**Dear AP Biology Students:**

**DUE: First class period of AP Biology**
**Materials Needed: a printed copy of this assignment, a pencil and a straight edge**
**Time Required: 30 minute to 2 hours**

Graphing plays a major role in AP biology. Most students think they know how to graph because they have graphed a lot in math classes. Past experience has indicated that this is a false sense of knowledge since oftentimes one can use a graphing calculator or plots on graph paper with axes and scaling already on the graph. In AP Biology you will almost always be given a blank graph and will have to determine the proper size, scaling and axes for the graph you will be plotting. Points are often awarded for

1. correct scaling (Proper spread of axis numbers and the use of most of the graph)
2. correct labeling of axes with units
3. correct plotting of data points
4. sometimes you may get a point if the graph is properly labeled

Please read through the following and then print out the exercise so that you can practice doing the graphs. This assignment is due on the first day of school.

If you get stuck, please email me and I shall reply as soon as possible.

Happy graphing.

**Name:** **AP Bio Graphical Practice Assignment**

**Science Practice 4: Representing and describing data**

Representing and describing data is one of six major practice skills that you will need to learn for the national exam.

You must know how to construct and interpret the following graph types:

| | | | |
|---|---|---|---|
| 1. X,Y | 3. Bar | 5. Line | 7. Box & Whisker |
| 2. Log Y | 4. Histogram | 6. Dual Y | 8. Pie |

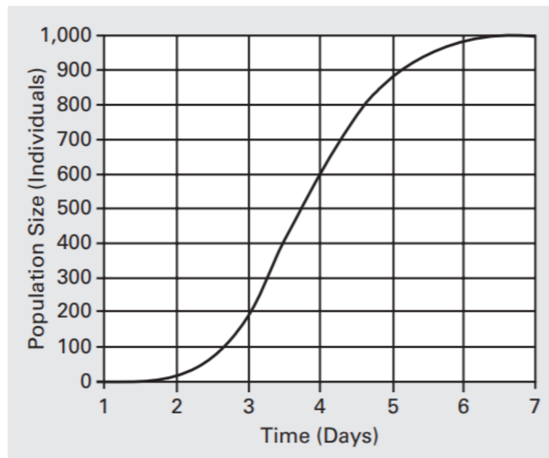
For each of the above you should construct a graph showing the following.

| | | |
|---|---|---|
| A. orientation | C. units | E. plotting data points |
| B. axis labeling | D. proper scaling | F. trend line (for above graphs 1,2 5,6 only) |

Let's learn about each graph type and then practice constructing some of them.

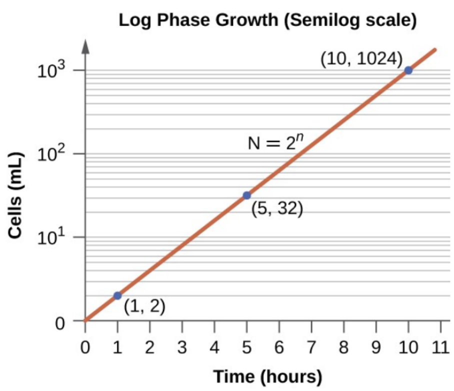
1. **<u>X, Y Graph</u>**:

   This is your standard graph with the independent variable (what you change in experiment, often a unit of time) on the X-axis and the dependent variable (what you measure in an experiment) on the Y=axis. An example is at right.



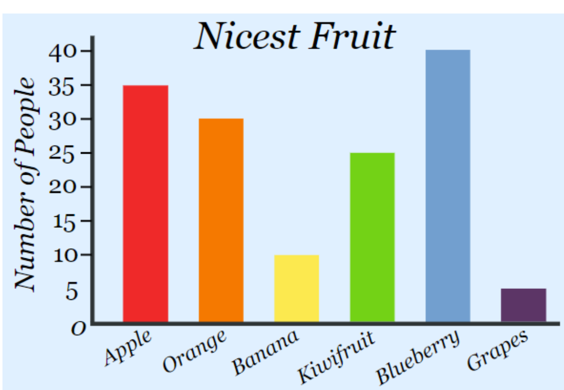

2. **<u>Log Y graph</u>**:

   This graph is similar to the X,Y graph except the Y axis is a logarithmic scale.

