Unit 1: Measurements in Science Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Block: \_\_\_\_\_\_

|  |
| --- |
| **Learning Targets**  *At the end of the unit, students should have mastered the following learning targets:* |
| 1. I CAN describe how to behave safely in a lab and can select the correct measurement tool in a lab setting |
| 1. I CAN write a given value in scientific notation; I CAN determine the standard notation for a given value written in scientific notation |
| 1. I CAN determine the number of significant digits in a given value in standard notation |
| 1. I CAN determine the number of significant digits in a given value in scientific notation |
| 1. I CAN describe the difference between precision and accuracy; I CAN determine whether a scenario is accurate or precise (or both) |
| 1. I CAN record laboratory measurements to the limit of precision, using the correct number of significant digits |
| 1. I CAN calculate (+, -, x, ÷) values and report the answer in the correct number of significant digits |
| 1. I CAN state the units of the metric system and describe what they are used to measure (i.e. meters are for distrance) |
| 1. I CAN convert between values within the Metric System (i.e. kilometers to meters to centimeters, etc.) *\*The metric system needs to be memorized: kilo, deca, deci, centi, milli, micro* |
| 1. I CAN convert between two units using dimensional analysis using both the English and Metric Systems (i.e. using conversion factors developed from equality statements) |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Chemistry Calendar | | | | |
| Monday | Tuesday | Wednesday | Thursday | Friday |
| January 16 | 17 | 18 1st day of Semester  45 min ADV | 19 | 20 |
| 23 | 24 | 25 | 26 | 27 |
| 30 | 31 | February 1 | 2 45 min ADV | 3 |

**Scientific Notation Practice**

**Notes on Scientific Notation:**

Convert the following to scientific notation:

1. 0.005 = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
2. 5,050 = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
3. 0.0008 = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
4. 1,000 = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
5. 1,000,000 = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
6. 0.25 = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
7. 0.025 = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
8. 0.0025 = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
9. 500 = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
10. 5,000 = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

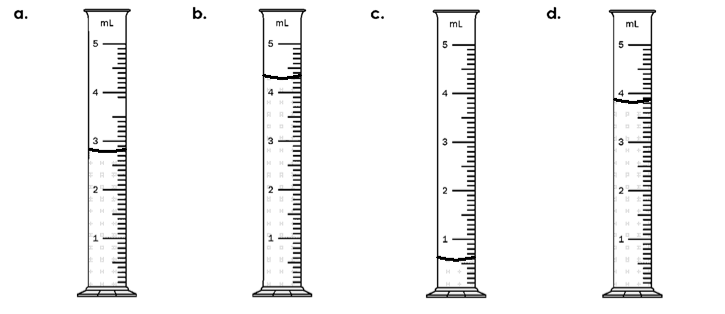
Convert the following to standard notation:

1. 1.5 x 103 = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
2. 1.5 x 10-3 = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
3. 3.75 x 10-2 = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
4. 3.75 x 102 = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
5. 2.2 x 105 = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
6. 3.35 x 10-1 = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
7. 1.2 x 10-4 = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
8. 1 x 104 = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
9. 1 x 10-1 = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
10. 4 x 100 = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Notes on Precision and Accuracy**

**Accuracy and Precision Practice**

1. Is it possible to be accurate but not precise?

1. Estimate the amount of liquid in the following devices and state their limit of precision:

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

LOP: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ LOP: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ LOP: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ LOP: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Counting Significant Figures Practice**

**Notes on Counting Significant Figures:**

For the following, determine the number of significant figures in the value and what the units are used to measure:

1. 23.30 cm \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
2. 1843.02 cm \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
3. 2.000 km\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
4. 0.0001015 kg \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
5. 3.65 kg \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
6. 0.0031 g \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
7. 2,500 m \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
8. 2,500. m \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
9. 150 mm \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
10. 98.701 K \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
11. 0.5 mL \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
12. 704,000 m \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
13. 0.0900 g \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
14. 1,000 K \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Scientific Notation Practice**

