Culver City H.S. • Chemistry Honors

Summer Work

CHAPTERS 1 & 2

General Information

The purpose of the summer assignment is to cover chapters one and two of the textbook, which deal with essential foundations for success in chemistry. Most of the material is review from previous science and math classes. If some material appears new, tutorials are available and students are expected to self-study. There will be a graded Summer Work Test on the first day of class.

Due Date

Summer Work must be completed and turned in on the day of registration: Wednesday, August15 for 12th graders; Thursday, August 16 for 10th & 11th graders; Friday, August 17th for 9th graders.

Failure to do so will result in being dropped from the class. No late work is accepted.
(Make copies or take pictures of your work as insurance in case pages get lost)

Textbook

Glencoe Science, Chemistry: Matter and Change
Textbooks can be picked up from the CCHS library.

Questions?

Email any questions to Mrs. McCabe annmccabe@ccusd.org

Assignment

Student Information Form *(requires ~10 minutes)*

Complete the form at https://goo.gl/forms/2ZrM8FqLupNChyZA3 *(10 points)*

Chapter One *(requires ~3 hours)*

1. Read the entire chapter, pages 2-21. SPEND TIME looking at the pictures and diagrams while reading the captions.
2. Answer the Assessment questions at the end of each Section: p.6 #1-5, p.9 #6-10, p.13 #11-16, p.17 #17-21. *(10 points)*
3. Complete "Fundamentals of Experimental Design" POGIL *(10 points)*
4. Complete "Organizing Data" POGIL *(10 points)*
5. Optional online tutorial: http://www.bozemanscience.com/scientific-method

Chapter Two *(requires ~6 hours)*

1. Read the entire chapter, pages 24-49. SPEND TIME looking at the pictures and diagrams while reading the captions. Work through the Example Problems in the yellow boxes throughout the chapter.
2. Answer the Assessment questions at the end of each Section: p.30 #4-11, p.35 #22-28, p.42 #39-44, p.45 #45-50.*(10 points)*
3. Complete the Practice Problems following each of the Example Problems in the yellow boxes: p.29 #1-3, p.32 #12-14, p.33 #15-16, p.34 #17-18, p.35 #19-21, p.38 #29-30, p.39 #31-32, p.41 #33-36, p.42 #37-38. *NOTE: the worked out solutions for each of these problems are found on pages 922-923 of the textbook. (10 points)*
4. Optional online tutorials: https://www.mathsisfun.com/numbers/scientific-notation.html
   http://www.mr-damon.com/scientific_calculator.htm
   http://www.bozemanscience.com/significant-digits,
   http://www.bozemanscience.com/factor-label-method
   http://www.chem.tamu.edu/class/fyp/mathrev/mr-da.html
5. Optional online practice quizzes: http://www.sciencegeek.net/APchemistry/APtaters/chap02counting.htm
   http://ths.sps.lane.edu/chemweb/unit1/problems/significantfigures/

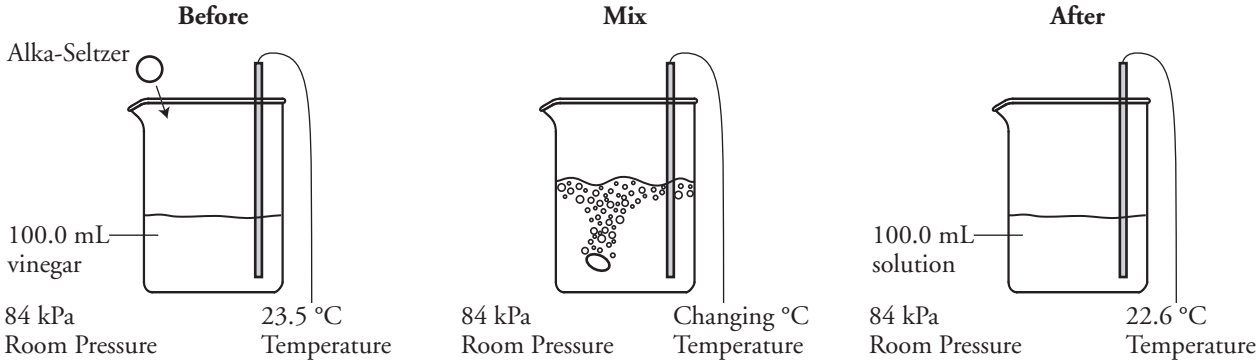
Fundamentals of Experimental Design

What is measured during a controlled experiment?