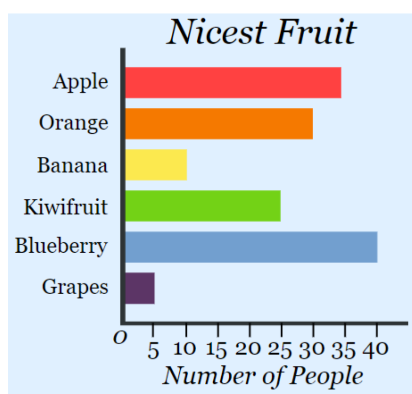



3. **<u>Bar Graph</u>**:

   A graph showing the numerical value of a variable as the height or length of a rectangle representing categorical (nonnumerical) data. Note that the categorical data can be on the horizontal or vertical axis.



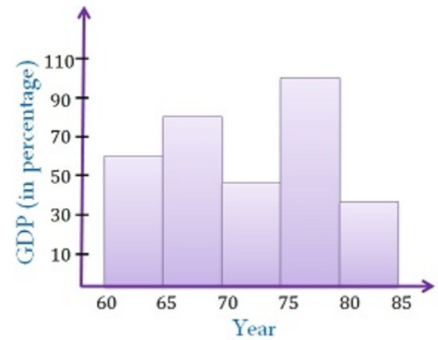

or



4. **<u>Histogram</u>**:

A histogram is like a bar graph except that the data is noncategorical and continuous (think distribution) and that the rectangles are placed side-by-side. A **histogram** represents the frequency distribution of continuous variables. Conversely, a **bar graph** is a diagrammatic comparison of discrete variables. **Histogram** presents numerical data whereas **bar graph** shows categorical data. The **histogram** is drawn in such a way that there is no gap between the **bars**.

