prepares a slide of the letter "d" and positions the slide on the stage of the microscope so the letter is in the normal reading position. Draw how the "d" will appear when viewed.
2. How many millimeters is the field of view containing critter A? (diagram)
How many micrometers is it?
3. What is the approximate length of critter A in micrometers?
4. When viewing critter A, if it appears to be moving toward 8 o'clock, what direction is it actually moving? (Use the numbers on the clock as directions for the field of view)
5. Assuming critter A is observed under low power, how will the appearance of critter change when he is observed under high power as to size, detail, and brightness?



PROPERTIES OF MICROSCOPY

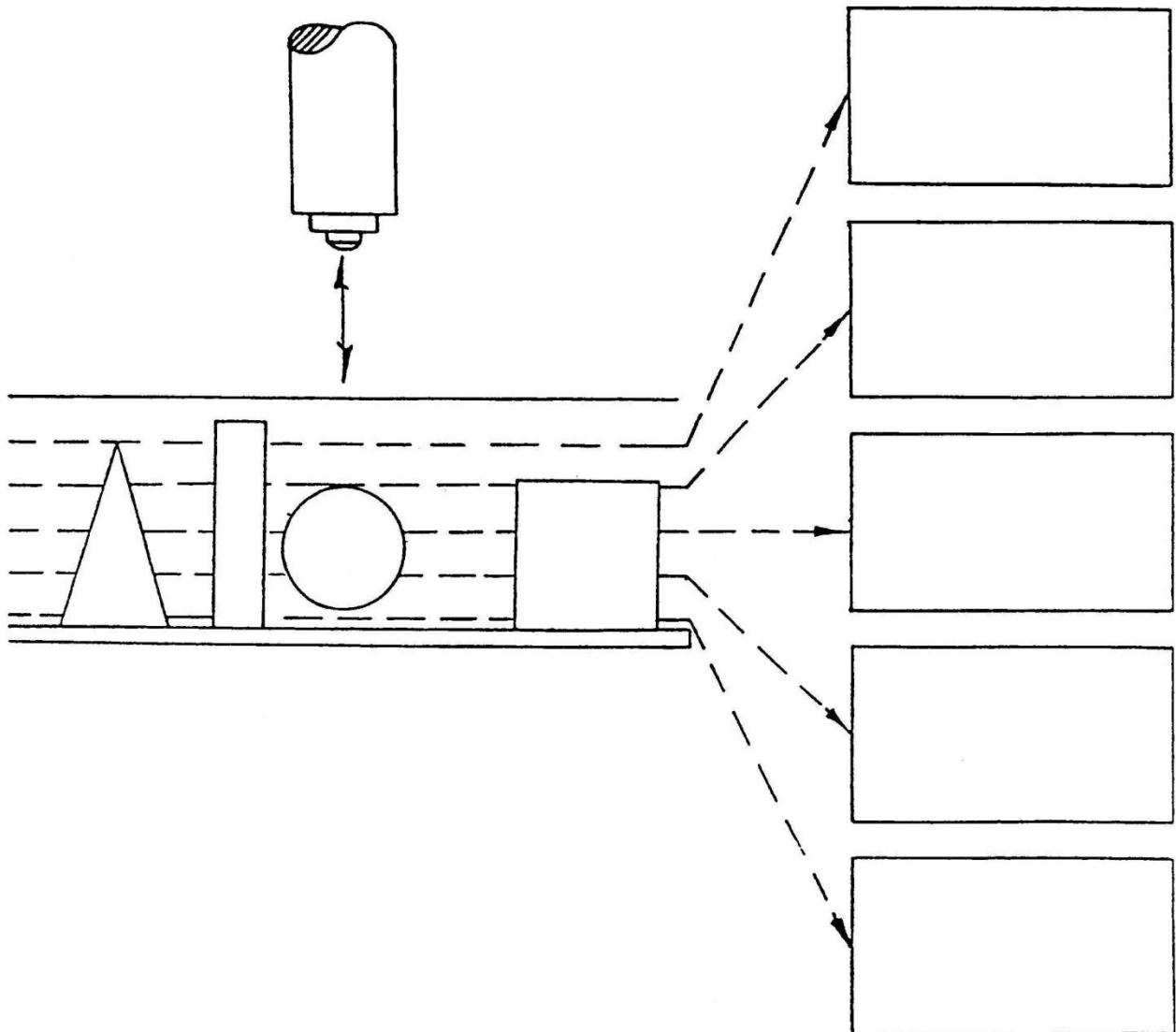
Materials: Microscope with 10X ocular and 5X, 10X, and 40X objectives, clear mm ruler, photo of protozoan.

1. A student prepares a slide of the letter "d" and positions the slide on the stage of the microscope so the letter is in the normal reading position. Draw how the "d" will appear when viewed. **It will be inverted and reversed.**
2. How many millimeters is the field of view containing critter A? (diagram)
How many micrometers is it? **about 1600 mcm**
3. What is the approximate length of critter A in micrometers?
about 600 mcm
4. When viewing critter A, if it appears to be moving toward 8 o'clock, what direction is it actually moving? (Use the numbers on the clock as directions for the field of view)
toward 2 o'clock
5. Assuming critter A is observed under low power, how will the appearance of critter change when he is observed under high power as to size, detail, and brightness?
Larger, greater detail, and darker



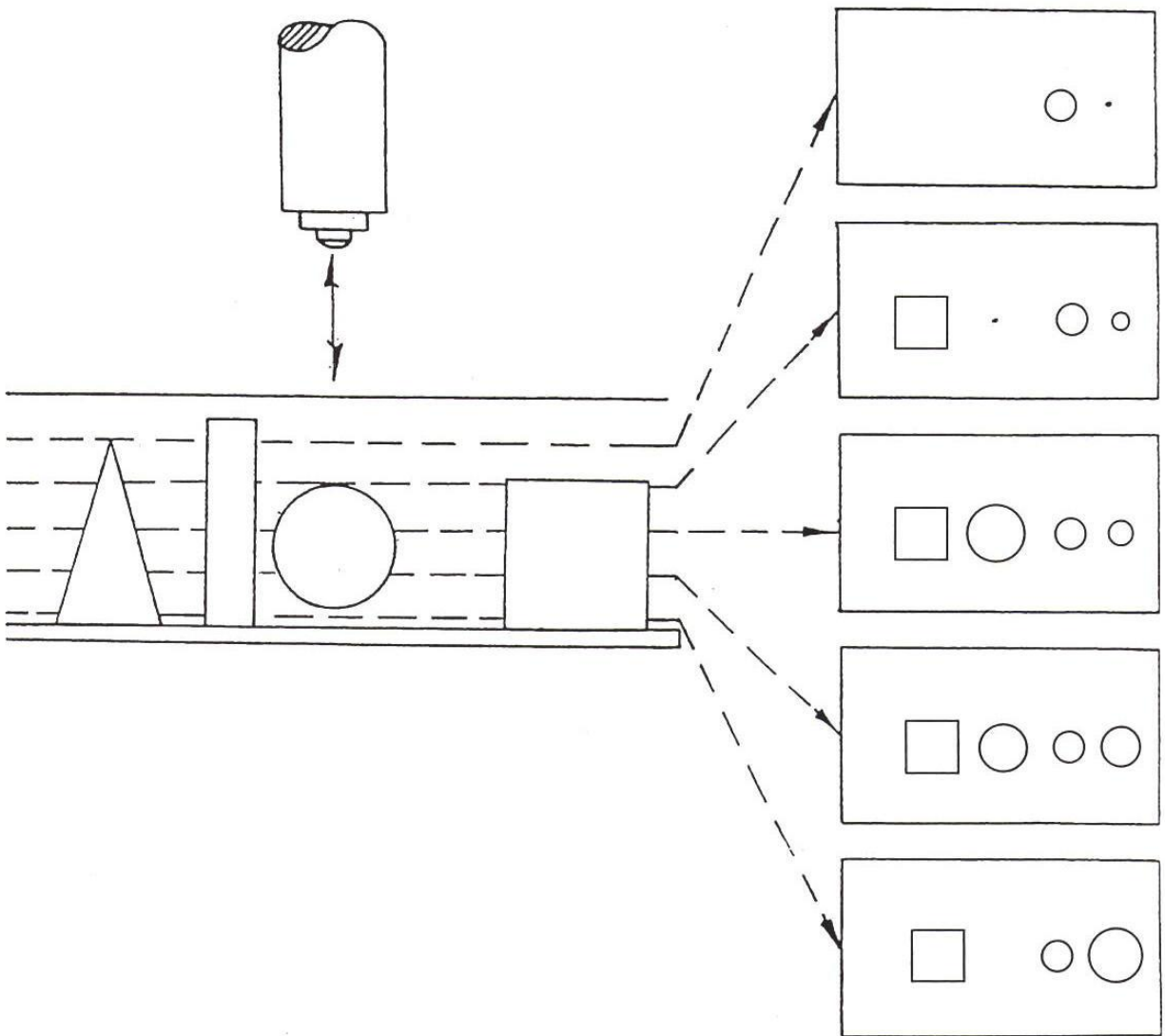
DEPTH OF FOCUS EXERCISE

Below are four objects located between a slide and a coverslip. The actual objects would of course be 3-D. The objects are left to right; a cone, a cylinder, a sphere and a cube. As one focuses down through the various levels a two dimensional representation will be visible. At each level (represented by the dotted lines to the slide diagram) **draw what two dimensional shapes would be present and give their proper location on the slide diagram.**



DEPTH OF FOCUS EXERCISE

Below are four objects located between a slide and a coverslip. The actual objects would of course be 3-D. The objects are left to right; a cone, a cylinder, a sphere and a cube. As one focuses down through the various levels a two-dimensional representation will be visible. At each level (represented by the dotted lines to the slide diagram) draw what two dimensional shapes would be present and give their proper location on the slide diagram.