Why?

Working in the science lab can be a lot of fun. Mixing random chemicals and burning stuff just to see what happens can be entertaining (and possibly dangerous), but it doesn't lead to anything helpful to the scientific community. In order to be helpful to the community, a researcher's work in the lab must be systematic. A researcher usually asks a question and then designs an experiment to investigate that question. In this activity you will identify different types of variables that will help you design controlled experiments.

Model 1 – Alka-Seltzer® and Vinegar



1. Briefly describe the reaction illustrated in Model 1 in one or more complete sentences.

2. Did the room pressure change as the reaction occurred? If yes, was there an increase or decrease?

3. What two pieces of evidence observed during the "mix" phase of the reaction suggest that a chemical change is taking place?

4. Did the solution temperature increase or decrease during the reaction?

Model 2 – Results of Alka-Seltzer® Experiment

	Number of Alka-Seltzer Tablets	Volume of Vinegar (mL)	Room Pressure (kPa)	Initial Temp (°C) (Vinegar Solution)	Final Temp. (°C) (Final Mixture)
Trial 1	1	100.0	84	23.5	22.6
Trial 2	2	100.0	84	23.5	21.5
Trial 3	3	100.0	84	23.5	20.4
Trial 4	4	100.0	84	23.5	19.2
Trial 5	5	100.0	84	23.5	18.1

5. Which trial in the Model 2 data table corresponds to the reaction illustrated in Model 1?

6. Consider the five trials that produced the data in Model 2.
   a. What variable was purposefully changed in the experiment?

   b. What variable changed as a result of changing the variable listed in part *a*?

7. What variable(s) shown in the Model 2 data table remained constant among all the trials?

Model 3 – Boiling Points of Alcohols

Alcohol Name	Formula	Number of Carbons	Volume of Alcohol (mL)	Boiling Point (°C)	Room Pressure (kPa)
Methanol	CH_3OH	1	75	64.7	101
Ethanol	CH_3CH_2OH	2	75	78.4	101
Propanol	$CH_3CH_2CH_2OH$	3	75	97.1	101
Butanol	$CH_3CH_2CH_2CH_2OH$	4	75	117.7	101
Pentanol	$CH_3CH_2CH_2CH_2CH_2OH$	5	75	137.9	101

8. Describe the similarities and differences in the five alcohols used in the Model 3 experiment.

9. Consider the experiment that produced the data in Model 3.
   a. What variable was purposefully changed in the experiment?

   b. What variable changed as a result of changing the variable listed in part *a*?

10. What variable(s) in the Model 3 data table remained constant among all the trials?

Read This!

When designing an experiment, you need to consider three types of variables. The **independent variable** is changed by the experimenter by design. This variable is sometimes called the "manipulated variable." The **dependent variable** is what changes as a result of the change in the independent variable. This variable is sometimes called the "responding variable." In some cases more than one dependent variable is considered. The third category involves **controlled variables**. These are variables that you think might change the outcome of the experiment, but since you are not studying them, you need to keep them constant in each trial.

11. Identify the independent, dependent, and controlled variables for the experiments that produced the data shown in Model 2 and Model 3.

Model Experiment	Variables		
	Independent	Dependent	Controlled
Alka-Seltzer® and Vinegar			
Boiling Points of Alcohols			

Read This!

A well-written research question states the independent and dependent variables for an experiment. For example, a student investigated the effect of the deicer, magnesium chloride, on vegetation on the sides of highways. Her research question was, "What is the effect of magnesium chloride solution concentration on the growth of rye grass?"

12. Write a research question, using the format suggested in the *Read This!* box, for the experiments in Models 2 and 3.

    Alka-Seltzer® and Vinegar —

    Boiling Points of Alcohols —

13. A student wonders, "Will changing the volume of alcohol in a boiling point experiment change the boiling point of the liquid?" Identify the variables that should be considered in this experiment.

    Independent **Dependent** **Controlled**

Extension Questions

14. Many experiments designed to investigate the reaction of Mentos® with Diet Coke® have been documented on YouTube. Design and write an experiment that uses the knowledge gained in this activity to investigate this reaction. Include a research question; the independent, dependent and controlled variables; and a simple procedure.