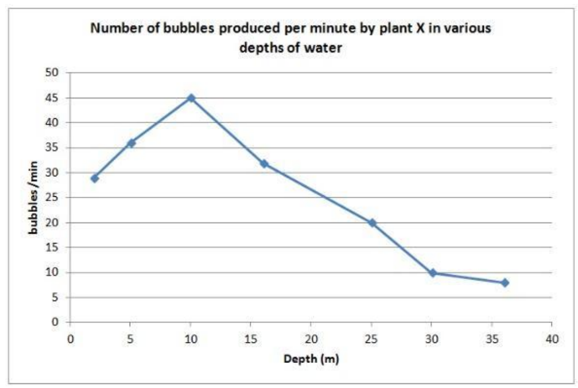

**Bar Graph**




**Histogram**

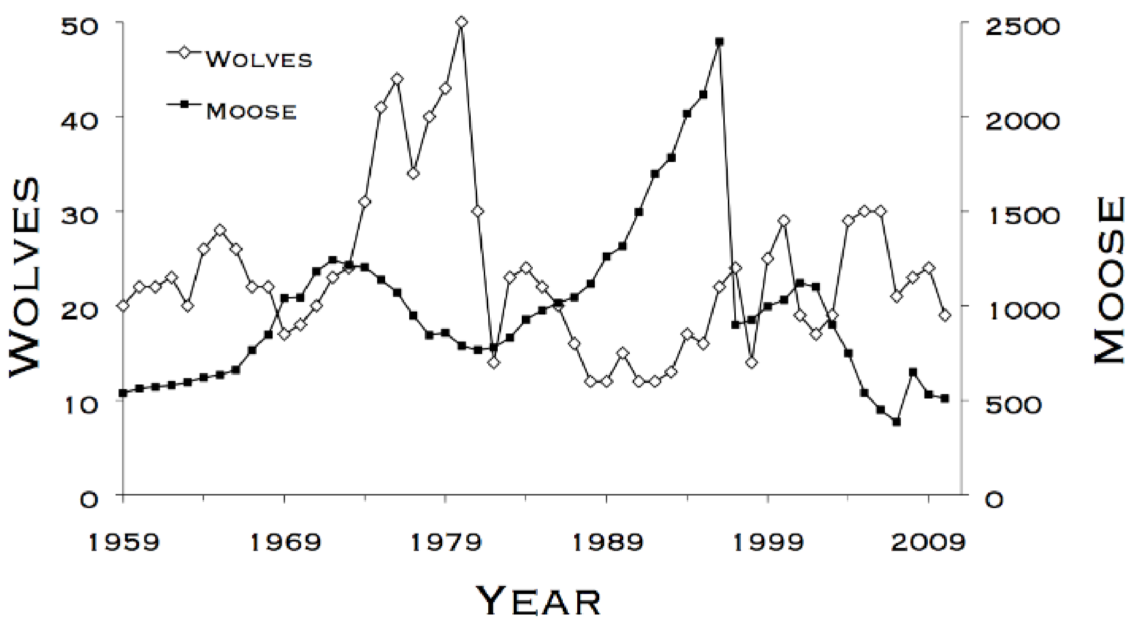
5. **<u>Line Graph</u>**:

A **line graph** consists of a series of points plotted on the grid and connected point to point by a **line**. **Line graphs** are only used when both variables are quantitative. **Line graphs** show trends, such as how things change over time. See the example at right. Lines should start and end on dots!

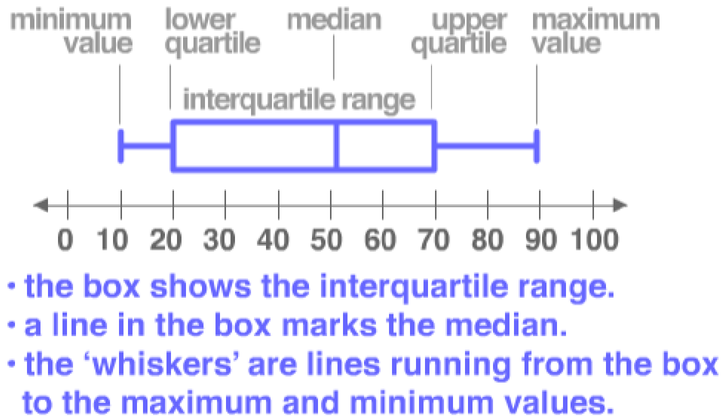


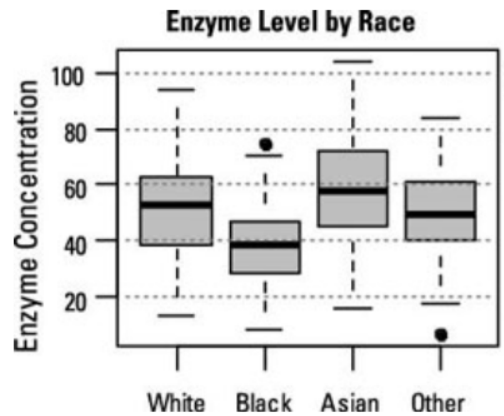

6. **<u>Dual Y Graph</u>**:

A graph showing two dependent variables (Y-axes) for the same independent variable (x-axis). The Y-axes are placed at opposite ends of the X-axis and scaled and labeled independently.