TRIPLE BEAM BALANCE WITH AUXILLARY WEIGHTS

Equipment:

triple beam balance

auxillary weights

object A (less than 500g)

object X (more than 650 g)



Use the triple beam balance and **three** auxillary weights to determine the requested information.

Be sure to include units with all answers.

1. What is the **most specific** metric graduation or increment on the balance? What is the capacity of this balance **without** using the auxillary weights?
2. There are usually three auxillary weight for this balance.
What is be the capacity of this balance with the three weights: 2-1000g weights and 1-500g weight?
3. One of the auxillary weights has been lost – a 1000g weight.
What is the capacity of the triple beam balance as it is equipped with the remaining **two** auxiliary weights in **grams**? in **kilograms**?
4. What is the actual mass of the **1000g** weight?
5. What is the actual mass of the **500g** weight?
6. What is the combined actual weight of the 3 auxillary weights?
7. Place **Object A** on the **triple beam balance** and determine its mass.
What is its **mass in grams**?
8. Place **Object X** on the **triple beam balance** and determine its mass. What is its **mass in grams**?

PLEASE - Place all slides on the balance back at zero!!

TRIPLE BEAM BALANCE WITH AUXILLARY WEIGHTS

Equipment:

triple beam balance
auxillary weights
object A (less than 500g)
object X (more than 650 g)



Use the triple beam balance and **three** auxillary weights to determine the requested information.

Be sure to include units with all answers.

1. What is the **most specific** metric graduation or increment on the balance? What is the capacity of this balance **without** using the auxillary weights?
0.1 g 610g
2. There are usually three auxillary weight for this balance. What is be the capacity of this balance with the three weights: 2-1000g weights and 1-500g weight?
2160 g
3. One of the auxillary weights has been lost – a 1000g weight. What is the capacity of the triple beam balance as it is equipped with the remaining **two** auxiliary weights in **grams**? in **kilograms**?
2110g 2.11 kg
4. What is the actual mass of the **1000g** weight?
295 g
5. What is the actual mass of the **500g** weight?
147.5 g
6. What is the combined actual weight of the 3 auxillary weights?
737.5 g
7. Place **Object A** on the **triple beam balance** and determine its mass. What is its **mass in grams**? **Depends upon object weighed**
8. Place **Object X** on the **triple beam balance** and determine its mass. What is its **mass in grams**?

Depends upon object weighed

PLEASE - Place all slides on the balance back at zero!!

ELECTRONIC BALANCE

Equipment:

electronic balance

baby food bottle with graduations

bottle of mystery liquid as orange juice or molasses



Use the bottle with liquid and the electronic balance to answer the following questions.

1. The electronic balance has a button labeled **TARE** or **ZERO**. What is its function?
2. An object is placed on the electronic balance and the balance shows “**ERR**”.
What does it tell you about the object being weighed?
3. What is the advantage of using an electronic balance to weight the contents of a container over using a triple beam balance for the same task?
4. What is the capacity of this electronic balance? (Look for a plate on the balance – sometimes on the back)
5. The mass of the bottle when empty is ____ grams.
6. Using the graduations on the bottle, place 60 mL of the mystery liquid into the bottle.
What is the mass of the bottle with the liquid in grams?
7. What is the mass of the liquid inside the baby bottle in grams?
8. What percent of the mass of the bottle with the liquid is from the liquid?
9. What is the density of the liquid in grams/mL?
10. Predict the density of pure water.

ELECTRONIC BALANCE

Equipment:

electronic balance

baby food bottle with graduations

bottle of mystery liquid as orange juice or molasses



Use the bottle with liquid and the electronic balance to answer the following questions.

1. The electronic balance has a button labeled **TARE or ZERO**. What is its function?
Resets to zero
2. An object is placed on the electronic balance and the balance shows “ERR”.
What does it tell you about the object being weighed?
Object is beyond capacity of the balance
3. What is the advantage of using an electronic balance to weight the contents of a container over using a triple beam balance for the same task?
Can use tare to reset and not show weight of container – just contents
4. What is the capacity of this electronic balance? (Look for a plate on the balance – sometimes on the back)
Depends upon balance
5. The mass of the bottle when empty is ____ grams. **Depends upon bottle**
6. Using the graduations on the bottle, place 60 mL of the mystery liquid into the bottle.
What is the mass of the bottle with the liquid in grams?
Depends upon liquid used
7. What is the mass of the liquid inside the baby bottle in grams?
Depends upon liquid weighed
8. What percent of the mass of the bottle with the liquid is from the liquid?
9. What is the density of the liquid in grams/mL?
if a solution, slightly over 1 g/mL
10. Predict the density of pure water. **1.0 grams/mL**

LAB EQUIPMENT - NAME AND FUNCTION



A



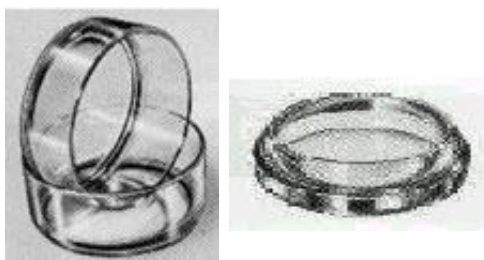
Easy temp probe
B



C



D



E



F



G

250mL



H

LAB EQUIPMENT - NAME AND FUNCTION



I



**100 mL
J**



K



L

250 mL



M



N



O

250 mL



P

EQUIPMENT QUESTIONS

Equipment Identification

Give the name and function of each of the following pieces of equipment. (Use the letter under the equipment)

A.

B.

C.

D.

E.

F.

G.

H.

I.

J.

K.

L.

M.

N.

O.

P.

Equipment Usage

Examine the pieces of equipment and the letter on each piece.

1. Give the **letter** and the **name** of the piece of equipment that should be used to determine the diameter of a cylinder.
2. Give the **letters** of the pieces of equipment that should be used to **safely heat 220 mL of water**.
3. Give the **letters** of the pieces of equipment that could be used to **measure or store 187 mL of a solution**.
4. Give the **letters** of the pieces of equipment that could be used to **determine the temperature of a solution**.
5. Give the **letters** of the pieces of equipment that should be used to **prepare and observe a wet mount**.

EQUIPMENT QUESTIONS

Equipment Identification

Give the name and function of each of the following pieces of equipment. (Use the letter under the equipment)

- A. Microscope slide
- B. Easy temp probe
- C. Safety Goggles
- D. Stereoscope or dissecting scope
- E. Culture Dish
- F. Ring Stand and Ring
- G. Vernier Caliper
- H. 250 mL beaker
- I. Thermometer
- J. 100 mL Graduated Cylinder
- K. Wire gauze
- L. Coverslips
- M. Flask
- N. Bunsen Burner
- O. Compound Microscope
- P. 250 mL Graduated Cylinder

Equipment Usage

Examine the pieces of equipment and the letter on each piece.

1. Give the **letter** and the **name** of the piece of equipment that should be used to determine the diameter of a cylinder.
G – vernier caliper
2. Give the **letters** of the pieces of equipment that should be used to **safely heat 220 mL of water**.
C,F,H or M,K,N
3. Give the **letters** of the pieces of equipment that could be used to **measure or store 187 mL of a solution**.
H,J,M,P
4. Give the **letters** of the pieces of equipment that could be used to **determine the temperature of a solution**.
B,I
5. Give the **letters** of the pieces of equipment that should be used to **prepare and observe a wet mount**.
A,L,O

MEASURING DEVICES – CAPACITY AND GRADUATIONS

Measuring Devices: metric ruler, 100 mL graduated cylinder, thermometer, 60 cc syringe, 250 mL graduated cylinder, Vernier caliper

Capacity (cap) is the amount that can be measured with an instrument.

Range is the low value up to the high value - thermometers.

Numbered increment or graduation (NI) is the value represented by each of the numbered graduations or increments on the instrument. Some instruments such as balances may have more than one set of numbered increments.

Unnumbered increment or graduation (UnNI) is the value represented by the unnumbered graduations or increments on the instrument.

Provide the requested information for each measuring device.

Metric Ruler

Capacity _____
Numbered Increments (graduations) _____
Unnumbered Increment (graduations) _____

Vernier Caliper

Capacity _____
Numbered Increments (graduations) _____
Unnumbered Increment (graduations) _____

Vernier Scale

Numbered Increments (graduations) _____
Unnumbered Increment (graduations) _____

Graduated Cylinder (100 mL)

Capacity _____
Numbered Increments (graduations) _____
Unnumbered Increment (graduations) _____

Graduated Cylinder (250 mL)

Capacity _____
Numbered Increments (graduations) _____
Unnumbered Increment (graduations) _____

Syringe

Capacity _____
Numbered Increments (graduations) _____
Unnumbered Increment (graduations) _____

Lab Thermometer

Range _____
Numbered Increments (graduations) _____
Unnumbered Increment (graduations) _____

MEASURING DEVICES – CAPACITY AND GRADUATIONS

Measuring Devices: metric ruler, 100 mL graduated cylinder, thermometer, 60 cc syringe, 250 mL graduated cylinder, Vernier caliper

Capacity (cap) is the amount that can be measured with an instrument.

