Name: _____

Date: _____

Period: _____

PROPER USE OF LAB EQUIPMENT and DATA ANALYSIS SKILLS

Introduction: A good scientist must be able to use scientific tools to make accurate observations. While studying science in this class, you will be required to use many pieces of lab equipment to help you collect data and to make observations. It is essential that you be able to use each piece of equipment accurately and safely. You must also have the skills to record and analyze the data that you collect while using these pieces of equipment. The best way to become familiar with the tools used by scientists is to handle them yourself. In this lab, you will learn to use basic pieces of lab equipment and the methods of data recording and analysis.

Purpose:

1. To learn to use the following pieces of equipment safely and accurately: Celsius thermometer, meter stick, quadruple beam balance, graduated cylinder, and the Bunsen burner.
2. To learn to organize data in a data table.
3. To learn to graphically represent data in a bar graph, line graph and circle graph.

Part I: The Celsius Thermometer

Thermometers are very fragile and must be handled with care. **Read the following** rules for the proper use of a thermometer.

1. Never "shake down" a thermometer to reset it.
2. Never use a thermometer to stir a liquid.
3. Never allow a thermometer to touch the bottom of a container that is being heated.

Read the following directions for using and reading a thermometer.

1. Place the bulb end of the thermometer into the object with an unknown temperature.
2. Wait several minutes for the thermometer to adjust to the temperature of the object.
3. Without removing the thermometer from the object, note the number nearest the top of the column of liquid in the thermometer.

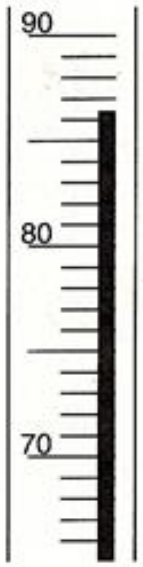
1. What are the temperatures shown by these thermometers?

1. _____

2. _____

3. _____

4. _____

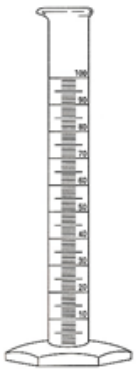


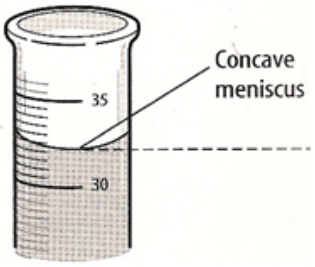
5. _____

6. _____

2. Why must you read the temperature without removing the thermometer from the solution?
3. Why should the thermometer never be used to stir a liquid?
4. Why should the thermometer never touch the bottom of a container that is being heated?

Part II: The Graduated Cylinder



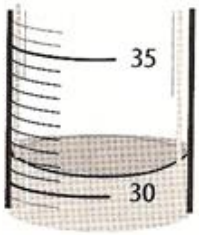


Read the following directions for using and reading a graduated cylinder:

1. Place the cylinder on a flat surface.
2. Look at the cylinder from the side at eye level. The top of the liquid should be at eye level. The view of the surface of the liquid will be curved. This curved surface is called the "meniscus".
3. Read the graduated cylinder at the bottom of the meniscus.

1. How much liquid is contained in each of the following graduated cylinders?

a)



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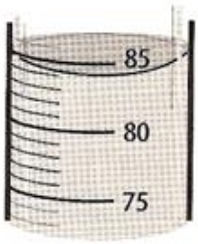
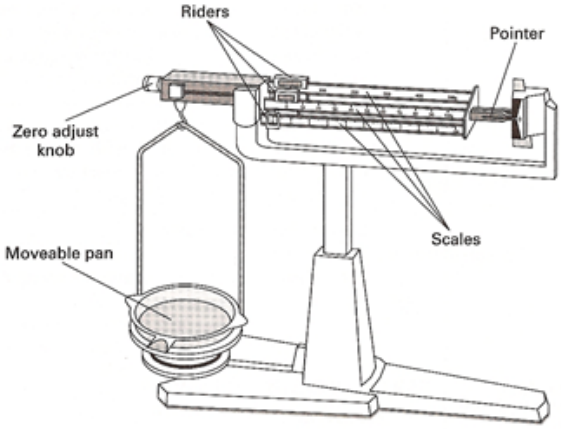


c)

Part III: The Quadruple-Beam Balance



Balances are sensitive equipment and must be handled with care.

Read the following rules for the proper use of a balance.