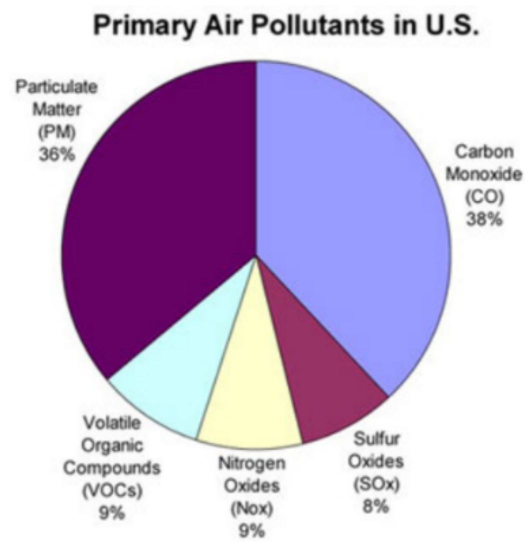


7. **<u>Box and Whisker Graph</u>**:
A graphic way to display the median, quartiles, and extremes of a data set on a number line to show the distribution of the data.




8. **<u>Pie Graph</u>**:
A special **chart** that uses "**pie** slices" to show relative sizes of data. The **chart** is divided into sectors, where each sector shows the relative size of each value. The total equals 100%.




**<u>Basic Graphical Elements</u>**:
1. **Axis labels**: You plot the independent variable (the one which you control, the inputs) on the horizontal axis (x-axis) and the dependent variable (the one you are measuring, the outputs) on the vertical axis (y-axis). Include a short descriptive label that represents each axis.
2. **Units**: Write the units in parenthesis after the axis label—often this is an abbreviation.
3. **Intervals/Scaling**: Choose uniform intervals that make it easy to read so the data occupy <u>most</u> of the graph. You can include a break in the axis if there is a large gap between zero and the data points. Be careful not to exaggerate the variations in the data if you do this.
4. **Data**: Plot the data points on the graph. You do <u>not</u> normally connect the dots. You may connect the dots but make sure the line starts and stops on a dot! Decide whether the origin (0,0) is a valid data point. If the data points show a correlation you may add a trend line (line of best fit) or a smooth curve that represents the overall pattern. If it's linear, this typically can be added by using a ruler and "eyeballing" it. A trend line is a nice way to illustrate the basic relationship between the two variables. You may need to find the equation of the trend line.
5. **Title**: Choose a title for the graph that uniquely identifies it. The title should not just repeat the labels but add information specific to what the data represents. The title informs the reader about the experiment and tells the reader exactly what is being measured.

**<u>It is Practice Time</u>**!

Correctly construct graphs and interpret data asked below.

I. Following a flu outbreak, a student gathered data on the number of students who became ill until she became sick on the 14th day of her study. The information she gathered is shown below. Create a line graph of the data below on the graph above.
Title:

| Date (Feb., 1996) | Number of ill Students |
|---|---|
| 1 | 12 |
| 2 | 18 |
| 3 | 30 |
| 4 | 49 |
| 5 | 115 |
| 6 | 127 |
| 7 | 125 |
| 8 | 107 |
| 9 | 108 |
| 10 | 115 |
| 11 | 117 |
| 12 | 95 |
| 13 | 60 |
| 14 | 52 |

1. On what day/date were the most students ill? __________
2. Between which two days was the rate of reported illnesses the greatest? __________
3. What was the greatest number of students ill on any one day? __________
4. Estimate the probable number of students who might report to be ill on day 15 if the trend continues. __________

II. In 1989, the US Department of the Interior reported that were 356 endangered species of plants and animals in the United States. These endangered organisms included

