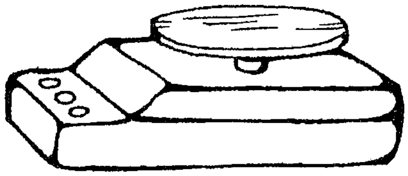
NAME________________________ SCI #__________

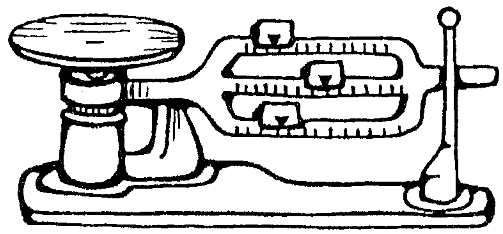
ACTIVITY

"A Test of Your Measuring Skills"

HOW TO WEIGH AN OBJECT

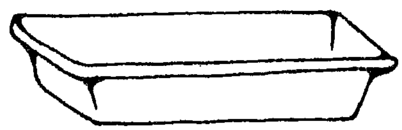
Weighing balances are used to measure the weight of an object. It is important that the object to be weighed is put inside a weighing container so that the material is not spilled on the balance pan.





STEP 1 "Zero" the scale. (Your instructor will show you how to do this.)

Then, weigh the weighing container.
Why is it important to weigh the container first?



STEP 2 Put the substance or object into the weighing container, and weigh them together.

STEP 3 Determine the difference between the weights for Step 1 and Step 2.

GO GET

Some table salt.

NOW

Your instructor will give you specific directions for using each type of weighing scale. Make sure that you "zero" the scales before weighing.

1. Weigh 2.7 g of table salt, and put that amount onto a piece of paper. This is the recommended daily intake of salt in your diet.

2. Weigh 11.6 g of table salt, and put that amount next to the other pile. This is the typical daily salt intake by people in our society.

NAME____PER______________

Lab Practical: Following Procedures in the Lab

Purpose: In this activity you will learn determine your skill in following written directions. This will be graded as a quiz. Please be sure to complete all questions on the lab.

Materials:

red, blue, and yellow water
3 small beakers or cups
test tube stand
small graduated cylinder
6 test tubes

Procedure:

1. Label each test tube A, B, C, D, E, or F using tape
2. Pour about 25 mL of each color of water into three small beakers or cups. One should be blue, one yellow, and one red.
3. Into test tube A, measure 9.5 mL of red water
4. Into test tube C, measure 9 mL of yellow water
5. Into test tube E, measure 9 mL of blue water
6. From test tube C, measure 2 mL, and pour the 2 mL into test tube D
7. From test tube E, measure 3.5 mL and add it to test tube D and mix
8. Into test tube F, measure 2 mL of blue water and 3.5 mL of red water and mix
9. From test tube A, measure 4 mL of water and pour it into test tube B
10. From test tube C, measure 1.5 mL of water and pour it into test tube B and mix
11. Once your observations are complete, empty all the test tubes into the sink, remove the tape and rinse well. Put all test tubes upside down on the test tube rack. Show me the cleaned lab table and I will stamp this lab.

Observations and Data:

Carefully measure the total amount of water in each test tube. Complete the table below by recording the final color and total amount of water in each test tube.

Test Tube	Color of Water	Total Volume of Water (mL)
A		
B		
C		
D		
E		
F		

NAME____________________________________ PER____________

Questions:

1. What lab table were you working?

____

2. Who was your lab partner?

____

3. What was the biggest difficulty in completing this lab?

____

____

____

4. Other than practicing following procedures, what other purpose did this lab have?

____

____

____

Clean-up

To be signed by me!

NAME____PER______________

Student Page Day 2 Names ____________________

Title: Creating your own colors Inquiry Lab

Purpose:
Today we will be experimenting on our own to see which group can make the best set of six colored test tubes. The class will vote on which group they feel created the best set of colors.

Materials:
red, blue, and yellow water test tube stand 6 test tubes
3 small beakers or cups small graduated cylinder

Procedure:
Yesterday we followed a recipe to make six colors of the rainbow. Today we will be making our own recipes to see which combinations of the primary colors make the most interesting combinations. Be sure to record each test tube combination you try. Write what you did to follow each step of the scientific method below.