Use the table below to answer questions that follow:

|  |  |  |
| --- | --- | --- |
| **Value** | **Scientific Notation** | **Significant Figures** |
| 3097 | 3.097 x 103 | 4 |
| -6001 | -6.001 x 103 | 4 |
| 59.67 | 5.967 x 101 | 4 |
| 0.000128 | 1.28 x 10-4 | 3 |
| 0.10 | 1.0 x 10-1 | 2 |
| -0.00504 | -5.04 x 10-3 | 3 |
| 600 | 6 x 102 | 1 |
| 600. | 6.00 x 102 | 3 |

1. List the values that have zeros between two non-zero numbers:
2. When a zero is between two non-zero numbers, is it counted as a significant figure?
3. List the values that have zeros at the beginning of the value:
4. When a zero is at the beginning of a value, is the zero included in the scientific notation?
5. When a zero is at the beginning of a value, is it counted as a significant figure?
6. List the values that have zeros at the end of the value:
7. When a zero is at the end of a value, is the zero included in scientific notation?
8. When a zero is at the end of a value, is the zero included in the significant figures?
9. There are two values show for six hundred; the scientific notation for these values the same? How do they vary in the number of significant figures?
10. What is the relationship between the coefficient of a number in scientific notation and the number of significant figures for the value it represents?
11. Does it make a different whether a value is positive or negative when counting the number of significant figures?

**Notes on Multiplying and Dividing with Significant Figures**

**Notes on Adding and Subtracting with Significant Figures**

**Adding and Subtracting with Sig Figs**  
Complete the following calculations using the rules for adding and subtracting significant figures.   
Make sure to provide a calculated answer and a reported answer.

1. 2.436 2. 356. 934 3. 88.30 4. 243.872  
   + 15.3 + 5. 11 + 294.837 - 241**\_\_\_\_\_\_\_**   
   C: C: C: C:   
     
   R: R: R: R:

1. 32.567 6. 246. 24 7. 658.0 8. 1233.872  
    1.456 238.27 23.5478 9.62  
   + 135.0 + 98.3 + 1345.29 - 241­­\_\_\_\_\_\_

C: C: C: C:   
  
R: R: R: R:

**Multiplying and Dividing with Sig Figs**  
Complete the following calculations using the rules for multiplying and dividing significant figures.   
Make sure to provide a calculated answer and a reported answer.

1. 2.436 10. 356. 934 11. 88.30 12. 243.872  
   × 15.3 × 5. 11 ÷ 294.837 ÷ 241\_\_\_\_\_  
   C: C: C: C:   
     
   R: R: R: R:

1. 32.567 14. 246. 24 15. 658.0 16. 1233.872  
   × 15.3 × 5. 11 ÷ 294.837 ÷ 241\_\_\_\_\_  
   C: C: C: C:   
     
   R: R: R: R:

**Practice Calculations with Significant Figures**

Calculate the following using the correct rules ( +, -, ×, ÷) Make sure to provide a calculated and reported answer.

1. 23.7 × 3.8 Calculated: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Reported: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
2. 45.76 × 0.25 Calculated: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Reported: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
3. 81.04 - 0.010 Calculated: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Reported: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
4. 6.47 + 64.5 Calculated: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Reported: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
5. 43.678 × 64.1 Calculated: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Reported: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
6. 1.678 ÷ 0.42 Calculated: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Reported: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
7. 28.367 ÷ 3.74 Calculated: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Reported: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
8. 4278 ÷ 1.006 Calculated: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Reported: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
9. (6.8 ÷ 4.7) × 17.44 Calculated: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Reported: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
10. (320 - 22.7) × 3.8 Calculated: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Reported: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Calculate the following using the correct rules ( +, -, ×, ÷) Make sure to provide a calculated and reported answer.  
For these, make sure to include UNITS in your final answers!