32 species of mammals,

61 species of birds,

8 species of reptiles,

5 species of amphibians,

45 species of fishes,

3 species of snails,

32 species of clams,

8 species of crustaceans,

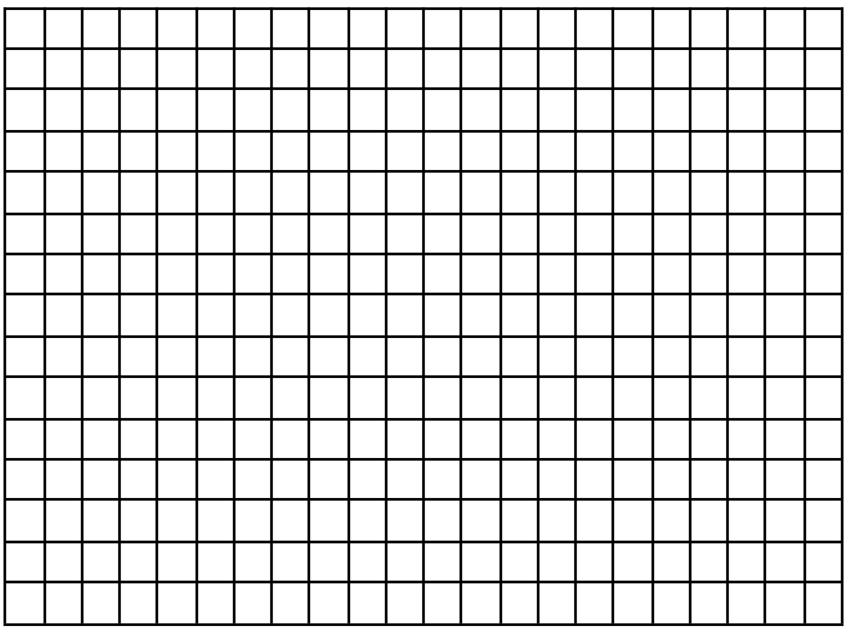
10 species of insects,

3 species of spiders, and

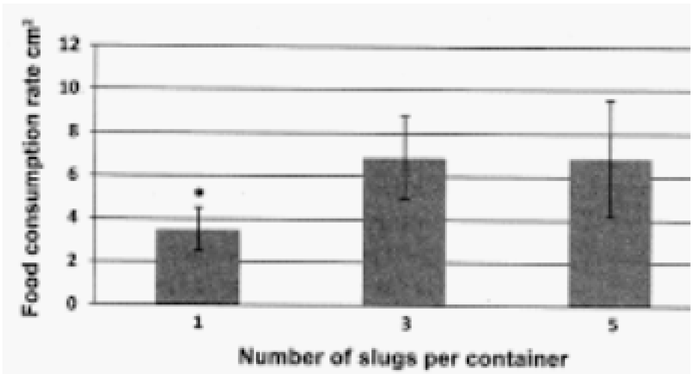
140 species of plants.

Construct a bar graph of each of the numbers of endangered plant and animal species in 1989.

Title:



III. Using standard errors (S.E.) can help one visualize if there is a significant difference between two groups. If the error bars overlap, there is likely no difference and if there is no overlap, then there is likely a difference. Note that this does not work with standard deviation, only standard error. Study the graph below and answer the accompanying questions assuming the bars represent one standard error.




Is there a significant difference in food consumption (yes/no/too close to tell) between containers having

A. 1 vs 3 slugs? __________

B. 3 vs 5 slugs? __________

C. 1 vs 5 slugs? __________

IV. Sometimes **rates** can be determined from graphs by determining the **slope** (ΔY/ΔX). Study the X,Y graph on page one and determine the change in population per day (include units!)

A. between days 3 and 4. __________ B. between days 3 and 5. __________

V. Study the dual Y graph on page 2 and answer the following questions.

A. In which year is the moose population the greatest? __________

B. What is the moose population in that year? __________

C. In which year is the wolf population the greatest? __________

D. What is the wolf population in that year? __________

VI. The **mean** is the average so add up the values and divide by the number of values.

The **mode** is the value that is most common.

The **median** is the value in the middle when all values are ordered from lowest to highest. If an even number of values exist, then the median is the average of the middle two values.

The **range** is the difference between the lowest and highest value of a set of values.

Study the flu outbreak data in Question I and solve for the following. Round to nearest whole number.

A. mean __________ B. mode __________ C. median __________ D. range ______

VII. Identify <u>two</u> differences between a bar graph and a histogram.

1.

2.