

## Graphing and Data Skills Practice

Complete the data analysis and graphing packet attached and have it ready to turn in on DAY ONE of the 2017-2018 school year. The new AP biology curriculum stresses the importance of being able to analyze and graph data. So we will begin our year with a tutorial on data analysis graphing, and statistical analysis tools that you will use throughout your AP biology year.

### **Part 1: Math and Statistics for AP Biology - Research the answer to the following questions**

1. In designing an experiment or other scientific study, why do scientists need to sample from a population rather than using an entire population?
2. Suppose you are designing an experiment to test the effects of nicotine on the heart rate of rats. What are the disadvantages of having too small a sample size (i.e., testing on too few rats)? What are the disadvantages of having too large a sample size (i.e., testing on too many rats)?
3. Explain the difference between discrete variables and continuous variables. Give an example of each.
4. Explain the difference between quantitative and categorical variables. Give an example of each.
5. What is a null hypothesis?
6. Explain the difference between a Type I error and a Type II error.
7. What are some steps that scientists can take in designing an experiment to avoid false negatives?

## **Part 2: Graphing**

Graphing is an important procedure used by scientists to display the data that is collected during a controlled experiment. Line graphs must be constructed correctly to accurately portray the data collected. Many times the wrong construction of a graph detracts from the acceptance of an individual's hypothesis

A graph contains five major parts:

- a. Title
- b. The independent variable
- c. The dependent variable
- d. The scales for each variable
- e. A legend

- The **TITLE**: depicts what the graph is about. By reading the title, the reader should get an idea about the graph. It should be a concise statement placed above the graph.
- The **INDEPENDENT VARIABLE**: is the variable that can be controlled by the experimenter. It usually includes time (dates, minutes, hours, etc.), depth (feet, meters), and temperature (Celsius). This variable is placed on the X axis (horizontal axis).
- The **DEPENDENT VARIABLE**: is the variable that is directly affected by the independent variable. It is the result of what happens because of the independent variable. Example: How many oxygen bubbles are produced by a plant located five meters below the surface of the water? The oxygen bubbles are dependent on the depth of the water. This variable is placed on the Y-axis or vertical axis.
- The **SCALES** for each Variable: In constructing a graph one needs to know where to plot the points representing the data. In order to do this a scale must be employed to include all the data points. This must also take up a conservative amount of space. It is not suggested to have a run on scale making the graph too hard to manage. The scales should start with 0 and climb based on intervals such as: multiples of 2, 5, 10, 20, 25, 50, or 100. The scale of numbers will be dictated by your data values.
- The **LEGEND**: is a short descriptive narrative concerning the graph's data. It should be short and concise and placed under the graph.
- The **MEAN** for a group of variables: To determine the mean for a group of variables, divide the sum of the variables by the total number of variables to get an average.
- The **MEDIAN** for a group of variables: To determine median or "middle" for an even number of values, put the values in ascending order and take the average of the two middle values. e.g. 2, 3, 4, 5, 9, 10 Add 4+5 (2 middle values) and divide by 2 to get 4.5
- The **MODE** for a group of variables: The mode for a group of values is the number that occurs most frequently. e.g. 2, 5, 8, 2, 6, 11. The number 2 is the mode because it occurred most often (twice)

**Problem A:** Using the following data, answer the questions below and then construct a line graph.

Depth in Meters	Number of Bubbles/Min Plant A	Number of Bubbles/Min Plant B
2	29	20
5	36	27
10	45	40
16	36	50
25	20	34
30	10	20