1. 1.35 m × 2.467 m Calculated: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Reported: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
2. 1,035 m2÷ 42 m Calculated: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Reported: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
3. 12.01 mL + 35.2 mL + 6 mL Calculated: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Reported: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
4. 55.46 g – 28.9 g Calculated: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Reported: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
5. 0.021 cm × 3.2 cm × 100.1 cm Calculated: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Reported: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
6. 0.15 cm + 1.15 cm + 2.051 cm Calculated: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Reported: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
7. 150 L3 ÷ 4 L Calculated: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Reported: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
8. 505 kg – 450.25 kg Calculated: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Reported: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
9. 1.252 m × 0.115 m × 0.012 m Calculated: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Reported: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
10. 1.278 x 103m ÷ 1.4267 x 10 m Calculated: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Reported: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Significant Figures and Calculations Dice Game!**

**Instructions:** One partner begins with the dice, the other starts with a pen/pencil. Select a “lucky number” (1-6). Player 1 with the dice starts the game by rolling the dice as many times as it takes to get the “lucky number”. Meanwhile, player 2 with the pencil answers as many questions below as possible. When the lucky number is rolled, player 1 gets the pencil and begins answering questions and player 2 starts rolling the dice. Repeat until all of the questions are answered. The player to finish their grid with correct answers first wins. If you get stuck, check out the hints on the back side of the page.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Write the number of SigFigs** | 1,205 mL | 1,200 mL | 0.00705 cm | 1.00 m | 25,068.75 km |
| 2.75 x 107 km | 1.2 x 10-2 sec | 7.0 nm | 6,000 L | 0.0070300 km |
| **Answer in correct SigFigs** | 4 + 6.75 = | 34.75 – 14.25 = | 1.2439 + 567 = | 98.00 – 4.9218 = | 6,700 + 8,000 = |
| 24 x 12 = | 9.763 x 2 = | 34.5 ÷ 1.225 | (9.0 + 0.8) x 275 = | 13 ÷ (0.55 + 0.325 + 1) |
| **Record the measurement** |  |  |  |  |  |

**Practice Using Dimensional Analysis (Conversion Factors)**

**Notes on the Using Dimensional Analysis (Conversion Factors)**

1. 3 hrs = \_\_\_\_\_\_\_\_\_\_\_\_\_ sec
2. 5.5 kg = \_\_\_\_\_\_\_\_\_\_\_\_\_\_ lbs
3. 2.5 yds = \_\_\_\_\_\_\_\_\_\_\_\_\_\_in
4. 1.3 yrs = \_\_\_\_\_\_\_\_\_\_\_\_\_\_ hrs
5. 6.35 miles = \_\_\_\_\_\_\_\_\_\_\_\_ km
6. 60.0 in = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ m
7. Jules Verne wrote a book called *Twenty Thousand Leagues Under the Sea*. Using the equivalences below, convert 20,000 leagues to yards.   
   12 in = 1 ft  
   3 ft = 1 yd   
   1 fathom = 2 yards   
   1 statue mile = 5280 ft   
   1 nautical mile = 6080 ft   
   1 league = 3 nautical miles
8. Given the following, convert 1 fizzle to frizzles.  
   3 swizzles = 7 twizzles  
   1 fizzle = 2 drizzles   
   2 twizzles = 14 sizzles   
   1 swizzle = 20 frizzles   
   8 drizzles = 6 sizzle