1. Problem—What problem were you working on in this lab?

2. Research—What did you research to make your colors better?

3. Hypothesis—What colors did you think would work the best?

4. Experiment—What did you do to test your colors? Write the recipe for at least three of your test tubes.

5. Analyze Data—What did you see when you were testing your colors?

NAME____PER_______________

6. Conclusion—How did your colors work out? Write the recipe to make at least three of the colors that you like the most.

A TEST OF YOUR WEIGHING AND VOLUME SKILLS

It has been said that pennies before 1982 are heavier than pennies after 1982. We have 20 pennies in each category on the lab table.

EXPERIMENTAL QUESTION

1. Are the post-1982 pennies lighter or heavier?

2. If there is a difference in weight, then is that difference because either . . .
   - **a.** they are not made of the same metal, or
   - **b.** they are not the same size coin.

NOW

1. Design and perform an experiment to answer the questions above.

2. Compare groups of at least 10 coins in each category to measure the difference in weight or volume. ***Hint:*** The volume of objects can also be determined by measuring the displacement of water.

3. Ask to see one of the post-1982 pennies that has been cut in half to show its metal composition.

LAB REPORT

Question:

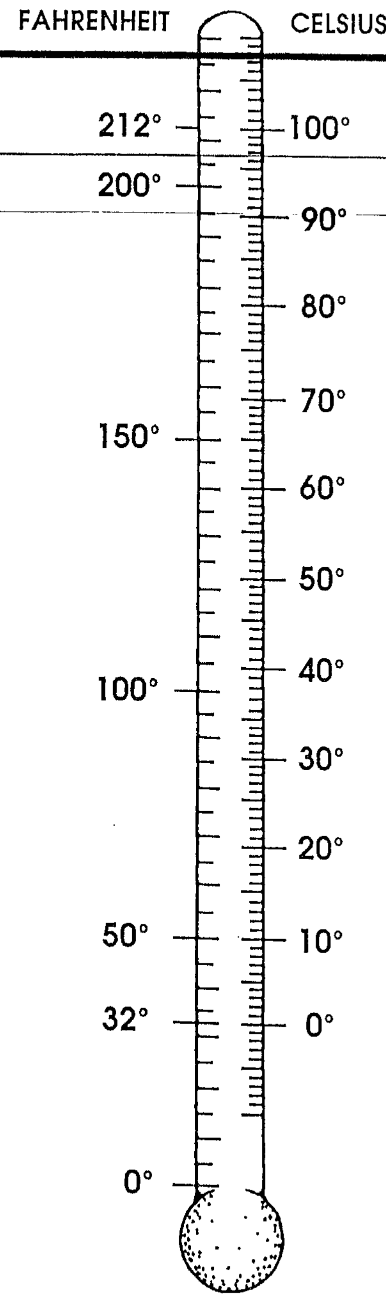
Hypothesis:

Experimental Design:

Results:

Conclusions:

TEMPERATURE



The English measurement of temperature is in degrees Fahrenheit (°F). Using this scale, water freezes at 32°F and boils at 212°F.

There is a scientific temperature scale that is more like a metric scale. It uses Celsius (°C), and on this scale water freezes at 0°C and boils at 100°C.

NOW

This scale was copied from a dual scale thermometer. Using this illustration, answer the questions below.

? QUESTION

1. How many °F are there between the 0°C mark and the 100°C mark? __________
   Therefore, how many °F are there in one °C? __________

