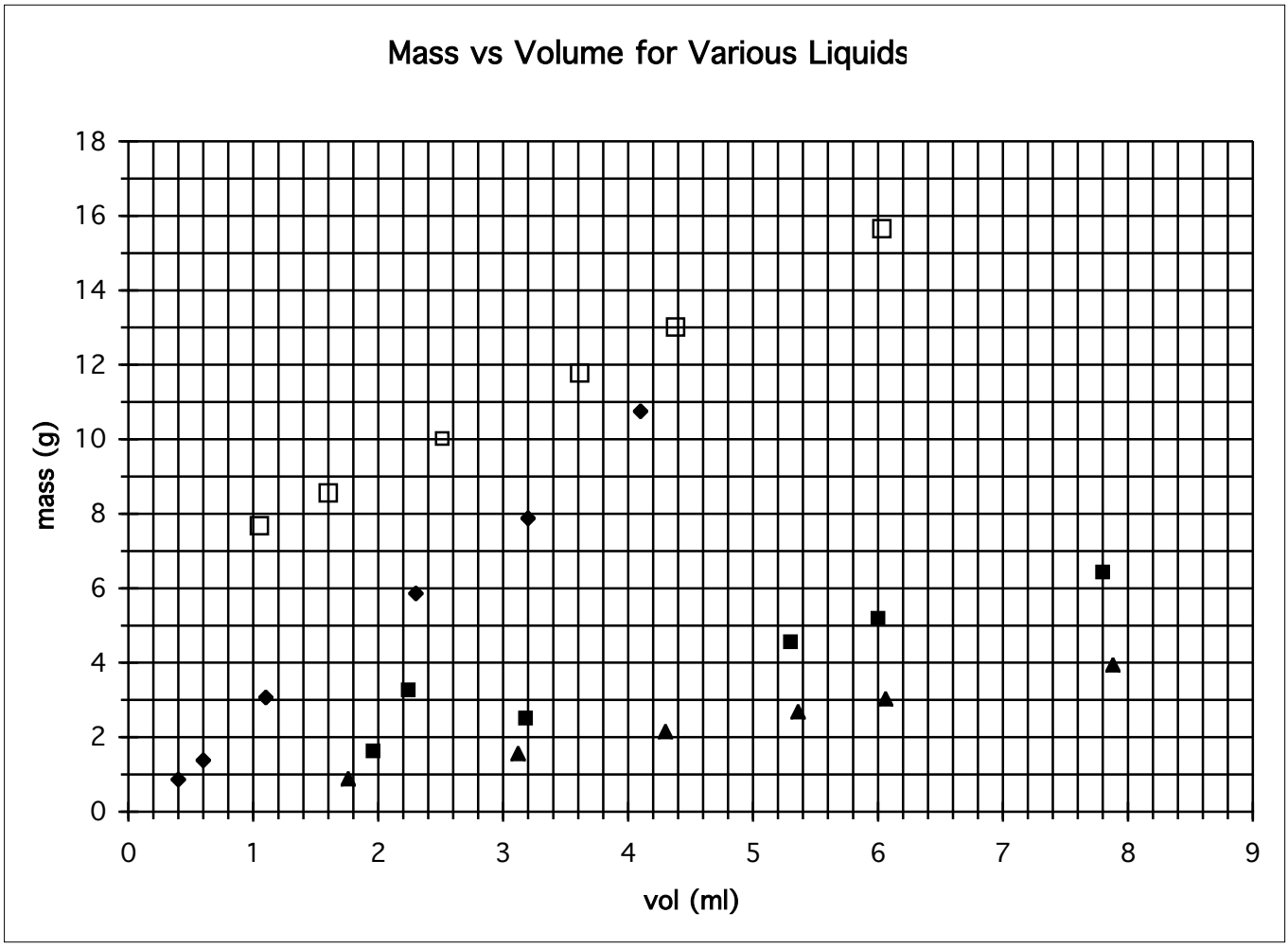
Graphing and Slope

Name_____

Use the graph below to answer the questions.

1. Draw the regression (trend) line for the "open square" data. Remember that a regression is the "average" line. Do not force the line through (0,0) if it clearly should not go there.