Range is the low value up to the high value - thermometers.

Numbered increment or graduation (NI) is the value represented by each of the numbered graduations or increments on the instrument. Some instruments such as balances may have more than one set of numbered increments.

Unnumbered increment or graduation (UnNI) is the value represented by the unnumbered graduations or increments on the instrument.

Provide the requested information for each measuring device. **(Answers depend upon the measuring device used. Note that instruments of the same capacity are not all graduated the same.)**

Metric Ruler

Capacity _____
Numbered Increments (graduations) _____
Unnumbered Increment (graduations) _____

Vernier Caliper

Capacity _____
Numbered Increments (graduations) _____
Unnumbered Increment (graduations) _____

Vernier Scale

Numbered Increments (graduations) _____
Unnumbered Increment (graduations) _____

Graduated Cylinder (100 mL)

Capacity _____
Numbered Increments (graduations) _____
Unnumbered Increment (graduations) _____

Graduated Cylinder (250 mL)

Capacity _____
Numbered Increments (graduations) _____
Unnumbered Increment (graduations) _____

Syringe

Capacity _____
Numbered Increments (graduations) _____
Unnumbered Increment (graduations) _____

Lab Thermometer

Range _____
Numbered Increments (graduations) _____
Unnumbered Increment (graduations) _____

MEASUREMENT - USING MEASURING DEVICES

Materials: metric ruler, 100 mL graduated cylinder, 60 cc syringe,
250 mL graduated cylinder, Vernier caliper, container of colored liquid

1. Which of the measuring devices provided can be used to measure the inside and outside diameter of a cylinder?
2. Measure the inside and outside diameter of the 250 mL graduated cylinder with each of the appropriate instrument. Record the results and identify the instrument used. Compare the instruments and indicate which is the most accurate.
3. Measure the dimensions of this sheet of paper in **centimeters**. Now measure it in **millimeters**. Record your results.
4. Which of the measuring devices provided can be used to measure 30.5 mL of a liquid
Which will give the greatest accuracy of measurements?
5. Measure 30.5 mL of the colored liquid using each instrument that is appropriate.
When you are finished, properly dispose of the liquid and rinse the measuring devices.

MEASUREMENT - USING MEASURING DEVICES

Materials: metric ruler, 100 mL graduated cylinder, 60 cc syringe,
250 mL graduated cylinder, Vernier caliper, container of colored liquid

1. Which of the measuring devices provided can be used to measure the inside and outside diameter of a cylinder?

Vernier caliper, metric ruler

2. Measure the inside and outside diameter of the 250 mL graduated cylinder with each of the appropriate instrument. Record the results and identify the instrument used. Compare the instruments and indicate which is the most accurate.

Depends upon cylinder used

Vernier caliper is more accurate

3. Measure the dimensions of this sheet of paper in **centimeters**. Now measure it in **millimeters**. Record your results.

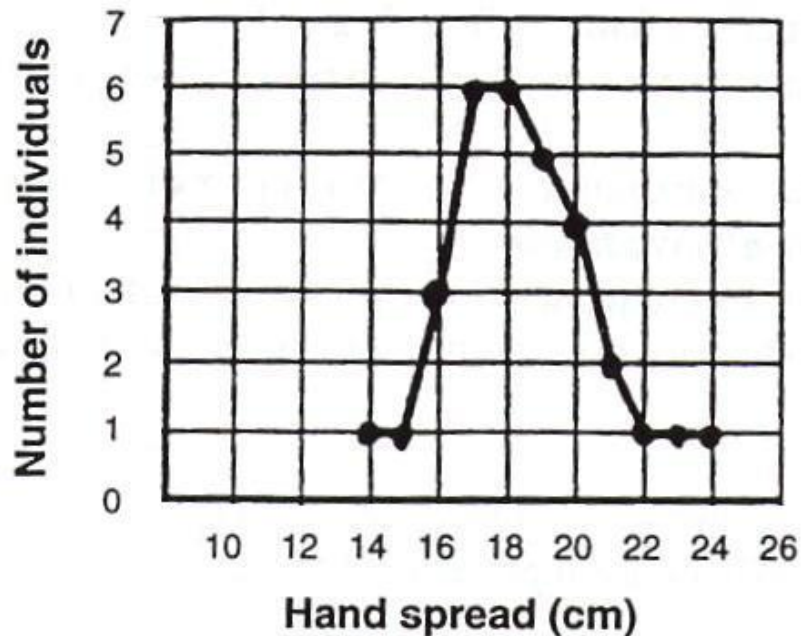
4. Which of the measuring devices provided can be used to measure 30.5 mL of a liquid
Which will give the greatest accuracy of measurements?

60 cc syringe or 100 mL graduated cylinder

5. Measure 30.5 mL of the colored liquid using each instrument that is appropriate.
When you are finished, properly dispose of the liquid and rinse the measuring devices.

GRAPH ANALYSIS

**Variation in hand sizes
within a class of students**

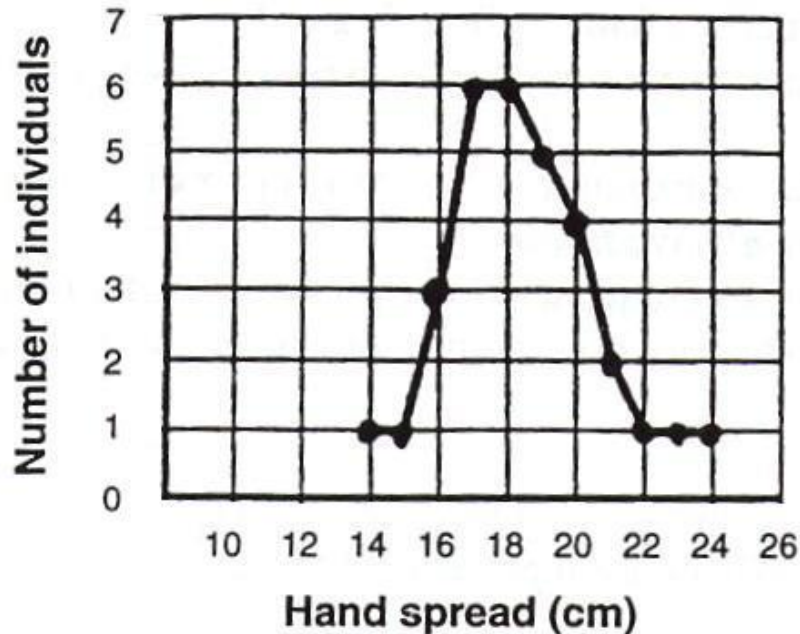


Examine the graph provided and answer the following questions

1. What is the independent variable for this study?
2. What is the dependent variable for the study?
2. How many students in this class participated in this study?
3. What width range has the fewest individual?
4. What is the average hand spread?
5. What is the median hand spread?
6. What is the mode hand spread?
7. What % of the class has a hand spread of 22 centimeters?
8. How would you expect the results to be different if you separated the class into males vs. females?