15. Scientists may design an experiment with a **control group**, which is a set of organisms or samples that do NOT receive the treatment (the independent variable) that is being tested. Scientists can then compare normal changes in organisms or samples with those that might have occurred because of the treatment. The idea of a "control group" is not the same as a "controlled variable." Suppose a scientist is doing an experiment to determine the effect of a cancer drug on mice with lymphoma.

    a. What are some of the variables the scientist should control in the experiment?

    b. Describe the control group for this experiment.

Organizing Data

How is data displayed to make it meaningful?

Why?

Scientists rely on data to describe nature and uncover relationships. The raw data—measurements taken in the lab—are most useful when they are organized in a way that makes the relationships clear. In this activity you will explore two common ways that scientists organize data to help in analysis.

Model 1 – Copper Samples

Group Number	Volume (cm^3)	Mass (g)	Substance
1	2.0	17.92	Copper
2	6.0	50.89	Copper
3	10.0	93.45	Copper
4	8.0	79.30	Copper
5	14.0	125.44	Copper
6	4.0	39.80	Copper
7	12.0	103.85	Copper

Room Temperature: 21.7 °C

1. What substance were the students working with to obtain the data in Model 1?

2. What variables did the students measure to produce the data in Model 1?

3. Briefly describe an experiment that the class might have done on the day that the data in Model 1 was collected. Discuss your answer with your group members to be sure there is consensus.

4. Consider the data in Model 1.
   a. Which variable was the **independent variable** in the experiment, and why do you think it was the independent variable?

   b. Which variable was the **dependent variable** in the experiment, and why do you think it was the dependent variable?

   c. List two **controlled variables** in the experiment?

5. Consider the data in Model 1.

   a. How is the data organized?

   b. Is the table in Model 1 organized in a way that helps determine a relationship between the independent and dependent variables in the experiment? Explain.

6. Propose a better way to organize the data in Model 1, and transcribe the data into the table below.

Group Number	Volume (cm^3)	Mass (g)	Substance

7. The data table in Question 6 should allow you to state a relationship between the variables involved in the class's experiment. Complete the following statement:

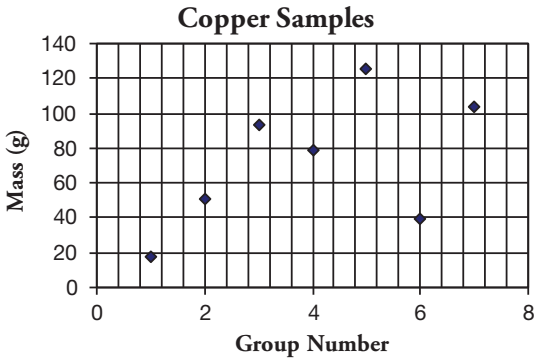
   As the volume of copper increases, the mass of copper _____.

Read This!

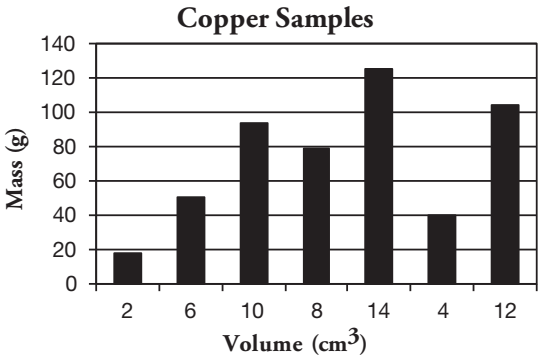
When scientists design an experiment they are usually looking for a cause-and-effect relationship between the independent variable and the dependent variable. Therefore, organizing the data by the independent variable is the easiest way to reveal a relationship. When the data is not organized, the relationships are not apparent.

Model 2 – Graphs for Copper Data

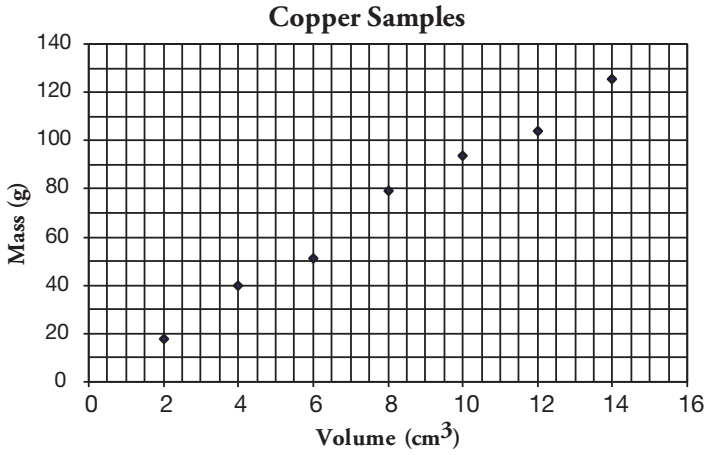
Graph A



Graph B



Graph C



8. Identify each of the graphs in Model 2 as a bar graph or a scatter plot.

9. One of the data points in graph B indicates that a volume of 8 cm^3 has a mass of 80 g. Which other graph in Model 2 shows this same data?