2. Water freezes at what temperature in °F? __________
   At what temperature in °C? __________

3. Water boils at what temperature in °F? __________
   At what temperature in °C? __________

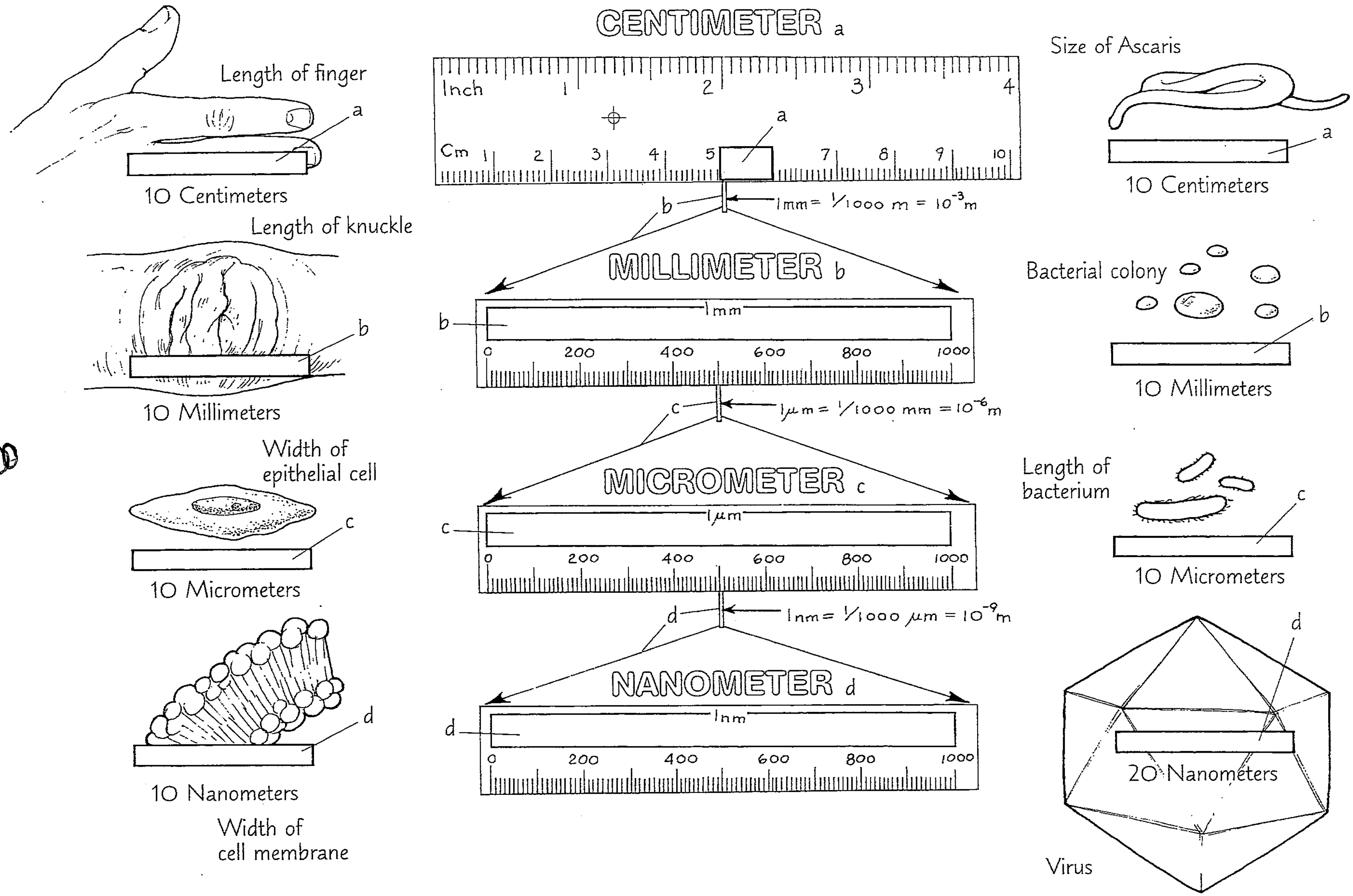
4. What is your favorite air temperature in °F? __________
   What would that be in °C? __________

5. What is your idea of a "hot day" in °F? __________
   What temperature is that in °C? __________

6. Your normal body temperature is 98.6°F. Your child's forehead seems to be hot. You grab a Celsius thermometer by mistake and take her temperature. It reads 37°. Should you rush her to the hospital? __________ (The formula for converting °C into °F is: **°F = °C x 1.8 + 32.**) Why must the number 32 must be added?

7. Your cookbook says that roast beef is rare at 140°, medium at 160°, and well done at 170°. You like your beef cooked medium-rare and only have a meat thermometer in °C. What temperature will the thermometer have to reach for the roast to be done the way you like it?