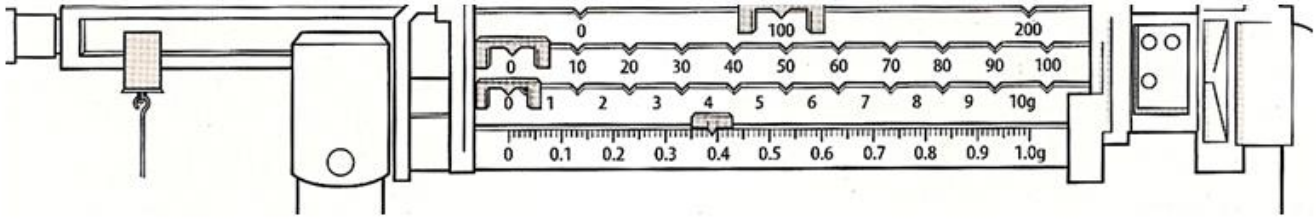
1. Never place a powder or liquid directly on the pan. Powders should be placed on weighing paper and liquids should be in a container.
2. Place all objects on the pan gently.
3. The adjustment knob is used to zero the balance.

Read the following directions for using and reading a balance.

1. Move all of the riders as far as they will go to the left. The pointer should now be in line with the zero marking. If not, move the adjustment knob very slowly until the pointer is in line with the zero marking.
2. Place an object on the pan. The pointer will swing up. Move the riders, starting with the back beam, until the pointer returns to the zero mark.
3. Total the masses indicated by each rider to find the mass of the object.
4. Move the riders to the left again and remove the object.

1. Study the diagrams below. What are the masses of the objects indicated by these balances?

a)



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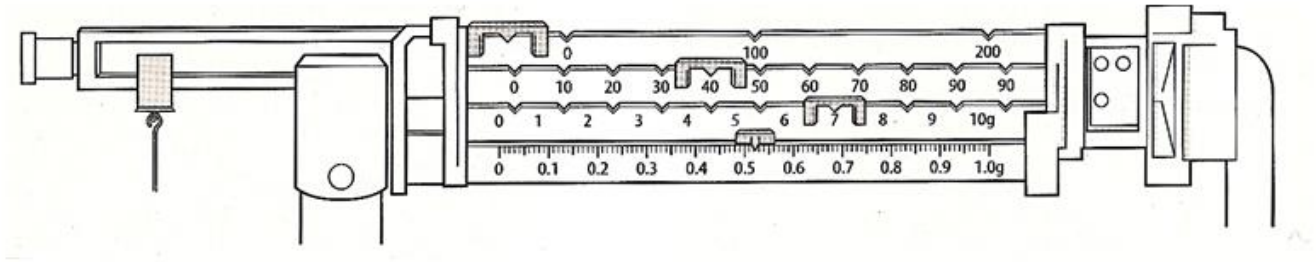


2. What place value is represented by each of the four beams?
3. What is the largest mass that this balance can measure?
4. What is the smallest mass that this balance can measure?

Part IV: The Metric Ruler

All of our measurements will be made using the metric system. The meter stick on your table is (obviously) one meter long. Study your meter stick to observe the following: (1) a meter consists of a 100 centimeters, and (2) a meter consists of 1000 millimeters. Notice that you will find a note card and a sheet of white, computer paper at this station.

1. How long is the meter stick in inches?
2. How long is one centimeter in inches?
3. What is the length of the note card in meters, centimeters, and millimeters?
4. What is the width of the computer paper in meters, centimeters, and millimeters?
5. What is the width of the lab table in meters, centimeters, and millimeters?

Part V: Tabling, Graphing and Analyzing Data

A. Making a Table

Any time data is collected in an experiment, it is most often presented in a table. The data table must have a title, rows, columns, and heads. The title should be placed at the top and tells the observer what information is contained in the table. At the top of each column should be a "head" that tells you what information is in the column.

Read the paragraph below. Use the information to complete a table.

An experiment was conducted to measure the amount of oxygen consumed during cellular respiration by germinating seeds at two different temperatures. Measurements were taken every two minutes for 10 minutes. The first set of seeds was kept in a cold environment in which the temperature was maintained at 10°C. The measurements (showing cumulative oxygen consumption) obtained at 2-minute intervals were: 1 mL, 1.8 mL, 2.7 mL, 3.6 mL, and 4.5 mL. The second set of seeds was kept in a warm environment in which the temperature was maintained at 24°C. The measurements (showing cumulative oxygen consumption) obtained at 2-minute intervals were: 2 mL, 3.1 mL, 4.3 mL, 5.6 mL, and 6.5 mL.