GRAPH ANALYSIS

**Variation in hand sizes
within a class of students**



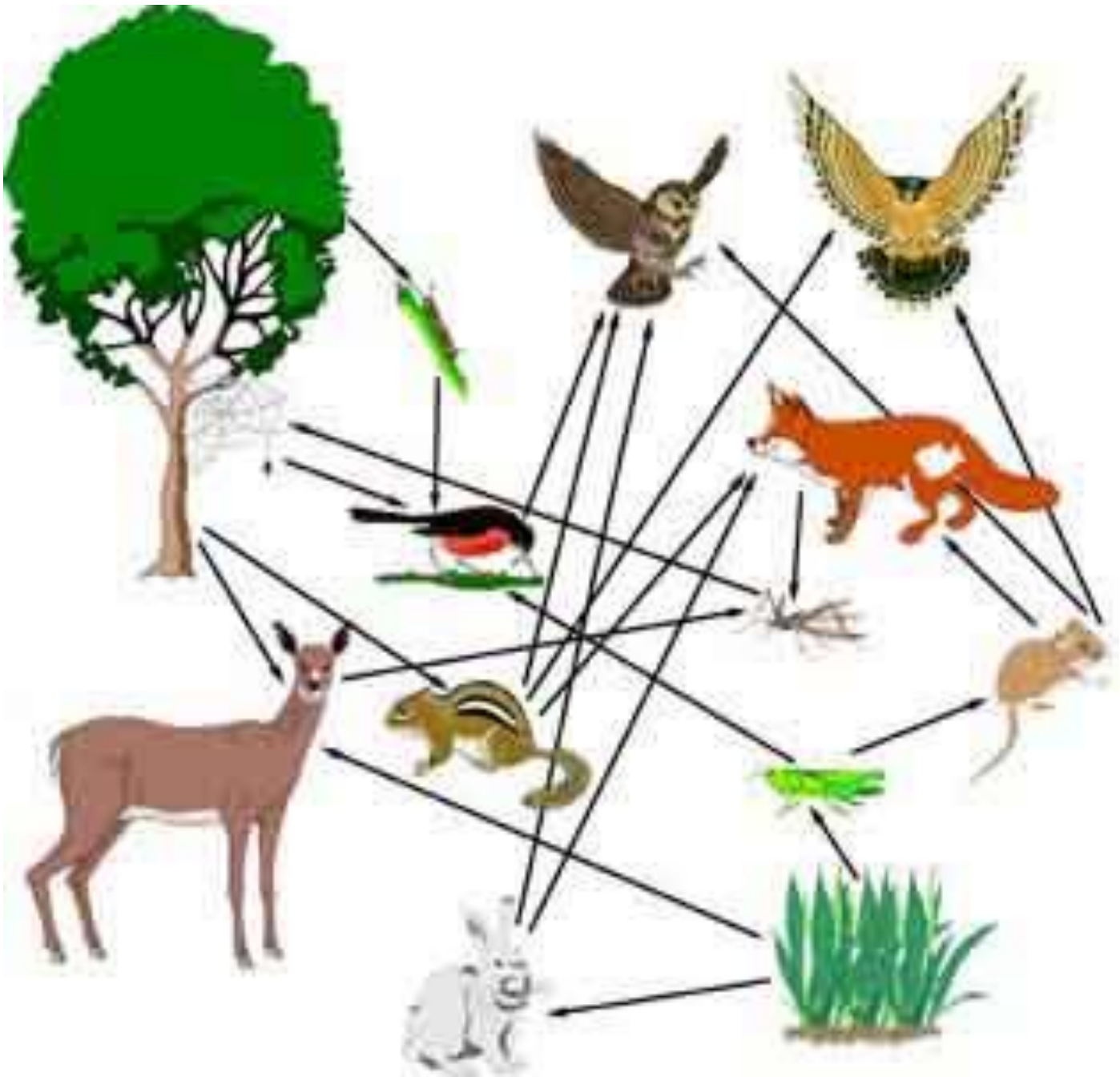
Examine the graph provided and answer the following questions

1. What is the independent variable for this study?
Hand spread in centimeters
2. What is the dependent variable for the study?
Number of individuals
2. How many students in this class participated in this study?
31 students (count the number of each length)
3. What width range has the fewest individual?
14-15 cm and 22-24 cm
4. What is the average hand spread?
18 cm
5. What is the median hand spread?
18 cm
6. What is the mode hand spread?
17-18 cm
7. What % of the class has a hand spread of 22 centimeters?
 $1/31 = 3\%$
8. How would you expect the results to be different if you separated the class into males vs. females?

Males should have greater hand spread

FOOD WEB ANALYSIS

FOREST FOOD WEB



Organisms on the food web:

Tree, spider in web, insect larva on bark, owl, hawk, robin eating worm, mosquito, fox, deer, chipmunk, grasshopper, mouse, rabbit, grass

FOOD WEB ANALYSIS

- 1.** Who are the producers in this forest food web? (List the names of the organisms)
- 2.** Who are the herbivores (eat plants) in the forest food web? (List the names of the organisms)
- 3.** What is the highest order consumer on this food web? (2nd order, 3rd order or 4th order)
Which animals are in the highest order? (List the names of the organisms)
- 4.** From whom will the mosquito obtain its nourishment?
(List the names of the organisms)
- 5.** Which organisms on the Forest Food web would make the numbers pyramid of this food web not typical? Why?

List each of the food chains within the food web. How many did you find?

FOOD WEB ANALYSIS

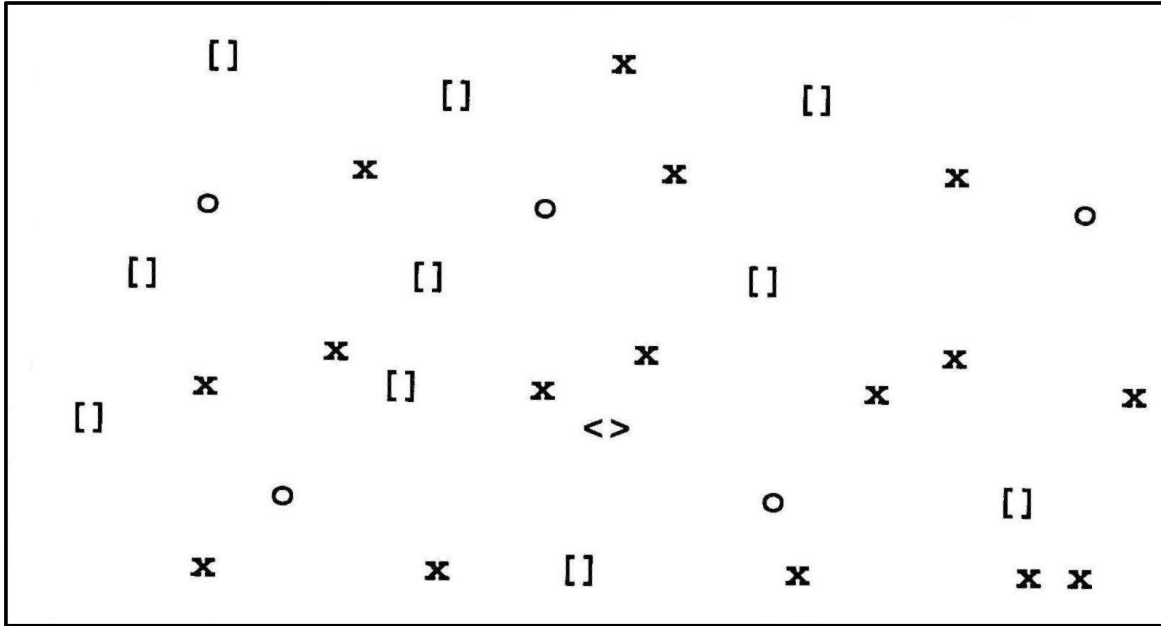
1. Who are the producers in this forest food web? (List the names of the organisms)
trees and grass
2. Who are the herbivores (eat plants) in the forest food web? (List the names of the organisms)
rabbit, deer, grasshopper, insect larva, squirrel
3. What is the highest order consumer on this food web? (2nd order, 3rd order or 4th order)
Which animals are in the highest order? (List the names of the organisms)
3rd order – fox, owl, hawk
4. From whom will the mosquito obtain its nourishment?
(List the names of the organisms)
deer, fox
5. Which organisms on the Forest Food web would make the numbers pyramid of this food web not typical? Why?
Tree and deer Single large producer and herbivore

List each of the food chains within the food web. How many did you find?

SAMPLE ANALYSIS #1 (Using Sample Diagram Only)

Equipment: metric ruler

SAMPLE DIAGRAM



FOOD CHAIN

Algae --> Forage Fish --> Salmon --> Eagle

Use the **ruler**, the **Sample Diagram**, and the **Food Chain** in answering the questions.

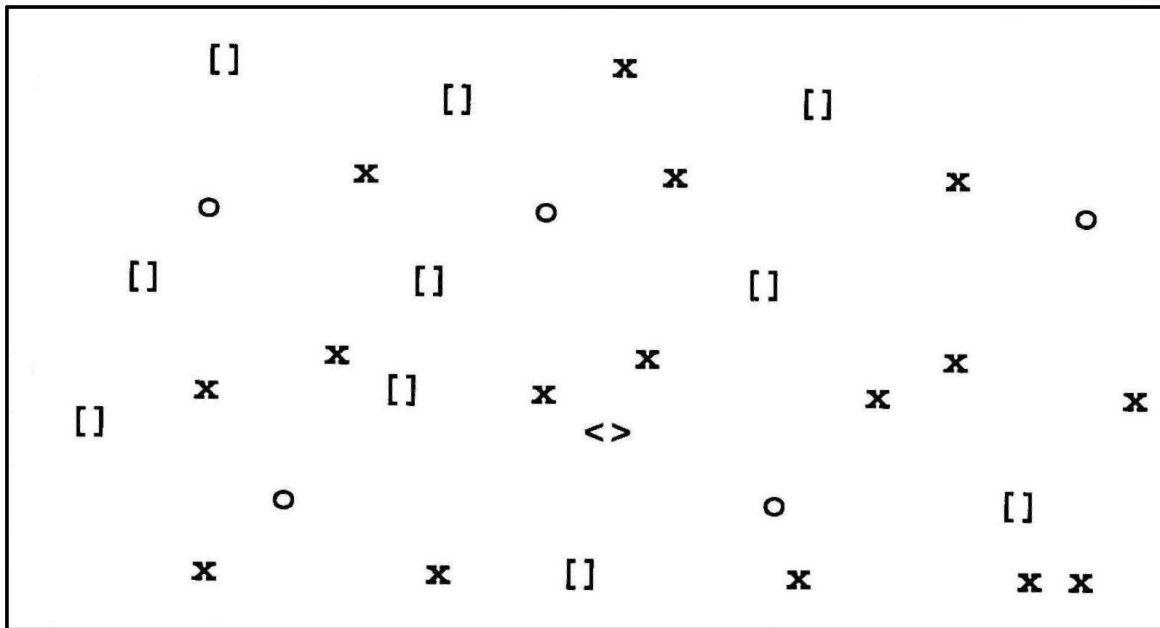
(Note: 1 sq. meter = 1 sq. kilometer)

1. What is the length & width of the sample diagram in **centimeters**?
Convert the dimensions to **meters**.
2. What is the area of the sample diagram in **square meters**?
3. Each symbol on the Sample Diagram represents an organism from the Food Chain. How many “X” symbols are on the sample diagram?
4. How many organisms represented by “X” symbols would there be per square kilometer? (See **Note** above)
5. Which **organism** on the Food Chain is represented by the “X” symbol on the Sample Diagram?
Is this organism a **producer** or is it a **consumer**?