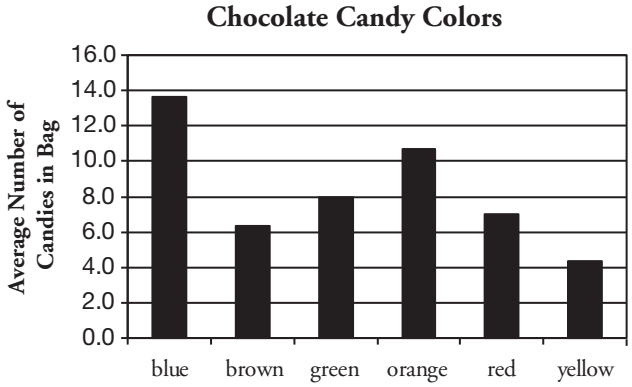
10. Of the three graphs in Model 2, which illustrates the relationship between the variables that you stated in Question 7 most clearly?

Read This!

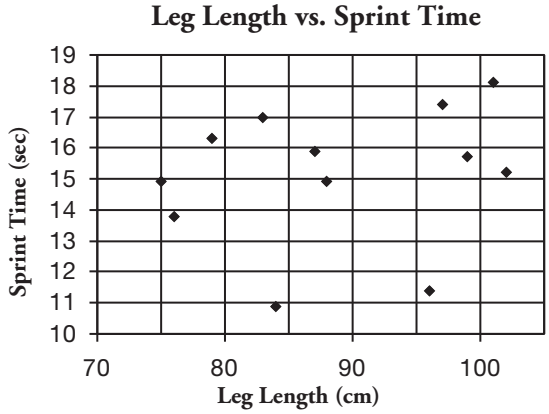
Scientists use graphs to clearly illustrate whether or not there is a relationship between variables. In most cases a scatter plot is used. Bar graphs are sometimes used if the independent variable is limited to specific numeric values (where the values in-between are not possible) or is non-numeric. A special type of bar graph called a histogram is used in cases where the scientist wants to show how often something happens.

Model 3 – More Examples of Graphs

Graph D



Graph E



11. Identify the independent variable and dependent variable for each of the graphs in Model 3.

	Graph D	Graph E
Independent Variable		
Dependent Variable		

12. Match the experimental questions below to the appropriate graph from Model 3.
    a. "Is the number of candies in a bag of chocolates dependent on the color of the candy?"
    Graph _____
    b. "Does the length of a person's leg affect the time it takes them to sprint 60 yards?"
    Graph _____
13. Why was the data for Graph D plotted in a bar graph?

14. Using the graphs in Model 2 and Model 3 as examples of proper graphs, identify the axis (*x* or *y*) where you would usually plot the independent variable.

15. For each of the following experiments, choose "scatter plot" or "bar graph" as the most appropriate way to display the data. Justify your answer.

a. Students heated oil on a hot plate at the #4 setting for different amounts of time. They wanted to answer the question "How long do you need to heat an oil bath to reach a given temperature?"

Volume Oil (mL)	Hot Plate Setting	Initial Temp. of Oil (°C)	Time Heated (min)	Final Temp. of Oil (°C)
250	#4	21	0	21
250	#4	21	5	30
250	#4	21	10	38
250	#4	21	15	47
250	#4	21	20	57

b. Students measured the height of each student in class. They wanted to answer the question "What is the most common height among 10th grade students?"