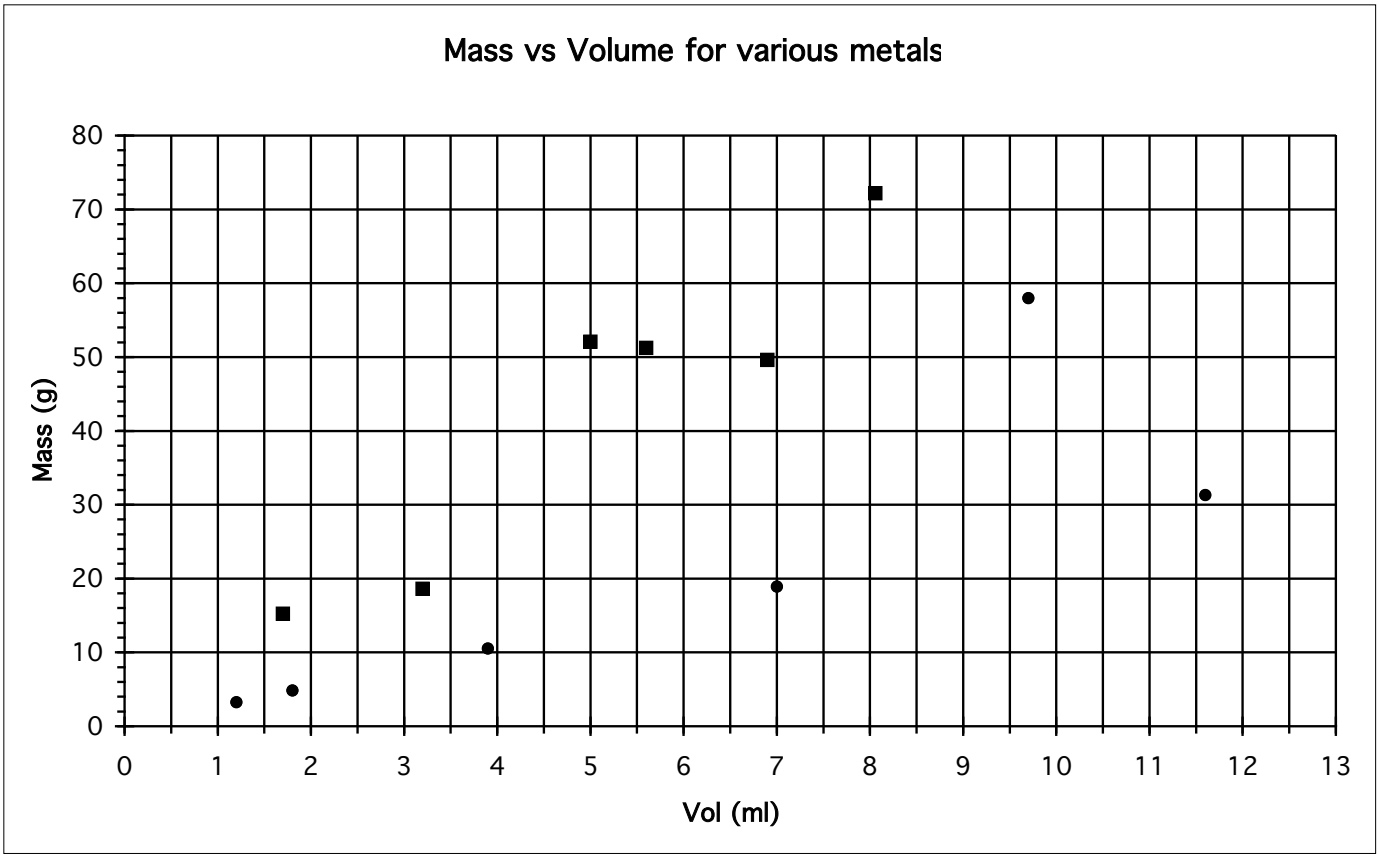


   a. Determine the slope for the open square data trend line.
   b. Mark the locations on the line that you use to determine the slope.
   c. Show your calculation work right on the graph.
   d. The open-box data is for carbon tetrachloride. (density = 1.6 g/ml) Comment on the accuracy and precision of the data.
   e. Clearly there is something wrong with the appearance of this line. Knowing that this is data for a liquid, do you have any suggestions of what may have gone wrong?

2. Draw a regression line for each of the other sets of data (diamond, square, and triangle).
   a. Determine the slope for each substance.
   b. Mark the locations on the line that you use to determine the slope.
   c. Show your calculation work right on the graph.
   d. Is(Are) there any point(s) that you may have wanted to ignore while drawing the line for your square data?
   e. Sketch a line on the graph that represents water.
   f. The triangle data is supposed to be for liquid water. Comment on the accuracy and precision of this data. Do you have any suggestions of what may have happened when this data was collected?

3. Sketch a second line that represents corn syrup.

Use the graph below to answer the questions.



4. Draw the trendline for the “square” data. Remember that a trendline is the "average" line. Eyeball the line putting some above and some below.
   a. Determine the slope for this line.
   b. Mark the locations on the line that you use to determine the slope.
   c. Show your calculation work right on the graph.
   d. The square data represents copper. Look up the theoretical density of copper. Comment on the accuracy and precision of the experimental copper data.

5. Draw the trendline for the “circle” data. Remember that a trendline is the "average" line.
   Recognize when to ignore data (as having too much error) and when to include it.
   a. Determine the slope for this line.
   b. Mark the locations on the line that you use to determine the slope.
   c. Show your calculation work right on the graph.
   d. The circle data is aluminum. Look up the theoretical density of aluminum. Comment on the accuracy and precision of the experimental aluminum data.