8. The water temperature gauge on you new Volkswagen reads 85°C. Are you overheating your engine? __________ Explain.



CENTIMETER a
Inch
1
2
3
4
Cm
1
2
3
4
5
7
8
9
10
a
b
1mm = 1/1000 m = 10^-3 m
MILLIMETER b
1mm
0
200
400
600
800
1000
c
1μm = 1/1000 mm = 10^-6 m
MICROMETER c
1μm
d
1nm = 1/1000 μm = 10^-9 m
NANOMETER d
1nm
Length of finger
10 Centimeters
Length of knuckle
10 Millimeters
Width of epithelial cell
10 Micrometers
10 Nanometers
Width of cell membrane
Size of Ascaris
10 Centimeters
Bacterial colony
10 Millimeters
Length of bacterium
10 Micrometers
20 Nanometers
Virus

ACTIVITY #3

"Personal List of Metric References"

Think of something easy to remember that you can associate with each of the metric units below.

Perhaps a centimeter might be the width of one of your fingernails.

Share your ideas among other members of your group. Be specific.

Whatever you choose as a reference, *make sure it's something you won't forget!*

MY METRIC LIST

Name: ______________________________

Metric Unit **My Personal Reference**

Length:

mm ______________________________

cm ______________________________

m ______________________________

km ______________________________

Volume:

ml ____________________ (How many drops?) __________

l ______________________________

Weight:

mg ______________________________

g ______________________________

kg ____________________ (How many pounds?) __________

CONVERSION FACTORS

Conversion Factors (also called dimensional analysis in science) are a bit more complex than the methods used in the previous exercises. However, Conversion Factors are capable of solving both simple and complex problems in science, and they have an automatic self-checking feature when the rules are followed.

RULE 1 ***The top unit of a Conversion Factor must be equal to the amount of the bottom unit of that factor.***

There are many Conversion Factors that you can use. Examples:

$$\frac{1\text{ cm}}{10\text{ mm}} \qquad \frac{10\text{ mm}}{1\text{ cm}} \qquad \frac{1\text{ meter}}{39.4\text{ inches}} \qquad \frac{1\text{ liter}}{1000\text{ ml}} \qquad \frac{100\text{ pounds}}{45\text{ kilograms}} \qquad \text{etc.}$$

Notice that you can invert any Conversion Factor.

All of the above factors are correct (OK factors) because the amount on the ***top*** of the factor is the *same amount* as that on the ***bottom*** of the factor.

$$1\text{ cm} = 10\text{ mm, so} \quad \frac{1\text{ cm}}{10\text{ mm}} = \frac{\text{same}}{\text{same}} = \text{OK factor}$$

RULE 2 ***The Conversion Factor that you choose must automatically cancel out the starting unit and leave the desired unit as your answer.***

For example, if you were starting with a kilometer unit and wanted to convert it into a yard unit, then the correct Conversion Factor would be:

$$\frac{1094\text{ yards}}{1\text{ kilometer}}$$

Remember: *Starting Unit* x *Conversion Factor* = *Desired Unit*

$$\text{kilometer} \times \frac{\text{yards}}{\text{kilometer}} = \text{Answer in yard units}$$

These units ***cancel out*** the starting unit and ***leave*** the desired unit.

RULE 3 ***You may have to use more than one Conversion Factor in order to solve a particular conversion problem.***

Let's use the example above, and follow it through to see how Conversion Factors work. As you will see, knowing a little information and using a Conversion Factor can get you where you want to go.

In the example under Rule 2, we wanted to convert kilometers into yards. We decided that the necessary Conversion Factor must be:

$$\frac{\textit{yards}}{\textit{kilometers}}$$

But, what if you couldn't remember how many yards there are in a kilometer? The solution is: Use as many Conversion Factors as are necessary, starting with the one that you *do remember.*

Perhaps you remember that 1 meter = 39.4 inches. And you know that there are 1,000 meters in a kilometer. How can you use these Conversion Factors to answer the above question?

Start with what you know:

$$1 \text{ kilometer} \times \frac{1000 \text{ meters}}{1 \text{ kilometer}} \times \frac{39.4 \text{ inches}}{1 \text{ meter}} \times \frac{1 \text{ yard}}{36 \text{ inches}} =$$

. . . and ***cancel*** the "units" as you work through the problem.

$$\frac{1000 \times 39.4 \times 1}{1 \times 1 \times 36} = \underline{\qquad\qquad}$$

in yards in a kilometer!

? QUESTION

1. How many inches are there in 50 cm? ***Hint:*** There are 39.4 inches in a meter.

   What is the starting unit? ______________

   What is the desired unit? ______________

   What is your answer? (Show your Conversion Factors.)