Height Range	Number of Students
under 4′ 0″	1
4′ 1″ to 4′ 6″	3
4′ 7″ to 5′ 0″	5
5′ 1″ to 5′ 6″	9
5′ 7″ to 6′ 0″	3
over 6′ 0″	1

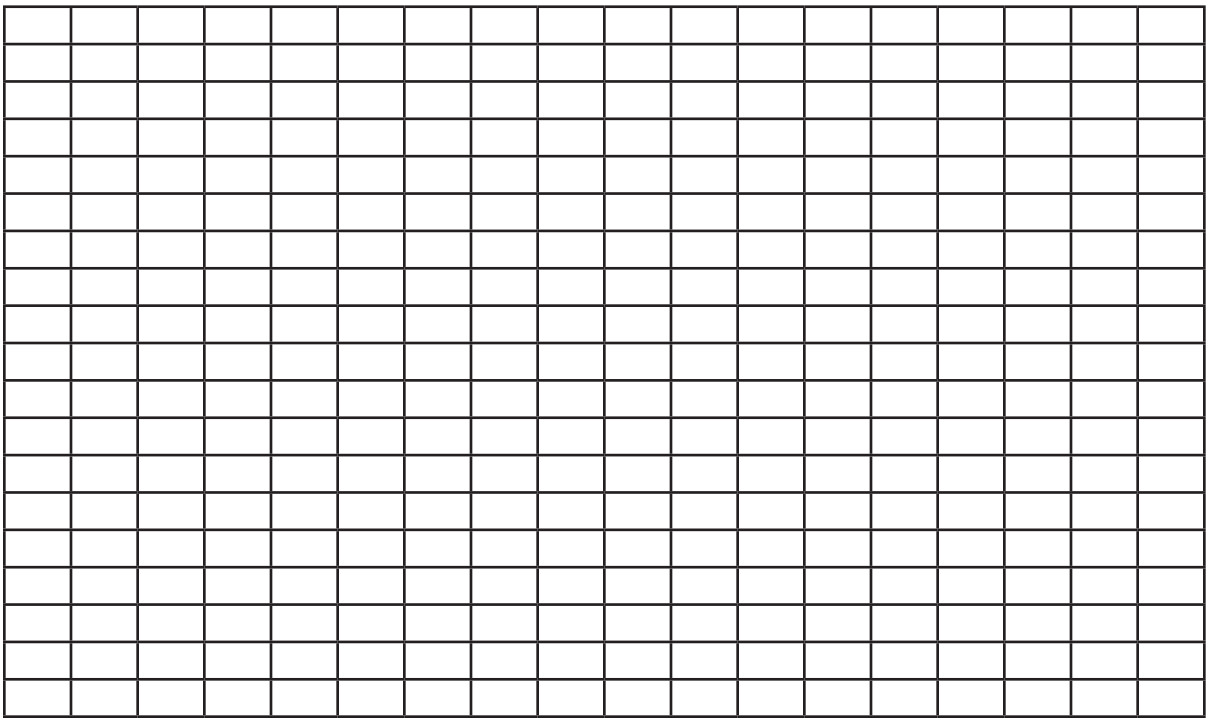
c. The Fish and Wildlife agency measured the size of Pacific salmon for 1 year and recorded the average weight for each species.

Salmon Species	Average Weight (lbs)
King	15
Sockeye	8
Silver	12
Chum	15
Humpback	5

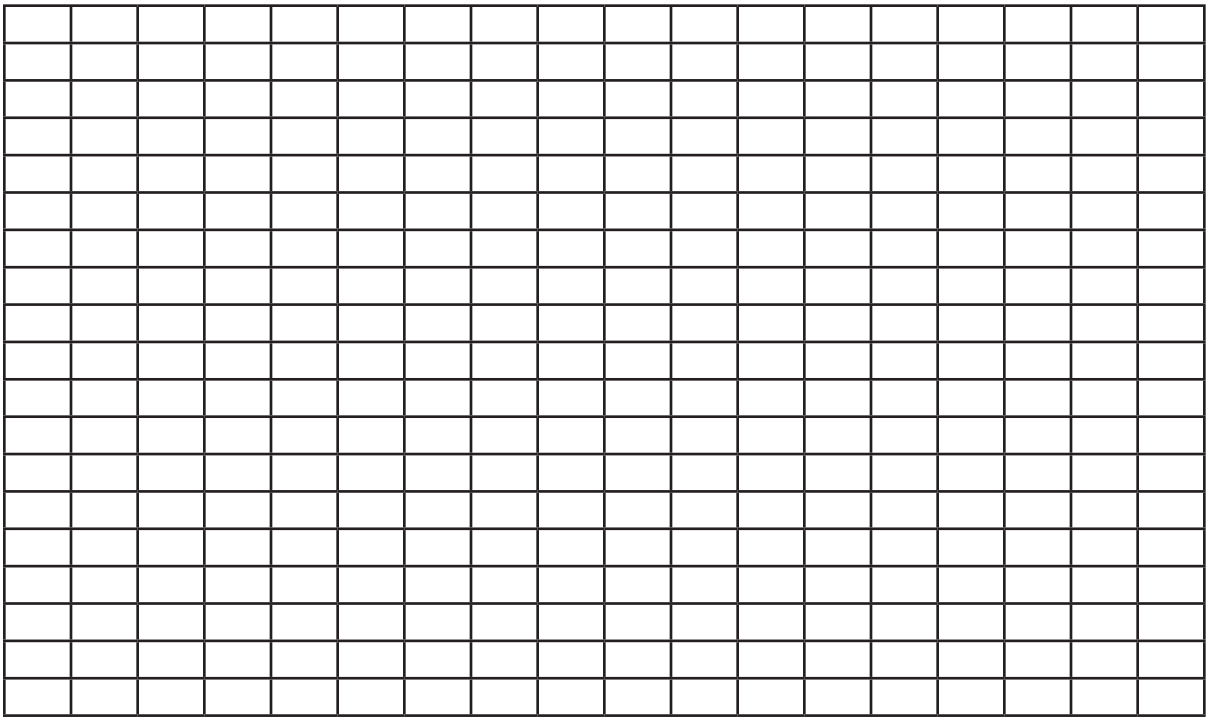
d. The National Oceanic and Atmospheric Administration measured the pressure of the atmosphere at various altitudes.