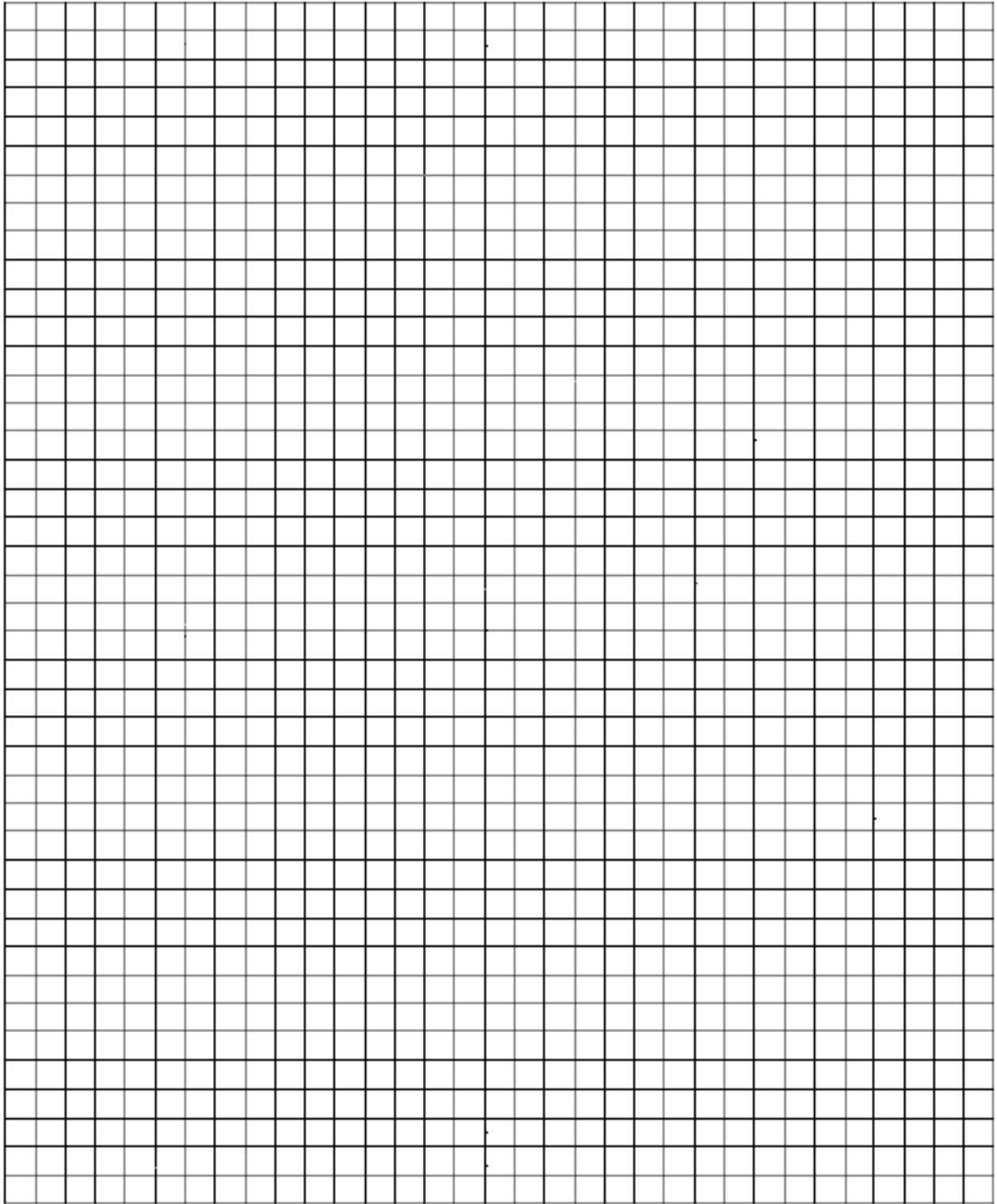
1. What is the dependent variable and why?
2. What is the independent variable and why?
3. What title would you give the graph?
4. What are the mean, median, and mode of all 3 columns of data?

a). Depth :            Mean \_\_\_\_\_ Median \_\_\_\_\_ Mode \_\_\_\_\_

b). Bubbles Plant A.: Mean \_\_\_\_\_ Median \_\_\_\_\_ Mode \_\_\_\_\_

c). Bubbles Plant B: Mean \_\_\_\_\_ Median \_\_\_\_\_ Mode \_\_\_\_\_

Title: \_\_\_\_\_



Legend:

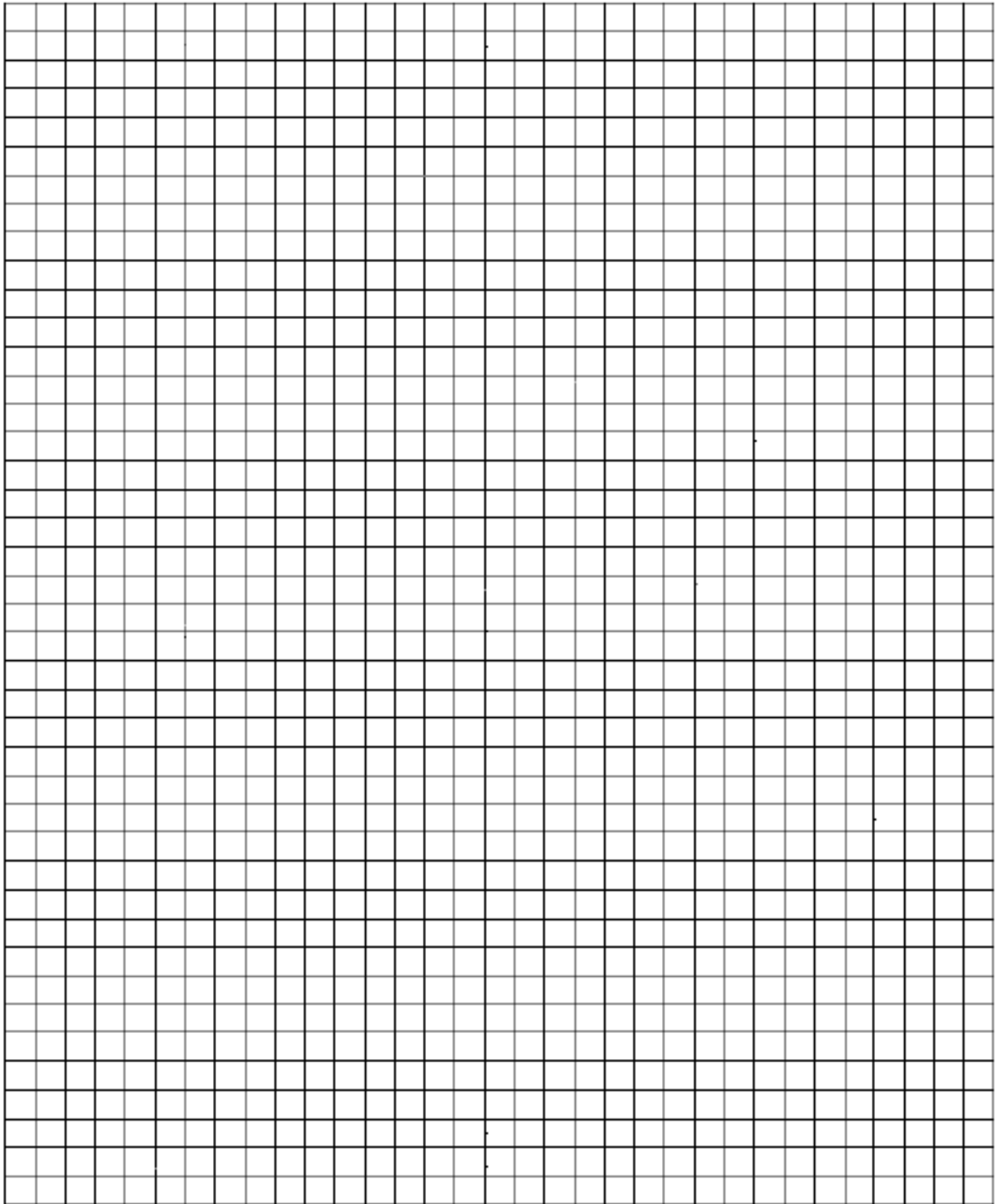
**Problem B:** Diabetes is a disease affecting the insulin producing glands of the pancreas. If there is not enough insulin being produced by these cells, the amount of glucose in the blood will remain high. A blood glucose level above 140 for an extended period of time is not considered normal. This disease, if not brought under control, can lead to severe complications and even death.