**Practice Using the Metric System**

**Notes on the Metric System**

1. 1.0 km = \_\_\_\_\_\_\_\_\_\_\_ m
2. 1.0 g = \_\_\_\_\_\_\_\_\_\_\_\_cg
3. 1.0 cL = \_\_\_\_\_\_\_\_\_\_\_ L
4. 1.0 mm = \_\_\_\_\_\_\_\_\_\_\_m
5. 1.0 kg = \_\_\_\_\_\_\_\_\_\_\_ mg
6. 1.0 kL = \_\_\_\_\_\_\_\_\_\_\_ DL
7. 1.0 Dm = \_\_\_\_\_\_\_\_\_\_\_ m
8. 1.0 m = \_\_\_\_\_\_\_\_\_\_\_\_\_ dm
9. 1.0 ng = \_\_\_\_\_\_\_\_\_\_\_\_ g
10. 1.0 L = \_\_\_\_\_\_\_\_\_\_\_\_\_ mL
11. 100. cm = \_\_\_\_\_\_\_\_\_\_\_\_m
12. 1,0000 L = \_\_\_\_\_\_\_\_\_\_\_ kL
13. 1,000 mL = \_\_\_\_\_\_\_\_\_\_\_ L
14. 100. m = \_\_\_\_\_\_\_\_\_\_\_\_\_\_ mm

**Practice Using Dimensional Analysis (Conversion Factors)**

1. Every three times I clean my bedroom, my mother makes me an apple pie. I cleaned my bedroom 9 times. How many apple pies does she owe me? (What?! Your mother doesn’t reward you for cleaning your bedroom? Aren’t there child labor laws? To make up for that injustice, you get this very easy problem.)

1. A Wando High School senior was applying to college and wondered how many applications she needed to send. Her counselor explained that with the excellent grade she received in Chemistry, she would probably be accepted to one college out of every three to which she applied. [3 applications = 1 acceptance] She immediately realized that for each application she would have to write three essays, [1 application = 3 essays] and each essay would require two hours of work [1 essay = 2 hours]. Of course, writing essays is no simple matter. For each hour of serious essay writing, she would need to expend five hundred calories [1 essay = 500 calories] which she could derive from her mother’s apple pies [1 pie = 1000 calories]. How many times will she have to clean her room in order to gain acceptance from 10 colleges? *(Hopefully you didn’t skip #1!)*

1. A chemistry teach working at golf camp during the summer found a liquid, which cuased him to slice ball after ball into the water without disturbing him at all. He thought that this was an important liquid to identify so he set out to determine its density (in g/mL). He found that a sample of the liquid had a mass equal to 455 golf balls and occupied a volume of 620 water cups that he obtained at the 7th hole. Each golf ball massed 50. Grams and the water cups at the 7th hole of the golf course held 45 mL each. What is the density of the liquid?

1. Because you never learned dimensional analysis, you have been working at a fast food restaurant for the past 35 years wrapping hamburgers. Each hour you wrap 184 hamburgers. You work 8 hours per day, you work 5 days per week. You get paid every 2 weeks with a salary of $840.34. How many hamburgers will you have to wrap to make your first one million dollars?

**Unit 1 Review: Measurements in Science**

1. Rewrite each of the following numbers to the number of significant figures in the parenthesis:
   1. 5651 (3)
   2. 15.001 (4)
   3. 0.0051 (2)
   4. 5554396 (6)
   5. 54342 (1)
   6. 500. (1)
2. How many significant figures are in the following numbers?
   1. 6106000
   2. 0.00105
   3. 9.511
   4. 0.005
   5. 0.5000
   6. 900
3. Perform these functions and round to the appropriate number of significant figures:
   1. 56.2 ÷ 10 =
   2. 17.01 × 0.0056 =
   3. 0.005 ÷ 150 =
   4. 5.661 + 11.32 =
   5. 5.00 + 7 =
   6. 10.53 – 9.86 =
   7. 0.005 + 10.569 =
   8. 601 ÷ 2 =
4. How many grams are in 17.5 cg?
5. If you can run backwards at 6.21 miles per hour, how many meters can you run in an hour?
6. You just siphoned 7.9 kg of gasoline form you car to put in your lawnmower. If the density of the gasoline is 0.680 g/mL, how many liters of gasoline do you have?
7. The total amount of fresh water on earth is estimated to be 3.73 x 108 km3. What is this volume in liters?