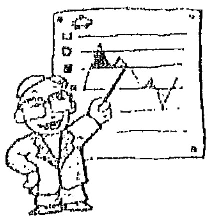
2. How many liters are there in 10 gallons? ***Hint:*** There are 946 ml in 1 quart.

   What is the starting unit? ______________

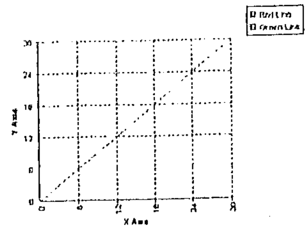
   What is the desired unit? ______________

   What is your answer? (Show your Conversion Factors.)

Name____



Graphs & Data Tables in Science

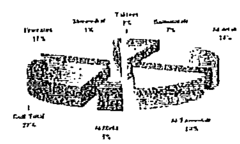


Background: One of the things most often seen in a description of any scientific experiment is a graph or table of some kind. A graph is a visual representation of numerical data collected from an experiment. Some of the types of graphs you'll find in science are bar and pie graphs. The one used most often (especially in Biology) is a line graph, and it is the type of graph we will create and analyze most during your Living Environment science class.

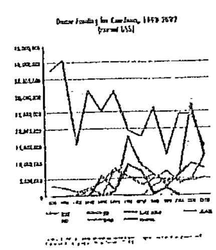
Line graphs describe the relationship between two (2) variables. Each variable is plotted along an axis. A line graph has a vertical axis and a horizontal axis. The "x-axis" is where scientists plot the independent variable and the "y-axis" is where they plot the dependent variable.

- They are good at showing specific values of data, meaning that given one variable the other can easily be determined.
- The y show trends in data clearly, meaning that they visibly show how one variable is affected by the other as it increases or decreases.
- They enable the reader to make predictions about the results of data not yet collected.

Purpose: The purpose of this laboratory exercise is:
- to further refine our skills at graphing collected data
- to better understand how to "interpret" the data on a graph
- be able to graph data from a given table of raw data
-



Materials: The following materials are needed to complete this laboratory exercise:
- calculator
- pencils and pens
- graph paper
- this lab handout



Procedure: The following procedure is used to perform this exercise:

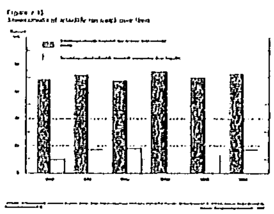
Part A: Interpreting Tables

1. What is a conclusion that can be drawn from data table 1.1 below?

____

____

- to answer this question, you must first compare sets of data from each column
  - First, what does the "Distance of Light from Plant" do as you read down the column?
  - Secondly, what happens to the "Bubbles per Minute" as you read down the column?
  - Lastly, your answer should include both trends.
    (Remember: data always shows us the relationship between two variable!)



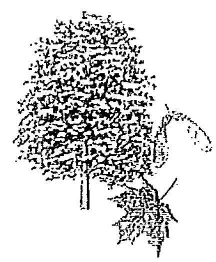
Data Table 1.1

Distance of Light From the Plant (cm)	Number of Bubbles per Minute Produced by Plant
10	60
20	25
30	10
40	5

2. Base your answers to questions 2-4 on Data Table 1.2 below.

Data Table 1.2

Test Tube	Temperature (°C)	Bubbles of Oxygen per Minute
1	0	3
2	10	22
3	20	40
4	30	58
5	40	71
6	50	2



2. At what temperature will the most oxygen be produced? ____________________

3. Between which temperatures will oxygen production decrease? ______________

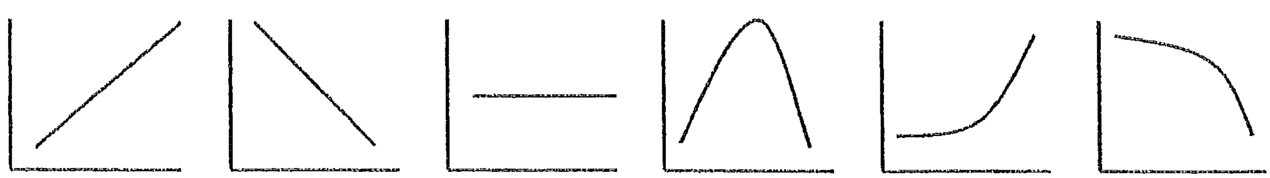
4. What is a conclusion that can be drawn from data table 1.2?