Answer the following questions concerning the data below and then graph it.

<b>Time After Eating (hours)</b>	<b>Glucose (ml/L of blood) Person A</b>	<b>Glucose (ml/L of blood) Person B</b>
0.5	170	180
1.0	155	195
1.5	140	230
2.0	135	245
2.5	140	235
3.0	135	225
4.0	130	200

1. What is the dependent variable and why?
2. What is the independent variable and why?
3. What title would you give the graph?
4. Which, if any, of the above individuals (A or B) has diabetes?
5. What data do you have to support your hypothesis?
6. If the time period were extended to 6 hours, what would the expected blood glucose level for Person B?

Title: \_\_\_\_\_



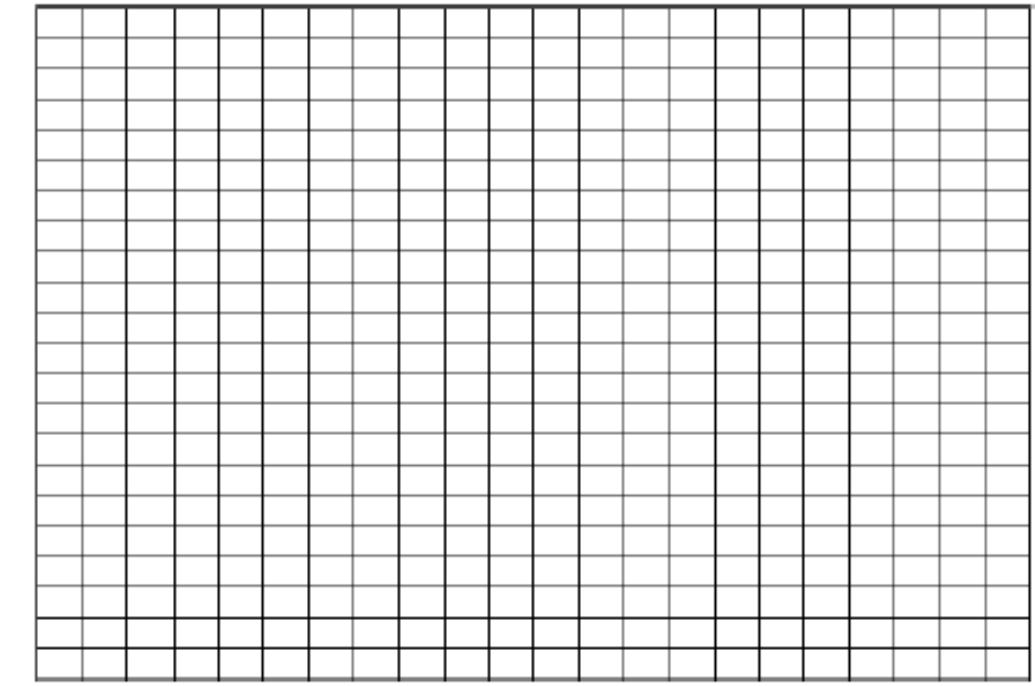
Legend:

**Problem C:** Temperatures were obtained in November in a fairly arid area of Nevada. At two different sites, temperature readings were taken at a number of heights above and below the soil surface. One site was shaded by a juniper (a plant) whereas the other was not.

Construct a line graph and plot the data

Condition	Height in cm from Soil Surface	Temp. in °C – Beneath Forest Cover	Temp. in °C – Unshaded Field
Air	150	18	20
Air	90	18	21
Air	60	18	20
Air	30	18	21
Soil Surface	0	16	33
Hummus	-6	12	19
Mineral	-15	9	15
Mineral	-30	7	12

Title: \_\_\_\_\_



Legend:

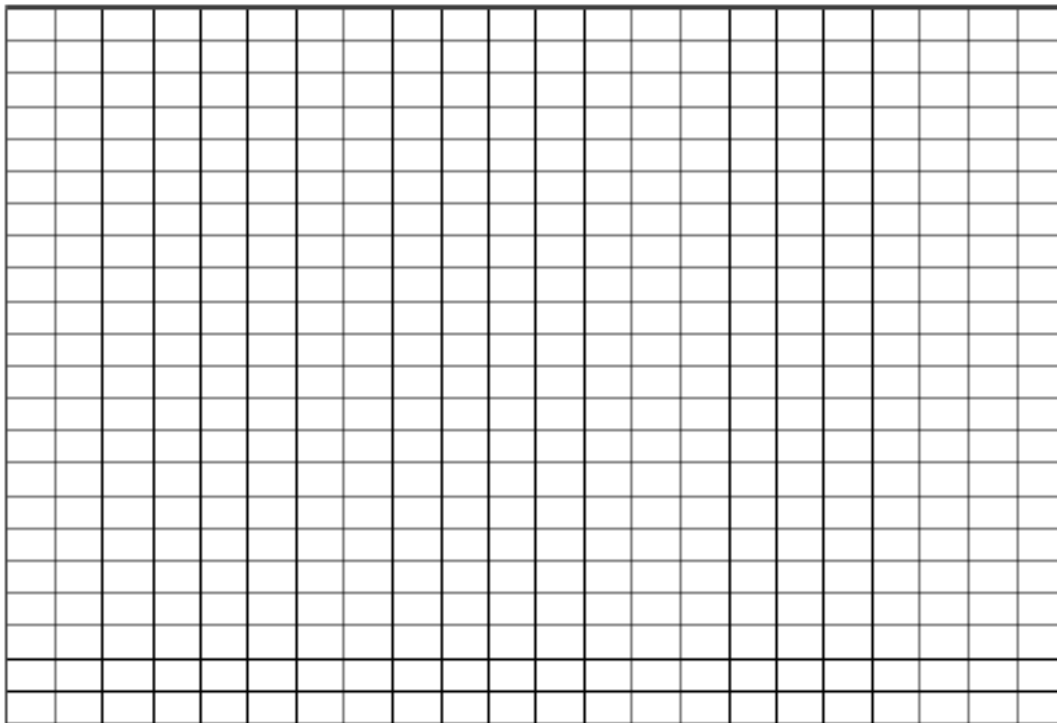
**Problem D:** A researcher interested in the disappearance of fallen leaves in a deciduous forest carried out a field experiment that lasted nearly a year. She collected all the leaves from 100 plots scattered throughout the forest. She measured the amount of leaves present in November, May and August. The percentages reflect the number of leaves found, using the November values as 100 percent.

Collection Date:	Ash	Beech	Elm	Hazel	Oak	Willow
November	4271 g 100%	3220 g 100%	2481 g 100%	1723 g 100%	5317 g 100%	3430 g 100%
May	2431 g 57%	3190 g 91%	1739 g %	501 g %	4401 g %	1201 g %
August	1376 g 32%	2285 g 71%	35 g %	62 g %	1759 g %	4 g %

Complete the table by calculating the missing percentages

Construct a line graph for the ash and elm leaves

Title: \_\_\_\_\_



Legend:



**Problem E:** A species of insect has been accidentally introduced from Asia into the US. The success of this organism depends on its ability to find a suitable habitat. The larval stage is very sensitive to changes in temperature, humidity and light intensity. Exposure to situations outside the tolerance limits results in a high mortality (death) rate. Study the data table below.

Temperature (°C)	Mortality (%)	Relative Humidity (%)	Mortality (%)	Light Intensity (fc)	Mortality (%)
15	100	100	80	300	0
16	80	90	10	400	0
17	30	80	0	600	10
18	10	70	0	800	15
19	0	60	0	1000	20
20	0	50	50	1200	20
21	0	40	70	1400	90
22	0	30	90	1600	95
23	20	20	100	1800	100
24	80	10	100	2000	100
25	100	0	100		

On the graphs, plot line graphs for the effects of temperature and humidity of mortality rates.

Title: \_\_\_\_\_

Title: \_\_\_\_\_

