SKILLS YOU WILL NEED FOR THE SECOND QUIZ

1. Multiply or divide two algebraic expressions. For example,

   (3x)(2y) = 6xy **(8xy) ÷ (2y) = 4x**

2. Multiply or divide two numbers with units and give the result in scientific notation. (REMEMBER THAT THE ALGEBRAIC RULES FOR UNITS ARE EXACTLY THE SAME AS THE RULES FOR LETTERS AND OTHER FACTORS. IF YOU MULTIPLY TWO NUMBERS, YOU MUST ALSO MULTIPLY THEIR UNITS.)

   [2.50 x 10^4 miles per hr.][3.0 hr.] = 7.5 x 10^4 miles

3. Use what we learned about experimental error:
   a. Determine the "most likely value" (MLV) of the thing being measured by averaging the results, as on pages 2 & 3. (Cross out the highest and lowest according to the olympic rule if they seem unlikely to be correct.)
   b. Determine the SLV and GLV as we did on pages 2 & 3.
   c. Estimate the uncertainty of the measuring technique by subtracting the SLV from the GLV and then dividing the result by 2, as we did on pages 2 & 3.

4. Given the amount of time needed for a pendulum to swing back and forth several times, calculate the period of the pendulum as we did on page 4. For example,

   [15 sec.]÷[10 swings] = 1.5 seconds per swing.

5. Use the distributive law to divide a number with an uncertainty by a counted quantity as we did on page 4. For example:

   [15 ± 0.5 sec.]÷[10 swings] = 1.5 ± 0.05 seconds per swing.

6. Convert a number with an uncertainty into "range" form. For example,
   3.45 ± 0.04 cm. = "probably between 3.41 and 3.49 cm."

7. Calculate the MLV, GLV, and SLV of a product or quotient by the "range" method as on pages 4 and 4b, and as on the previous quiz. For example,

   (600 ± 6 yards)÷(20 ± 0.2 minute) = "between 29.4 and 30.6 yd/min."

8. Convert an uncertainty from absolute form into percentage form by using #19 on RS I:

   600 ± 12 yards = 600 yards ± 2%

9. Given the mass of an object and the strength of gravity, calculate the gravitational pull on the object by using # 12 on RS I:

   (10 kg)(0.37 pounds per kg) = 3.7 pounds

10. Use all of the skills employed on the previous quiz.

1999 QUIZ #2 **name: _____**

1. Multiply as indicated. Answer in scientific notation, with units.
   a. $(3.60 \times 10^5 \text{ sec})(2.00 \times 10^4 \text{ cm/sec}) =$ _____ _____
   b. $(3.0 \times 10^{-7} \text{ cm})(1.5 \times 10^3 \text{ cm}) =$ _____ _____
   c. $(25.0 \pm 1 \text{ kg per in}^2)(3000 \pm 10 \text{ in}^2) =$ "between _____ and _____ ___"
2. Divide as indicated:
   a. $(100y^2) \div (2.35xy) =$ _____
   b. $9.9\text{kg} \div 3.3\text{kg} =$ _____
3. Divide as indicated. Answer in scientific notation, with units if necessary.
   a. $(6.4 \times 10^{-6}\text{grams}) \div (3.2 \times 10^{-4}\text{grams per meter}) =$ _____
   b. $(1.2 \times 10^{12} \text{ sq.mile}) \div (4.8 \times 10^{15} \text{ barrel}) =$ _____ ____
4. A pendulum swings ten times in 14.21 seconds, according to one student's stopwatch. Five other students timed the same ten swings with their own stopwatches. Their results were 12.65, 12.71, 12.84, 12.97, and 13.35 seconds.
   a. Estimate the uncertainty of that measuring process. _____ _____
   b. Determine the MLV and uncertainty of this pendulum's period. _____ ____ ____
5. A certain automobile consumes 9.56 ± 0.03 gallons of gasoline when driven 264 ± 3 miles. To determine its "gas mileage" you must divide the distance driven by the amount of gasoline consumed.
   a. Calculate the GLV of that gas mileage. _____ _____
   b. Calculate the SLV of that gas mileage. _____ _____
   c. Calculate the MLV of that gas mileage. Don't forget the units! _____ _____
   d. Estimate the uncertainty of that gas mileage. _____ _____
   e. Calculate the percentage uncertainty of the given amount of gasoline. _____
6. Calculate the gravitational pull on a 3.5-kilogram watermelon in Woodbridge. (Use SI units.)
7. Convert 250 feet to meters. (Use the method on page 6.)