B. Making a Line Graph

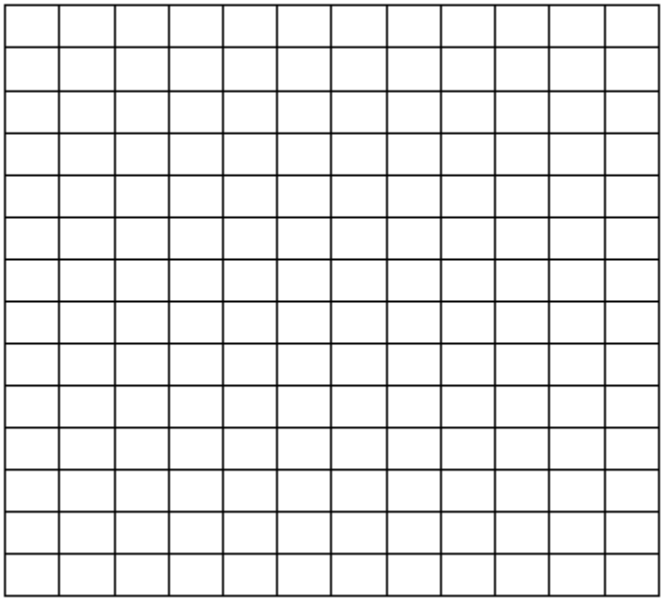
Line graphs show data plotted as points that are connected by a line. Line graphs are often used to show change over time and can be used to compare two or more sets of data.

Before a line graph can be constructed, you must identify the two variables that will serve as x and y coordinates on the graph. These are called the "independent variable" and the "dependent variable".

The independent variable is the one being manipulated or changed during the experiment. It is always placed on the x-axis or horizontal axis. The dependent variable is the observed result of the independent variable being changed. The dependent variable is always placed on the y-axis or vertical axis. An easy way to remember this is to ask yourself the questions, "What did I know before I did the experiment?" (independent variable) and "What did I learn by doing the experiment?" (dependent variable)

Graph the information that you placed in your newly constructed data table in Part A. Remember: Since you were comparing seeds at two different temperatures, there should be two different lines plotted on your graph.

Be sure to: (1) Label each axis appropriately, (2) Scale each axis appropriately, (3) Title your graph, (4) Label each of the two lines on your graph.



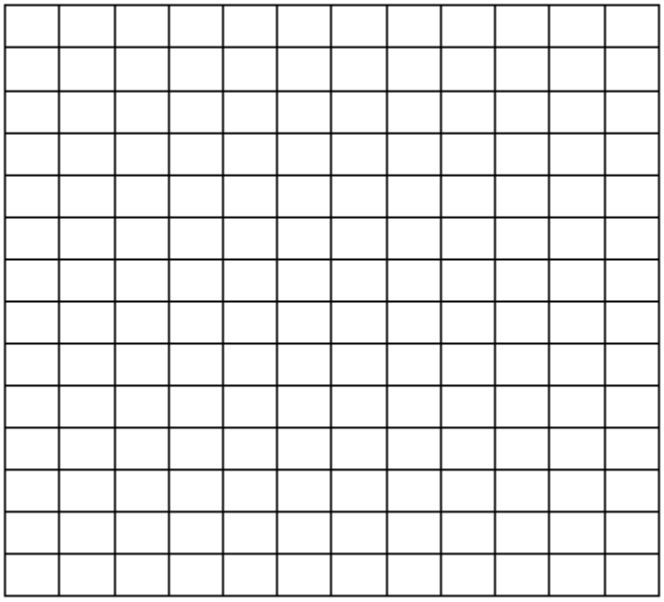
C. Making a Bar Graph

Bar graphs are useful for showing comparisons of data collected by counting. A bar graph has two axes, a horizontal axis and a vertical axis. Generally the horizontal axis is labeled and the vertical axis is divided. The data are not related so the bars do not touch.

Make a bar graph of the following information:

Students were surveyed to determine what part of the school day was their favorite. Students could choose only one of the following categories as their favorite part of the school day:

Part of the School Day	**# of Students**
Math Class	15
Science Class	25
English Class	8
History Class	10
Gym	46
Lunchtime	73



D. Making a Circle Graph

A circle graph is used to show how a certain quantity is broken down into parts. The circle represents the whole, and the "slices of the pie" represent the portions of the whole. In a circle graph, be sure to label the sections so that the data is shown.

Make a circle graph of the following information:

People were surveyed to determine what color automobile they would prefer. The results were:

Grey – 50%
Red – 25%
White – 10%
Blue – 10%
Beige – 5%