

Measurement

1-In a density experiment, a student experimentally measures the following four values for the density of liquid ethanol: 0.772g/ml, 0.774g/ml, 0.785g/ml, and 0.775g/ml. The theoretical density of ethanol is 0.789 g/ml at 20 °C.

a. Compute the average density of ethanol.

$$0.772\text{g/ml} + 0.774\text{g/ml} + 0.785\text{g/ml} + 0.775\text{g/ml} = 3.106 \text{ g/ml}$$

$$(3.106 \text{ g/ml})/4 = \mathbf{0.7765 \text{ g/ml}} \quad \text{---average}$$

b. Compute the % error for the average density (to 2 sig figs).

$$[\text{Absolute difference value of } (0.789 \text{ g/ml} - 0.7765 \text{ g/ml})] / 0.789 \text{ g/ml} = 0.0158 = 0.016$$

$$0.016 \times 100\% = \mathbf{1.6\%}$$

c. Compute the standard deviation for this data (to 2 sig figs).

$$s = \text{square root } \{(2.025 \times 10^{-5} + 6.25 \times 10^{-6} + 7.225 \times 10^{-5} + 2.25 \times 10^{-6}) / 4\} = \mathbf{2.5 \times 10^{-5}}$$

d. Is this data accurate? precise? Explain.

Precise since the values are almost the same to each other. The reason it is not accurate because the 4 values are too far from the theoretical density of ethanol is 0.789 g/ml.

2-Write the following measurements in scientific notation. Assume that terminal zeros of whole number are not significant. Remember that WebAssign uses the calculator notation of e instead of 10.

a. 850 g = $\mathbf{8.50 \times 10^2 \text{ g}}$

b. 0.00025 L = $\mathbf{2.5 \times 10^{-4} \text{ L}}$

c. 2350000 m = $\mathbf{2.35 \times 10^6 \text{ m}}$

3-Using appropriate rules for rounding, round each of the following numbers to three significant figures:

a. 34.7823 m = $\mathbf{34.8 \text{ m}}$

m

b. 0.003117 L = $\mathbf{0.00312 \text{ L}}$

L

c. 3356.8 s = $\mathbf{3360 \text{ s}}$

s

d. 1.2936 kg = $\mathbf{1.30 \text{ kg}}$

kg

Multiplication and Division

Perform the following calculations of measured numbers. Give the answers with the correct number of significant figures. Round your final answer only. Assume all numbers are measurements.

a. $57 \times 0.55 = 31.35$ --- **31**

b. $61.7 / 11 = 5.609$ --- **5.6**

c. $(2.327)(0.585)/((8.42)(0.0065)) = 24.87292$ ---- **24.9**

d. $95.0 / 5.00 = 19.0$

Addition and Subtraction

Perform the following calculations and give the answer with the correct number of significant figures.

a. $20.6 \text{ cm} + 0.179 \text{ cm} = 20.779$ -----**20.8 cm**

b. $106.21 \text{ mL} + 0.773 \text{ mL} + 53 \text{ mL} = 159.983 \text{ mL}$ -----**160 mL**

c. $153.751 \text{ g} - 15.57 \text{ g} = 138.181 \text{ g}$ ---- **138.18g**

4. Identifying each of the following numbers as measured or exact; give the number of significant figures in each. You may also type infinite or vague when appropriate.

a. 47.0 g – **measured, 3**

b. 10 pencils – **exact, 1**

c. 0.0005 cm – **measured, 1**

d. 550000 km – **measured, 2**

e. 3 eggs – **exact, 1**

5. Identify each of the following as an exact or a measured number.

(a) thickness of a book --- **measured number**

(b) number of tea bags needed to make a pot of tea -- **exact**

(c) number of pencils in a pack -- **exact**

(d) number of eggs in a 3-egg omelet -- **exact**

6- Type of Measurement/Metric Unit/Abbreviation

weight --- **gram** ----- **g**

The ruler below measures in arcmins. Using what you have learned about precise measurement, how long is the line in arcmins?

arc-minute(MOA) to *degree* (MOA to °): ° = MOA ÷ 60

reading is 9.2, $9.2 / 60 = 0.153^\circ$



Examine the graduated cylinder below. Choose the best volume reading. You have only ONE submission for this question. – **40.3 mL**