____

____

Part B: Interpreting Lines in Graphs

The following are a few examples of graph lines. These lines represent the RATE at which something occurs. In other words, it is "HOW MANY PER UNIT TIME"



A B C D E F

Name______________________________

5. Which line represents a tree which has not grown over time? __________

6. Which graph shows and increase, then decrease? __________

7. Which three (3) graphs show an increase in rate? __________

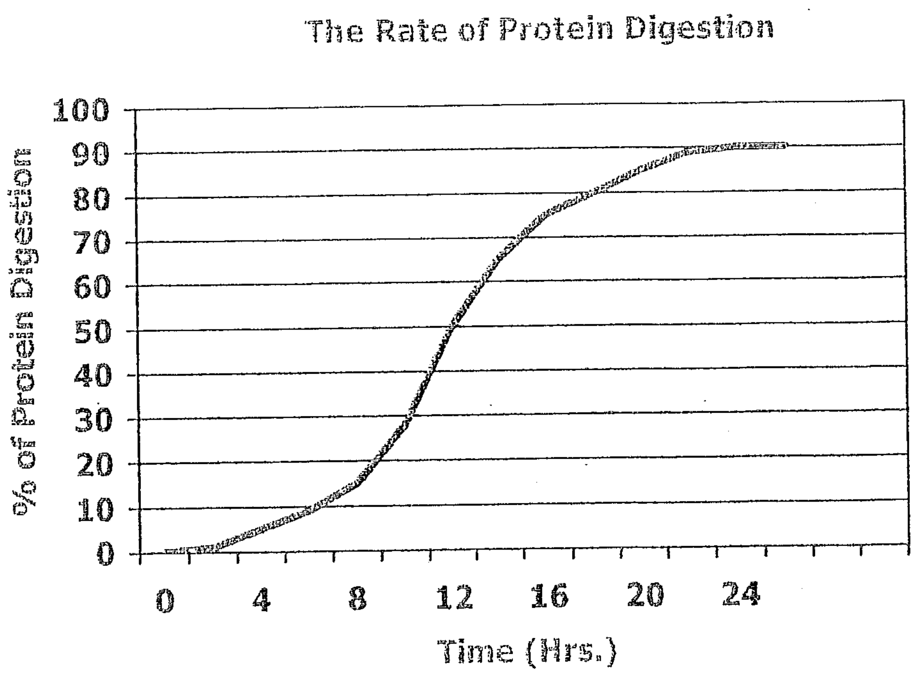
8. Which graph shows a constant rate increase over time? __________

9. Which graph shows a fast increase in rate that eventually remains constant? __________

10. Which graph shows a slow increase in rate that speeds up? __________

Part C: Determining Data from Graphs

Base your answers to questions 11-14 on the graph below.



11. After four (4) hours has passed, what percent (%) of the protein has been digested? __________

12. How long does it take for 25% of the protein to be digested? __________

13. At which of the following time intervals does the most rapid increase in rate occur? __________
 a) 0-8 hours b) 8-16 hours c) 16 -24 hours

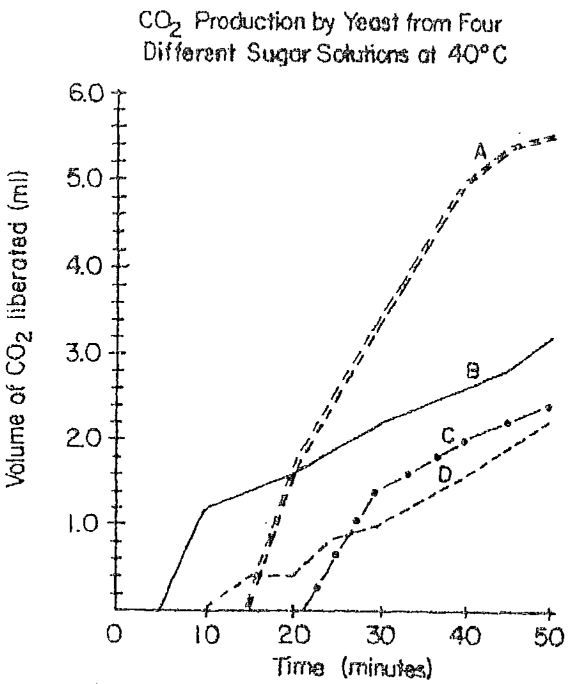
14. At approximately how many hours does the rate of protein digestion remain constant? __________

Name________________________________ Data Collection Date ____________________

Class Period Lab Period ____________

Part D: Interpreting Multiple Line Graphs

Base your answer s to questions 15 and 16 on the following multiple line graph.