SAMPLE ANALYSIS #1 (Using Sample Diagram Only)

Equipment: metric ruler

SAMPLE DIAGRAM



FOOD CHAIN

Algae --> Forage Fish --> Salmon --> Eagle

Use the **ruler**, the **Sample Diagram**, and the **Food Chain** in answering the questions.

(Note: 1 sq. meter = 1 sq. kilometer)

1. What is the length & width of the sample diagram in **centimeters**?
Convert the dimensions to **meters**.
17.1 cm x 9.2 cm .171 m x .092 m
2. What is the area of the sample diagram in **square meters**?
0.016 sq m
3. Each symbol on the Sample Diagram represents an organism from the Food Chain. How many “X” symbols are on the sample diagram? **16 X's**
4. How many organisms represented by “X” symbols would there be per square kilometer? (See **Note** above)
about 1000 specimens per square meter
5. Which **organism** on the Food Chain is represented by the “X” symbol on the Sample Diagram?
Is this organism a **producer** or is it a **consumer**?
Algae producer

SAMPLE ANALYSIS # 2 (Using Sample Box and Sample Diagram)

Equipment: metric ruler, sample box with buttons, Sample Diagram, Food Chain

Use the **plastic sample box with buttons**, the **ruler**, the **Sample Diagram** and the **Food Chain** in answering the questions.

Examine the data provided and do the calculations necessary to provide the requested information.

(**Note:** each seed in the plastic box represents a specimen and 1 sq. meter = 1 sq. kilometer)

1. What is the length & width of the floor (white region) of the **plastic sample box** in **centimeters**?
2. What is the **area** of the box floor in **square centimeters**?
3. Convert the dimensions of the plastic sample box to **meters**.
4. What is the **area** of the floor of the **plastic sample box** in **square meters**?
5. How many **specimens** are in the **plastic sample box**?
6. How many **specimens per square meter** were in the actual sample?
7. Based on the organisms in the **plastic sample box**, how many **specimens per square kilometer** should be present in that area?
8. Which of the four symbols on the Ecology Symbol Diagram is represented by the seeds in the plastic sample box? (**Draw the symbol on the answer sheet**) Which symbol on the Ecology Symbol Diagram is the most numerous? (**Draw the symbol on the answer sheet**)
9. Which organism from the Food Chain should have the **fewest** individuals in the ecosystem? Why?
10. Which **organism** on the **Food Chain** is represented by the specimens in the **plastic sample box**? Is this organism a **producer** or is it a **consumer**?

SAMPLE ANALYSIS # 2 (Using Sample Box and Sample Diagram)

Equipment: metric ruler, sample box with buttons, Sample Diagram, Food Chain

Use the **plastic sample box with buttons**, the **ruler**, the **Sample Diagram** and the **Food Chain** in answering the questions.

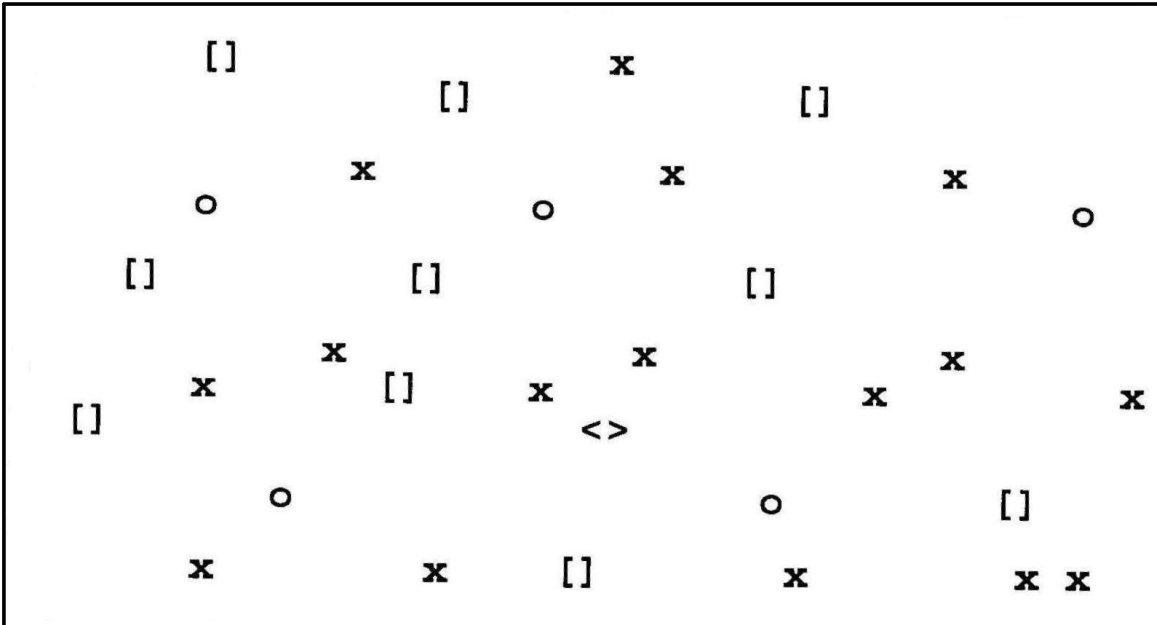
Examine the data provided and do the calculations necessary to provide the requested information.

(**Note:** each seed in the plastic box represents a specimen and 1 sq. meter = 1 sq. kilometer)

1. What is the length & width of the floor (white region) of the **plastic sample box** in **centimeters**?
17.5 cm x 7 cm
2. What is the **area** of the box floor in **square centimeters**?
122.5 square centimeters
3. Convert the dimensions of the plastic sample box to **meters**.
.175 m x .07 m
4. What is the **area** of the floor of the **plastic sample box** in **square meters**? **.01 square meters**
5. How many **specimens** are in the **plastic sample box**?
5 specimens
6. How many **specimens per square meter** were in the actual sample? **About 400 specimens per square meter**
7. Based on the organisms in the **plastic sample box**, how many **specimens per square kilometer** should be present in that area?
About 400 specimens per square kilometer (see the note above)
8. Which of the four symbols on the Ecology Symbol Diagram is represented by the seeds in the plastic sample box?
(**Draw the symbol on the answer sheet**) Which symbol on the Ecology Symbol Diagram is the most numerous? (**Draw the symbol on the answer sheet**) **5 O's**
9. Which organism from the Food Chain should have the **fewest** individuals in the ecosystem? Why?
Eagle – highest order consumer
10. Which **organism** on the **Food Chain** is represented by the specimens in the **plastic sample box**?
Is this organism a **producer** or is it a **consumer**?
Salmon – consumer

SAMPLE ANALYSIS # 2

SAMPLE DIAGRAM



FOOD CHAIN

Algae --> Forage Fish --> Salmon --> Eagle

FOOD LABEL ANALYSIS - Note: there are 3 single serve cans per container

Nutrition Facts

Serving Size 1 can drained (68g)

Servings Per Container 3

Amount Per Serving

Calories 90 **Calories from Fat 15**

% Daily Value*

Total Fat 1.5g **2%**

Saturated Fat 0g **0%**

Cholesterol 30mg **10%**

Sodium 220mg **9%**

Total Carbohydrate 0g **0%**

Dietary Fiber 0g **0%**

Sugars 0g

Protein 20g **38%**

Not a significant source of Vitamin A,
Vitamin C, Calcium and Iron.

* Percent Daily Values are based on a 2,000 calorie diet. Your daily values may be higher or lower depending on your calorie needs:

Calories: 2,000 2,500

Total Fat Less than 65g 80g

Sat Fat Less than 20g 25g

Cholesterol Less than 300mg 300mg

Sodium Less than 2,400mg 2,400mg

Total Carbohydrate 300g 375g

Dietary Fiber 25g 30g

Calories per gram:

Fat 9 • Carbohydrate 4 • Protein 4

INGREDIENTS: WHITE CHICKEN, WATER, AND SALT
VALLEY FRESH INC. P.O. BOX 339, TURLOCK, CA 95381

VALLEY FRESH CHICKEN SALAD

1 Can (3oz.) VALLEY FRESH CHUNK

WHITE CHICKEN, drained

2 Tbs. Diced Celery

2 Tbs. Sliced Green Onion

2 Tbs. Mayonnaise

1/4 tsp. Prepared Mustard

Dash Garlic Powder, Dash Onion Powder

Combine ingredients.

Serve immediately or cover and chill. Serves 2.

FOOD LABEL ANALYSIS

Use the data from the food label in answering the following questions?

Round off answers to the nearest whole number.