1999 QUIZ #2 Solutions

1. Multiply as indicated. Answer in scientific notation, with units.

   a. $(3.60 \times 10^5 \text{ sec})(2.00 \times 10^4 \text{ cm/sec}) =$ ***7.20 x 10^9 cm***

   b. $(3.0 \times 10^{-7} \text{ cm})(1.5 \times 10^3 \text{ cm}) =$ ***4.5 x 10^{-4} cm^2***

   c. $(25.0 \pm 1 \text{ kg per in}^2)(3000 \pm 10 \text{ in}^2) =$ ***between 7.416 x 10^4 and 7.826 10^4 kg***

2. Divide as indicated:

   a. $(100y^2) \div (2.35xy) =$ ***42.5 y/x*** b. $9.9\text{kg} \div 3.3\text{kg} =$ ***3.0***

3. Divide as indicated. Answer in scientific notation, with units if necessary.

   a. $(6.4 \times 10^{-6}\text{grams}) \div (3.2 \times 10^{-4}\text{grams per meter}) =$ ***2.0 x10^{-2} meter***

   b. $(1.2 \times 10^{12} \text{ sq.mile}) \div (4.8 \times 10^{15} \text{ barrel}) =$ ***0.25 x 10^{-3} sq. mile/barrel***

4. A pendulum swings ten times in 14.21 seconds, according to one student's stopwatch. Five other students timed the same ten swings with their own stopwatches. Their results were 12.65, 12.71, 12.84, 12.97, and 13.35 seconds.

   a. Estimate the uncertainty of that measuring process.

   Using the "olympic rule" we delete the highest and lowest, keeping two-thirds of the data. The greatest and smallest remaining values are called the "GLV and SLV", or greatest and smallest likely values.
   The uncertainty is then (GLV - SLV)/2 = (13.35 - 12.71 sec)/2 = ***0.32 sec.***

   b. Determine the MLV and uncertainty of this pendulum's period. _____ ____ ____

   The period is the amount of time needed for one swing. The average of the four remaining time intervals is 12.97 ± 0.32 sec. Dividing that average by 10 swings and rounding off properly gives the period: ***1.29 ± 0.03 sec/swing***

5. A certain automobile consumes 9.56 ± 0.03 gallons of gasoline when driven 264 ± 3 miles. To determine its "gas mileage" you must divide the distance driven by the amount of gasoline consumed.

   a. Calculate the GLV of that gas mileage. ***(267 mi)/(9.53 gal) = 28.0 mi/gal***

   b. Calculate the SLV of that gas mileage. ***(261 mi)/(9.59 gal) = 27.2 mi/gal***

   c. Calculate the MLV of that gas mileage. ***(264 mi)/(9.56 gal) = 27.6 mi/gal***

   d. Estimate the uncertainty of that gas mileage. ***(28.0 - 27.2)/2 = ± 0.4 mi/gal***

   e. Calculate the percentage uncertainty of the given amount of gasoline.

   ± 0.3 gal/9.56 gal = ± 0.03 = ± 3%

   Note: I asked for the uncertainty of the given amount of gasoline rather than the calculated gas mileage so that students would not lose two points for one mistake.

6. Calculate the gravitational pull on a 3.5-kilogram watermelon in Woodbridge.

   (3.5 kg)(9.8 N/kg) = ***34.3 newtons***

7. Convert 250 feet to meters.

   (250 ft)/(3.27 ft/m) = (250 ft)(0.306 m/ft) = ***76.45 m***