6. Sketch a line on the graph that represents water.

7. Sketch a second line that represents gold.

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1. When drawing the trendline for the open squares, do not draw it through the (0, 0) point. Although you would like to since 0 mass must always equal 0 volume, the points are so precise, that it would be wrong to ignore the precision that is screaming at you to draw the line through all the points
   a. Slope of open square data = ~ 1.7 g/ml
   b. Mark the spots on the line that you used to determine your slope. They need not be actual data points. In fact it is easiest to read the number for slope if you choose places on the line that is intersected by the grid.
   c. Show the value that you used for the rise, and the value for the run. Then divide it out to get the slope. Be sure and put a unit on your slope value.
   d. & e. The precision of the open square line is very good, however it seems odd that the line does not go through the (0, 0) point as all density data should. The slope of the line is ~ 1.7 g/ml which is actually quite close to the theoretical density of carbon tetrachloride. This would imply that the data is accurate, but that the student is making some systematic error, which is causing this deviation from the origin. If you look carefully you can see that it all the mass values had 6 g removed, the line would be lowered and go through the origin – perhaps the student forgot to subtract tare and thus not subtract away the 6 g mass of the container.
   e. See d above.
2. For the solid square boxes, it might be wise to ignore the one point (2.25, 3.3) since it clearly a deviation form the rest of the quite precise points. Drawing the lines for the triangles and diamonds should be fairly simple.
   a. Slope of diamonds = ~ 2.5 g/ml
      Slope of solid squares = ~ 0.83 g/ml
      Slope of diamonds = ~ 0.5 g/ml
   b. Mark the spots on the line that you used to determine your slope. They need not be actual data points. In fact it is easiest to read the number for slope if you choose places on the line that is intersected by the grid.
   c. Show the value that you used for the rise, and the value for the run. Then divide it out to get the slope. Be sure and put a unit on your slope value.
   d. See the comment above at #2
   e. The water line should be just above the solid square line. Perhaps you should pick the (6, 6) point and connect it with the origin, giving a slope = 1.0 g/ml
   f. Although the precision of the triangle data looks good, because the points are all in a tight line, clearly the triangle data has accuracy issues as it's line gives a slope of 0.5 g/ml, and the density of water should be 1.0 g/ml. This would imply that there is some systematic error causing these poor but repeating results.
3. The corn syrup line should be above the water line, but below the diamond line with a slope ~ 1.45 g/ml

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4. Try to draw your average line so that some points are above the line, and some are below the line.
   a. CAUTION – when you compute the rise over the run, do NOT just count boxes, because you should note that the value of the boxes on the y axis are 10 each, and on the x axis, they are 0.5 each. The square data should have a slope approx = 8.6 g/ml. Your line may vary slightly due to the difficulty of fitting the line to the plotted points.
   b. Mark the spots on the line that you used to determine your slope. They need not be actual data points. In fact it is easiest to read the number for slope if you choose places on the line that is intersected by the grid.
   c. Show the value that you used for the rise, and the value for the run. Then divide it out to get the slope. Be sure and put a unit on your slope value.
   d. Remember that you can look theoretical density values up on the Reference page that you can get on the Ch 5 documents page. The squares representing the copper data show an average line with a slope (density) very close to the theoretical value for copper (D = 8.96 g/ml) making it quite accurate; however, the data is not very precise as they are quite scattered around the line.
5. For the circle data, it is probably a good idea to ignore the point that clearly has error (9.7,58)
   a. CAUTION – when you compute the rise over the run, do NOT just count boxes, because you should note that the value of the boxes on the y axis are 10 each, and on the x axis, they are 0.5 each. The circle data should have a slope approx = 2.9 g/ml. Again, yours may vary slightly.
   b. Mark the spots on the line that you used to determine your slope. They need not be actual data points. In fact it is easiest to read the number for slope if you choose places on the line that is intersected by the grid.
   c. Show the value that you used for the rise, and the value for the run. Then divide it out to get the slope. Be sure and put a unit on your slope value.
   d. Remember that you can look theoretical density values up on the Reference page that you can get on the Ch 5 documents page. Since the circle data is representing aluminum, and the slope of the average line comes out to ~ 2.9 g/ml, you might say that the accuracy of the data as a whole is quite good. The precision is also good (with the exception of the one point) since most of the points fall very close to the average line.
6. When drawing the water line, pick a point far from the origin, such as (10, 10) then put one end of your ruler on the (0,0) point and the other end on the (10,10) point and connect. This will of course give a slope of 1.0 g/ml.
7. When drawing a line to represent gold, you might pick the point (1, 19.3) and connect it with the (0, 0) point.