1. How many **calories** are in a single serving of this chicken?
2. What **percent** of these calories come from fat?
3. How many **grams** are in a single serving of this chicken?
4. How many **grams** of **protein** are in a single serving of chicken?
5. What **percent** of a **single serving** of chicken is **protein**?
6. What **percent** of a **single serving** of chicken is **total carbohydrate**?
7. The **% daily value** is based upon a diet of how many **calories**?
8. One serving of this food provides what **percent daily value** of **protein**?
9. How many calories are in a gram of fat? How does this compare to the calories in a gram of protein or carbohydrate?
10. Using the **number of grams** of protein in one serving of this food and the **% daily value** of protein, determine the number of **grams** of protein you should have each day.

FOOD LABEL ANALYSIS

Use the data from the food label in answering the following questions?

Round off answers to the nearest whole number.

1. How many **calories** are in a single serving of this chicken? **90 cal**
2. What **percent** of these calories come from fat?
 $15/90 \times 100\% = 17\%$
3. How many **grams** are in a single serving of this chicken?
68 g
4. How many **grams** of **protein** are in a single serving of chicken?
20 g
5. What **percent** of a **single serving** of chicken is **protein**?
29 %
6. What **percent** of a **single serving** of chicken is **total carbohydrate**?
0 %
7. The **% daily value** is based upon a diet of how many **calories**?
2000 calories
8. One serving of this food provides what **percent daily value** of **protein**?
38 %
9. How many calories are in a gram of fat? How does this compare to the calories in a gram of protein or carbohydrate?
9 g compared to 4 g
10. Using the **number of grams** of protein in one serving of this food and the **% daily value** of protein, determine the number of **grams** of protein you should have each day.
53 g per day

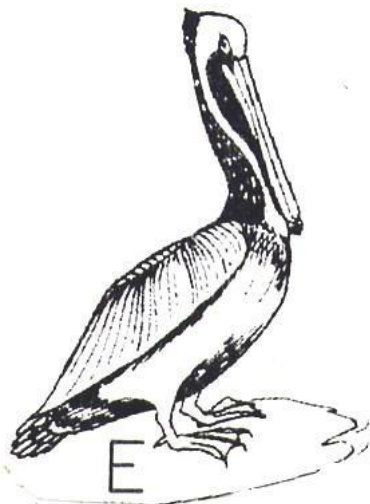
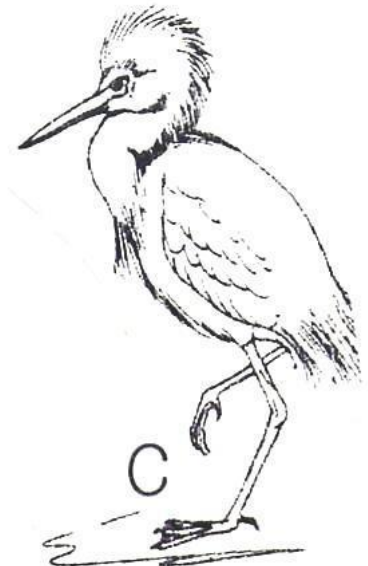
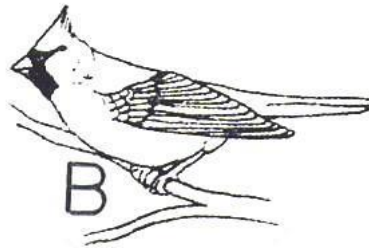
DICHOTOMOUS KEY – USING A KEY

Examine the background information, the specimens and the dichotomous key to answer the following questions.
For each question give the name from the key.

1. What is specimen A ?
2. What is specimen B ?
3. What is specimen C ?
4. What is specimen D ?
5. What is specimen E ?

DICHOTOMOUS KEY FOR BIRDS

1. The feet have webbing between the toes 2
1. The feet do not have webbing between the toes 3
2. Massive long flat beak and throat pouch *Pelecanus sp.*
2. Long slender beak and lacy plumes on back *Egretta sp.*
3. Toes with long grasping claws 4.
3. Toes long and slender for perching *Cardinalis sp.*
4. Hair tufts at the top corners of the head *Otus sp.*
4. Head lacks hair tufts *Falco sp.*



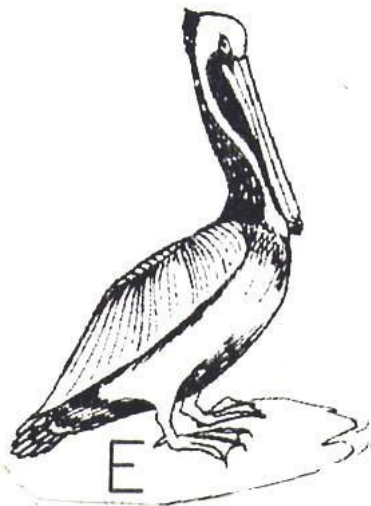
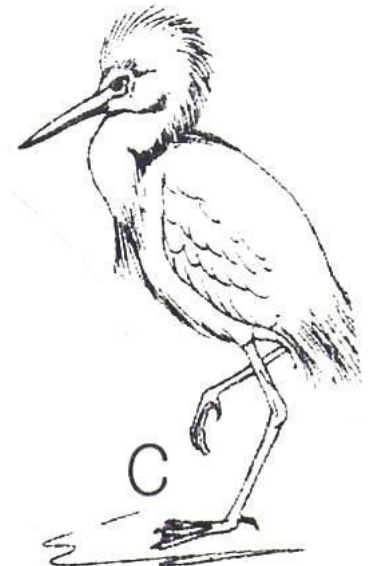
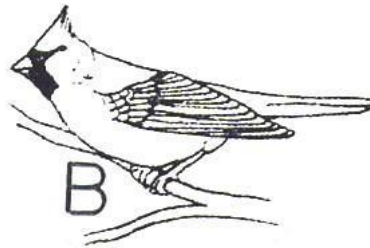
DICHOTOMOUS KEY – USING A KEY

Examine the background information, the specimens and the dichotomous key to answer the following questions.
For each question give the name from the key.

1. What is specimen A ? *Falco sp.*
2. What is specimen B ? *Cardinalis sp.*
3. What is specimen C ? *Egretta sp.*
4. What is specimen D ? *Otus sp.*
5. What is specimen E ? *Pelecanus sp.*

DICHOTOMOUS KEY FOR BIRDS

1. The feet have webbing between the toes 2
1. The feet do not have webbing between the toes 3
2. Massive long flat beak and throat pouch *Pelecanus sp.*
2. Long slender beak and lacy plumes on back *Egretta sp.*
3. Toes with long grasping claws 4.
3. Toes long and slender for perching *Cardinalis sp.*
4. Hair tufts at the top corners of the head *Otus sp.*
4. Head lacks hair tufts *Falco sp.*



GENETIC PROBLEMS – GENOTYPES AND PHENOTYPE FREQUENCIES



A



B

1. The traits expressed in the hybrid corn are (see diagram B). Count the number of each kernel type in the enlarged photo of diagram A, record the number next to the kernel type name below.
- A. purple smooth -
 - B. purple sunken -
 - C. white smooth -
 - D. white sunken -
2. Based upon your count of the expressed traits and using the letter “P” for purple gene and “W” for the smooth gene, give the genotype for each type of kernel.
- (A) purple and smooth -
 - (B) purple and sunken -
 - (C) white and smooth -
 - (D) white and sunken -
3. What are the four types of alleles possible for the following cross $PpWw \times PpWw$
4. Complete the following Punnett Square for the cross listed in # 3 :

Gametes				

5. What is the expressed phenotype ratio for the hybrid ear of corn?

GENETIC PROBLEMS – GENOTYPES AND PHENOTYPE FREQUENCIES



A



B

- The traits expressed in the hybrid corn are (see diagram B). Count the number of each kernel type in the enlarged photo of diagram A, record the number next to the kernel type name below.
 - purple smooth -
 - purple sunken -
 - white smooth -
 - white sunken -
- Based upon your count of the expressed traits and using the letter “P” for purple gene and “W” for the white gene, give the genotype for each type of kernel.
 - purple and smooth - **PPWW, PPWw, PpWW or PpWw**
 - purple and sunken - **PPww or Ppww**
 - white and smooth – **ppWW or ppWw**
 - white and sunken - **ppww**
- What are the four types of alleles possible for the following cross PpWw x PpWw
PW Pw pW pw
- Complete the following Punnett Square for the cross listed in # 3 :

Gametes	PW	Pw	pW	pw
PW	PPWW	PPWw	PpWW	PpWw
Pw	PPWw	PPww	PpWw	Ppww
pW	PpWW	PpWw	ppWW	ppWw
<u>pw</u>	PpWw	Ppww	ppWw	ppww



PEDIGREE ANALYSIS

Background Information:

Remember that capital letters represent dominant genes and lower case letters represent recessive genes. Use **D** for the dominant gene and **d** as the recessive gene for this problem.

Phenotype is the appearance of the trait and **genotype** is the two gene combination that causes the trait.

A **karyotype** is print of human chromosomes. The numbered chromosome pairs termed **autosomes** are arranged longest to shortest.

The **sex (X & Y) chromosomes** are placed last with normal females having XX and normal males having XY.