Altitude (m)	Atmos. Pressure (atm)	Altitude (m)	Atmos. Pressure (atm)
0	1.000	16,132	0.100
2750	0.750	30,901	0.010
5486	0.500	48,467	0.001
8376	0.333		

16. Choose one of the data sets in Question 15 that you selected as appropriate for a scatter plot and graph it here. Remember to label the axes.



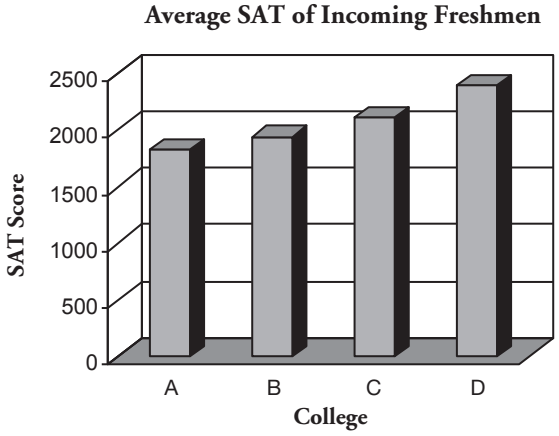
17. Choose one of the data sets in Question 15 that you selected as appropriate for a bar graph and graph it here. Remember to label the axes.



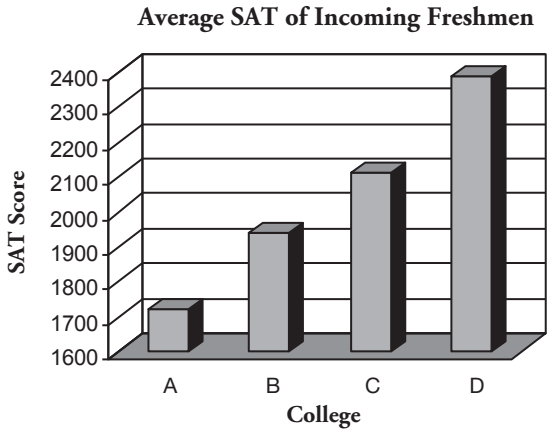
Extension Questions

Model 4 – SAT Scores

Graph F



Graph G



19. Describe the independent and dependent variables for the data that is displayed in Graphs F and G in Model 4.

20. When you look at Graph F, what message is communicated by the relative lengths of the bars to prospective students about College D's average SAT scores compared to the other three schools?

21. When you look at Graph G, what message is communicated by the relative lengths of the bars to prospective students about College D's average SAT scores compared to the other three schools?

22. For each of the graphs in Model 4, estimate the average score for each college represented by the height of the bar. Is the data being displayed in the two graphs the same or different? Support your answer with evidence from the graph.

23. A student takes a quick look at Graph G and says "Based on the size of these bars, it looks to me as though College D had entering freshman with SAT scores nearly four times higher than College A." Explain to this student what mistake he has made in processing the information presented in Graph G.