15. Which sugar solution was the first to liberate a measurable amount of CO_2? 15. ____

 1) A
 2) B
 3) C
 4) D

16. After how many minutes was the Volume of CO_2 liberated from sugar A Equal to the volume of CO_2 liberated from Sugar B solution? 16. ____

 1) 5
 2) 10
 3) 20
 4) 25

Part E: Creating Graphs

Complete the following graphing exercises using the data tables provided.

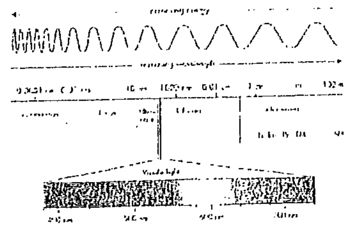
17. A group of biology students extracted the photosynthetic pigments from spinach leaves using the solvent acetone. A spectrophotometer was used to measure the percent absorption of six (6) different wavelengths of light by the extracted pigments. The wavelengths of light were measured in units known as nanometers (nm). One nanometer is equal to one-billionth of a meter. The Following data was collected:

Wavelength(nm)	Percent Absorption
Yellow light (585)	25.8%
Blue light (457)	49.8%
Orange light (616)	32.1%
Violet light (412)	49.8%
Red light (674)	41.0%
Green light (533)	17.8%

(continued on page 6)

Name________________________________ Data Collection Date ______________

Part E: Creating Graphs (cont.)

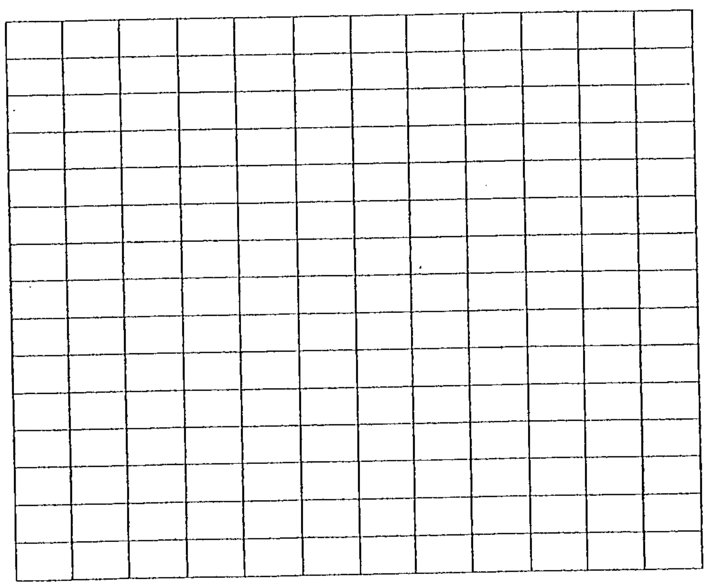


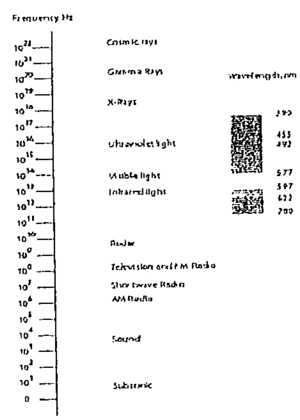
- record the raw data collected in the table below so that wavelengths are increasing.

Color of Light	Wavelength of Light (nm)	Percent Absorption by Spinach Extract

- Plot the data from the data table above on the following graph:

Percent Absorption





Wavelength of Light (nm)

Name________________________________ Data Collection Date ________________

18. What wavelength of light does spinach leaves absorb best? ________________

19. What color light does spinach leave absorb the least? ________________

20. What is a conclusion that can be drawn from the graph?