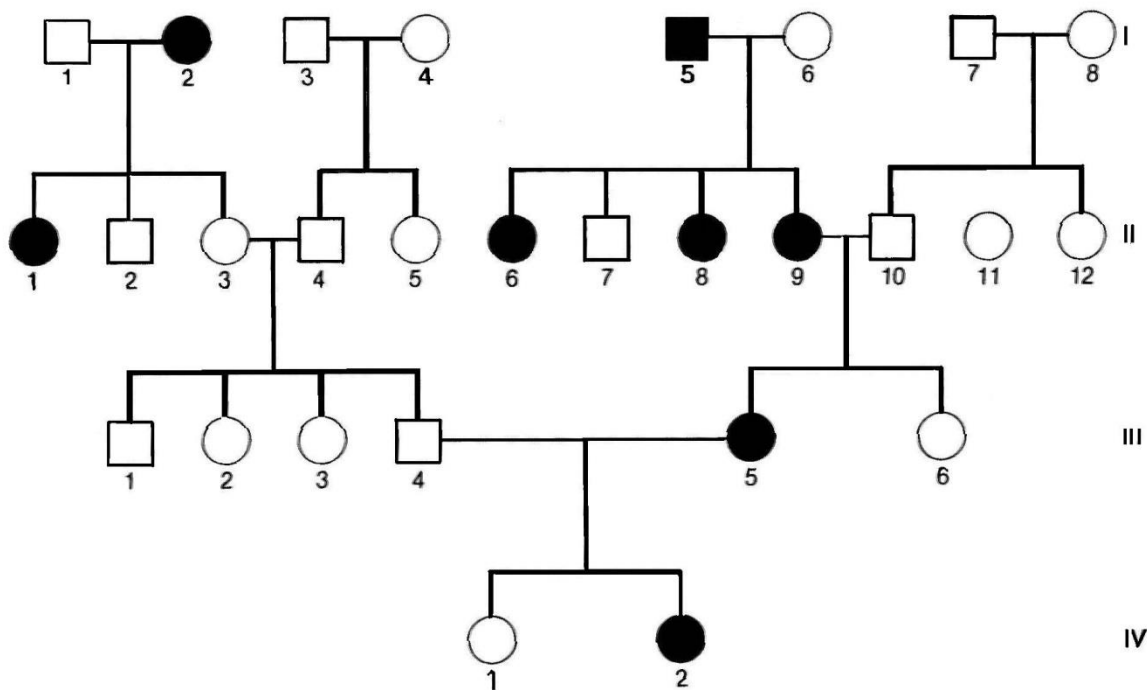
If only X chromosomes are present, it will be female.
If X and Y chromosomes are present, it will be male.

Bent chromosomes are not abnormal. It is just the way they were photographed.

If an individual has an extra chromosome, it is termed **trisomy** and if a chromosome is missing, it is termed **monosomy**.

Pedigree for Families with Night Blindness

This type of night blindness is caused by an autosomal dominant gene. The individuals in black display the trait.



PEDIGREE ANALYSIS QUESTIONS

When answering the questions, assume all couples are legally married.

1. How many generations are on this pedigree?
2. What is the relationship of **Individuals I-7 and II-9**?
3. What is the relationship of **Individuals I-1 and I-2**?
4. What is the relationship of **Individuals II-6 and II-11**?
5. What are the possible genotypes for a person who has night blindness?
6. What are the possible genotypes for a person who has normal night vision?
7. How many individuals have normal night vision?
8. What is the genotype of Individual IV-2?
9. What is the genotype of Individual II-2?
10. Are there any individuals who have a homozygous dominant genotype on this pedigree? If so, who are they?

PEDIGREE ANALYSIS QUESTIONS

When answering the questions, assume all couples are legally married.

1. How many generations are on this pedigree?
four (I – IV)
2. What is the relationship of **Individuals I-7 and II-9**?
Father-in-law and Daughter-in-law
3. What is the relationship of **Individuals I-1 and I-2**?
Husband and wife (assuming that all couples are legally married)
4. What is the relationship of **Individuals II-6 and II-11**?
Sisters-in-law
5. What are the possible genotypes for a person who has night blindness?
DD or Dd (D = dominant allele and d = recessive allele)
6. What are the possible genotypes for a person who has normal night vision?
dd
7. How many individuals have normal night vision?
20 individuals (count the symbols in white)
8. What is the genotype of Individual IV-2?
dd
9. What is the genotype of Individual II-2?
Dd because he is normal but mom has night blindness
10. Are there any individuals who have a homozygous dominant genotype on this pedigree? If so, who are they?
No – this is a dominant trait and each person with the trait has a parent with the recessive normal vision or children who have normal vision.

KARYOTYPE ANALYSIS

Background Information:

Chromosomes come in pairs.

A **karyotype** is print of human chromosomes.

The numbered chromosome pairs termed **autosomes** are arranged longest to shortest.

The **sex (X & Y) chromosomes** are placed last with normal females having XX and normal males having XY.

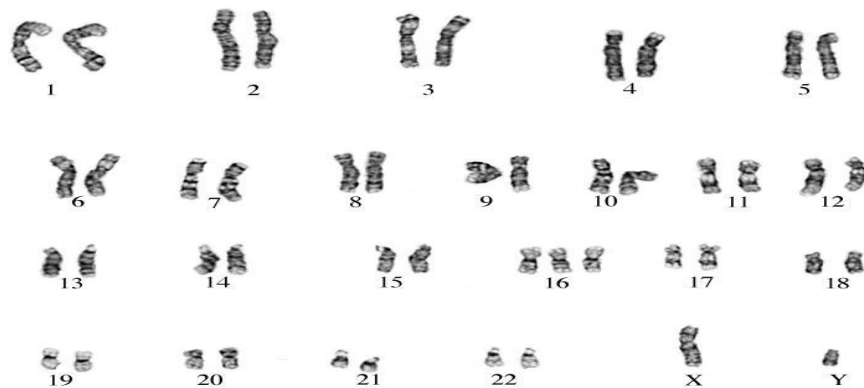
If only X chromosomes are present, it will be female.

If X and Y chromosomes are present, it will be male.

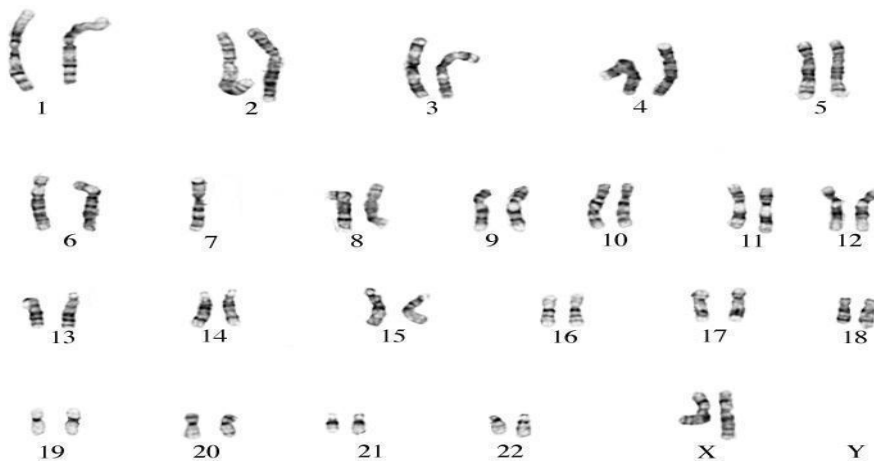
Bent chromosomes are not abnormal. It is just the way they were photographed.

If an individual has an extra chromosome, it is termed **trisomy** and if a chromosome is missing, it is termed **monosomy**.

Karyotype for Individual A



Karyotype for Individual B



KARYOTYPE ANALYSIS

Use the **Background Information** and the **Karyotypes** for **Individuals A, , and B** to answer the following questions.

1. Which individual(s) are **female**?
2. Which individual(s) are **male**?
3. How many **pairs chromosomes** are present in a normal human?
4. How many **pairs of autosomes** are present in a normal human?
5. Which individual(s), if any, are **monosomy**?
6. Which pair of chromosomes is affected for these individuals?
7. Which individual(s), if any, are **trisomy**?
8. Which pair of chromosomes is affected for these individuals?
9. For an individual who is **monosomy**, how many chromosomes are present in their karyotype?
10. For an individual who is **trisomy**, how many chromosomes are present in their karyotype?

KARYOTYPE ANALYSIS

Use the **Background Information** and the **Karyotypes for Individuals A and B** to answer the following questions.

1. Which individual(s) are **female**?
B
2. Which individual(s) are **male**?
A
3. How many **pairs chromosomes** are present in a normal human?
23 pr.
4. How many **pairs of autosomes** are present in a normal human?
22 pr.
5. Which individual(s), if any, are **monosomy**?
B
6. Which pair of chromosomes is affected for these individuals?
Pair 7 (This is a female with Monosomy 7)
7. Which individual(s), if any, are **trisomy**?
A
8. Which pair of chromosomes is affected for these individuals?
Pair 16 (This is a male with Trisomy 16)
9. For an individual who is **monosomy**, how many chromosomes are present in their karyotype?
45 chromosomes
10. For an individual who is **trisomy**, how many chromosomes are present in their karyotype? **47 chromosomes**

pH of Common Items

pH	Common Items
1.0	battery acid
2.0	lemon juice
2.2	vinegar
3.0	apples
3.5	soft drink
4.0	wine
4.5	tomatoes
5.6	unpolluted rainwater
6.6	milk
7.0	pure water
7.4	human blood
8.3	baking soda solution
8.4	sea water
10.5	milk of magnesia
11.0	household ammonia
12.4	lime
13.0	lye

pH – DETERMINATION AND ANALYSIS

Materials and equipment: pH paper and pH scale, pH probe, EasyLink, TI 84 calculator, plastic cups containing a mystery solution.

