**Questions: These are answered in the Report Sheet**

Answer the following questions with complete sentences and good grammar on a separate sheet of paper. Make sure your name is on each sheet, in the upper right hand corner. Number each answer. Although you do not have to re copy the question, it is always a good idea. If you want a word document, because you want to type your answers with the corresponding question, just ask.

**SECTION 4: QUESTIONS**

Answer the following questions with complete sentences and good grammar on this report sheet. Alternatively, you can type your answers if you so desire.

1. What is a meniscus?
2. Where is a liquid volume reading taken in relation to a meniscus?

1. In Part IIB, you determined the volume of water based on reading the volume in a graduated cylinder and the mass of the volumes water in the cylinder. Answer the following questions:
	1. Determine the volume of the water in the cylinder based on the mass of the water in the cylinder: Use the mass of the water in the cylinder and the density of the water from the CRC (IIb 1 & 2)
	2. Were the volumes the same? If they differed, how much did they differ by? For example, your volume by reading might be 10.3 mL and your volume by mass might be 10.8 mL.
	3. What does the percent difference tell you in terms of your precision using the graduated cylinder?
	4. Why was it important to take the temperature of the water?
2. Which of the following pieces of equipment is designed to deliver a volume of liquid? Which is designed to contain a specific volume of liquid? Explain your choices denoting the differences between the types of glass ware.
3. graduated cylinder,
4. pipette,
5. burette.

1. Suppose a 10-mL burette is used that has calibration marks representing each 1-mL and 0.1-mL. Accurate readings should be estimated and recorded to the nearest (a) 1.0-mL, (b) 0.1-mL, (c)0.01-mL, (d) 0.001-mL. Choose one and explain your answer.

1. An experiment calls for the measurement of 50-mL of water. Three students working in a group discuss the appropriate graduated cylinder to use to obtain the 50-mL water. Student A wants to use a 10-mL graduated cylinder with a precision of ±0.01mL but they would have to make 5 (five consecutive measurements to obtain the total volume); Student B wants to use a 25-mL with a precision of ±0.1 mL but they would have to make 2 (two consecutive measurements to obtain the total volume); Student C wants to use use a 100-mL with a precision of ±0.2 mL with no extra measurements.
2. Which student’s choice would allow the group to have the smallest overall systematic error?
3. Why is it important to choose the tool with the appropriate precision to make a measurement?
4. Although we did not use linear measurement in this lab, we often should consider significant figures in other tools. Consider a block with rectangular sides whose dimensions have been measured with a millimeter ruler. The height is 254.7 mm, the width is 136.8 mm, and the depth: 25.3 mm.
	1. Determine the volume of the block in cubic millimeters. Carry the answer to 5 significant figures

* 1. Determine the volume of the block if you assume that each of the above measurements should be 0.1 mm higher than listed. Carry the answer to 5 significant figures
	2. With which digit do the answers in parts ‘a’ and ‘b’ begin to differ? If you report the volume using all of the digits that are the same in parts ‘a’ and ‘b’ plus one more digit where the two values do not agree, how many digits should you report?
	3. How many digits would you report according to the rules for significant figures? Is this the same as in part c?

1. The density of water is very close to 1 g/mL at room temperature. You wish to determine the density of a sample with an approximate volume of 25 mL, and an approximate mass of 25 g. To how many significant figures should you report the density if you use the following tools: (Precisions for the tools are listed in Tables 1 & 2 in the instructions.) Please **explain** your choice in a complete sentence. Example: A kitchen balance with a precision of ±0.2g and a 25-mL graduated pipette. **For example, the mass of a sample of water is 25.0 g using a kitchen balance. The volume of the sample is 25.00 mL using a 25-mL graduated pipette. Since the mass of water has 3 significant figures and the volume of water has 4 significant figures, one would report 3 significant figures. The density would be 1.00 g/mL. GIANT HINT: Read the background document when doing this problem!**
	1. Analytical balance and 25-mL pipette
	2. Centigram balance and 25-mL pipette
	3. Semi-micro balance and 50-mL burette
	4. Centigram balance and 100 mL graduated cylinder
2. A student fills a burette with distilled water, adjusts the meniscus to reread 0.00-mL, and allows water to drain out until a reading of 10.00-mL is obtained. The water sample, weighed by difference has a mass of 9.72 g indicating that 9.72 mL of water were probably delivered. Which of the following experimental errors will account for the large difference between the volume according to readings and the volume according to mass? (There might be more than one correct or wrong answer). Give an explanation why each choice is either a contributing factor to the error in the volume or not a contributing factor to the error in the volume. (it helps to draw pictures!)

a) Initially the meniscus was above the 0.00-mL mark.

b) The final meniscus was below the 10.00-mL mark.

c)Air was not cleared from the burette tip before delivering the sample.

d)Water leaked from the burette into the beaker after the final burette reading was taken.

**Explain your** **answer**.

Grading: Neatness, attention to detail, completeness, typed answers.