The pH paper and the pH probe were used to determine the pH of 4 different solutions. Below are the results.

	pH paper	pH Probe
Solution A -	3	3.4
Solution B -	6	6.4
Solution C -	8	8.3
Solution D -	2	2.3

Use the data and the pH of common items in answering the questions.

1. Which of the common items might **Solution A** be?
Which of the common items might **Solution B** be?
2. Which of the common items might **Solution C** be?
Which of the common items might **Solution D** be?
3. What is the advantage of using the probe over using the pH paper?
4. Which Solutions (A-D) are **basic**? Which Solutions (A-D) are **acidic**?
5. How many times more hydrogen ions are present in a solution with a pH of 2 than a solution with a pH of 5?

Now determine the pH of the mystery solution provided using the pH paper and/or the pH probe. Record your results.

Using the list of common items, which of the common items might be the mystery solution?

USING THE pH PROBE:

1. Before each use of the pH Sensor, you need to rinse the tip of the sensor thoroughly with distilled water. Raise the pH Sensor from the sensor soaking solution and set the solution aside. Use a wash bottle filled with distilled water to thoroughly rinse the pH Sensor. Catch the rinse water in the second beaker or cup. Important: Do not let the pH Sensor dry out. Place it in the beaker or cup with 100 mL of tap water. The tip of the sensor is made of glass—it is fragile. Handle with care!
2. Turn on the calculator. Connect the pH Sensor to EasyLink interface and the EasyLink to the calculator. (With EasyLink the calculator will automatically launch EasyData and detect the sensor.)
3. Set up the data-collection mode.
4. Start the EasyData application, if it is not already running.
5. Select **[File]** from the Main screen, and then select **New** to reset the application.
6. Select **[Setup]** from the Main screen, and then select **Events with Entry**.

pH – DETERMINATION AND ANALYSIS

Materials and equipment: pH paper and pH scale, pH probe, EasyLink, TI 84 calculator, plastic cups containing a mystery solution.

The pH paper and the pH probe were used to determine the pH of 4 different solutions. Below are the results.

	pH paper	pH Probe
Solution A -	3	3.4
Solution B -	6	6.4
Solution C -	8	8.3
Solution D -	2	2.3

Use the data and the pH of common items in answering the questions.

- Which of the common items might **Solution A** be? **soft drink**
Which of the common items might **Solution B** be? **milk**
- Which of the common items might **Solution C** be? **baking soda**
Which of the common items might **Solution D** be? **vinegar**
- What is the advantage of using the probe over using the pH paper?
more accurate reading and no color interference
- Which Solutions (A-D) are **basic**? Which Solutions (A-D) are **acidic**?
C is basic **A,B,D are acidic**
- How many times more hydrogen ions are present in a solution with a pH of 2 than
a solution with a pH of 5?
1000

Now determine the pH of the mystery solution provided using the pH paper and/or the pH probe. Record your results.

It depends upon what is used as a mystery solution.

Using the list of common items, which of the common items might be the mystery solution?

USING THE pH PROBE:

1. Before each use of the pH Sensor, you need to rinse the tip of the sensor thoroughly with distilled water. Raise the pH Sensor from the sensor soaking solution and set the solution aside. Use a wash bottle filled with distilled water to thoroughly rinse the pH Sensor. Catch the rinse water in the second beaker or cup. Important: Do not let the pH Sensor dry out. Place it in the beaker or cup with 100 mL of tap water. The tip of the sensor is made of glass—it is fragile. Handle with care!
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5. Select **[File]** from the Main screen, and then select **New** to reset the application.
6. Select **[Setup]** from the Main screen, and then select **Events with Entry**.

TEMPERATURE – THERMOMETER VS PROBE

Equipment: laboratory thermometer, temperature probe (Easy temp) or temperature probe with Easy Link, TI 84 calculator, cup or beaker containing ice water

Place 50 mL of Ice Water into a cup or beaker and measure the temperature every 30 seconds for 4 minutes. (Be sure there are no pieces of ice in the water)

Measure and record the room temperature.

Using the Easy Temp Probe

1. Turn the TI-84 Plus calculator on, and display the home screen (a flashing dark square in upper right corner). If another application is open select **Quit** and/or **Clear** to get the home screen.
2. Connect the EasyTemp sensor to the calculator. After a few seconds, the EasyData main screen is displayed. The screen shows the current EasyData mode and the current sensor reading.
3. Select **File** and then the option **New**.
4. Measure the temperature of the ice water in the container.
 - Select **|Start|** from the top row of calculator buttons.
 - Hold the Temperature Probe with the tip in the center of the hand.
 - Watch the temperature vs. time graph until the temperature levels off.
 - Record the highest temperature to the nearest 0.1°C.
 - Use the **▶** and **◀** arrow keys to examine data point along the curve. The time and temperature will be displayed below the graph.
5. Select **|Start|** from the top row of calculator buttons. If asked, select **OK** to override the last run.

Questions:

1. What was the room temperature?
2. What was the initial temperature of the ice water?
3. What was the final temperature of the ice water?
4. How much did the temperature of the ice water change in 4 minutes?
5. What factors could affect the change in the temperature of the ice water?
6. How could you keep the ice water cool longer?

TEMPERATURE – THERMOMETER VS PROBE

Equipment: laboratory thermometer, temperature probe (Easy temp) or temperature probe with Easy Link, TI 84 calculator, cup or beaker containing ice water

Place 50 mL of Ice Water into a cup or beaker and measure the temperature every 30 seconds for 4 minutes. (Be sure there are no pieces of ice in the water)

Measure and record the room temperature.

Using the Easy Temp Probe

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8. Select **File** and then the option **New**.
9. Measure the temperature of the ice water in the container.
 - Select **|start|** from the top row of calculator buttons.
 - Hold the Temperature Probe with the tip in the center of the hand.
 - Watch the temperature vs. time graph until the temperature levels off.
 - Record the highest temperature to the nearest 0.1°C.
 - Use the **►** and **◄** arrow keys to examine data point along the curve. The time and temperature will be displayed below the graph.
10. Select **|Start|** from the top row of calculator buttons. If asked, select **OK** to override the last run.

Questions: Answers depend upon the conditions as room temperature, type of container and other environmental conditions.

1. What was the room temperature?
2. What was the initial temperature of the ice water?
3. What was the final temperature of the ice water?
4. How much did the temperature of the ice water change in 4 minutes?
5. What factors could affect the change in the temperature of the ice water?
Temperature of room or location of the test, air currents, type of container
6. How could you keep the ice water cool longer?
Insulated or Styrofoam cups, cool room with no air currents, cover the cup

OBSERVATIONS VS INFERENCES



Nectarine



Apple



Squash



Maple



Legumes



Nuts



Orange



Tomato



Milkweed

OBSERVATION QUESTIONS

Use the **name** of the fruit in answering the questions.

1. Which fruit has wings or is light and delicate and might be dispersed by the wind?
2. Which fruit has a pit in the center?
3. Which of these fruits has a leathery outer covering?
4. Which fruit has a core?
5. Which fruit has a very hard outer covering?

OBSERVATION VS INFERENCES QUESTIONS

Inferences are logical conclusions based upon observations.

List 5 observations about the fruits

- 1.
- 2.
- 3.
- 4.
- 5.

Form each observation listed, make an inference.

- 1.
- 2.
- 3.
- 4.
- 5.

Each question has two statements. Indicate whether each is an observation (**O**) or an inference (**I**) using one of the following: **I:I**, **I:O**, **O:I**, or **O:O**

1. The orange has a thick covering: The orange is easy to peel.
2. The peanut is a legume not a nut: The peanut has two fruits inside the shell.
3. The milkweed seed has feathery attachments: The maple seed has wings.
4. Tomatoes and squash are often called vegetables: Tomato seeds are edible.
5. The nuts need a nutcracker to break the shell: The nectarine has a hard pit.

OBSERVATION QUESTIONS

Use the **name** of the fruit in answering the questions.

1. Which fruit has wings or is light and delicate and might be dispersed by the wind?
2. Which fruit has a pit in the center?
3. Which of these fruits has a leathery outer covering?
4. Which fruit has a core?
5. Which fruit has a very hard outer covering?

OBSERVATION VS INFERENCES QUESTIONS

Inferences are logical conclusions based upon observations.

List 5 observations about the fruits. **Answers will vary but they must be observable from pictures**

- 1.
- 2.
- 3.
- 4.
- 5.

Form each observation listed, make an inference. **Answers will vary but they must be assumptions.**

- 1.
- 2.
- 3.
- 4.
- 5.

Each question has two statements. Indicate whether each is an observation (**O**) or an inference (**I**) using one of the following: **I:I**, **I:O**, **O:I**, or **O:O**

1. The orange has a thick covering: The orange is easy to peel.
O:I
2. The peanut is a legume not a nut: The peanut has two fruits inside the shell.
I:I
3. The milkweed seed has feathery attachments: The maple seed has wings.
O:O
4. Tomatoes and squash are often called vegetables: Tomato seeds are edible.
I:I
5. The nuts need a nutcracker to break the shell: The nectarine has a hard pit.
I:O