*Math Review Experiment A01*

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|  |  |  |
| Name |  | Lab Section |

*This is due for everyone! Not as a group.*

*Objective*

* Review the following selected mathematical topics:

Importance of Units SI Units & the Metric System

Unit Conversion Scientific Notation

Order of Operations Percentage Difference

*Materials*

Calculator

*Theory*

See the appendix to your lab manual for the theory section to this experiment. It is available for download on Blackboard.

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| ***Order of Operations***  |

1. Solve the following equations. If needed, write each answer to 3 decimal places.

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|  | **Operation** | **Value** |
| **a.** | 2 + 3 – 5 ÷ 8 |  |
| **b.** | (10 ÷ 2)2 + 12 - 33 |  |
| **c.** | (12 ÷ 3)3 + 10 - 4 x 6 |  |
| **d.** | (62 + (8 ÷ 4 + 32)) -42 |  |

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| ***Checking Your Calculator***  |

1. One equation you will see a lot in your astronomy class is related to Kepler’s Third Law of Planetary Motion. It relates how long it takes a planet to order the Sun to how far away it orbits. Simply, it is

$$P^{2}=ka^{3} (for a)$$

Let’s use Jupiter as an example. It takes 11.862 Earth years for Jupiter to orbit the Sun once (P = 11.862 years), and its orbits about 5.2 times further out than the Earth (a = 5.2)

If we solve the previous equation for *k*, we find

$$k=\frac{P^{2}}{a^{3}}$$

Use this equation to determine the value of *k. Give your answer to 4 decimal places.*

*(Hint: Your answer will be very close to 1. This is just a check that you can properly put in the steps in your calculator. If you can’t get an answer close to 1, then you should check how you type your this into your calculator.)*

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| Enter Answer Here |

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| ***Scientific Notation***  |

1. Practice with scientific notation – Write out the decimal equivalent (regular form) of the following numbers that are in scientific notation and vice versa.

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|  | **Scientific Notation** | **Decimal Equivalent** |  |  | **Scientific Notation** | **Decimal Equivalent** |
|  | 101 | 10 |  |  | 2 x 102 | 200 |
| **a.** | 102 |  |  | **a.** | 3 x 102 |  |
| **b.** | 104 |  |  | **b.** | 7 x 104 |  |
| **c.** | 107 |  |  | **c.** | 2.4 x 103 |  |
| **d.** | 10-2 |  |  | **d.** | 6 x 10-3 |  |
| **e.** | 10-5 |  |  | **e.** | 900 x 10-2 |  |
| **f.** | 100 |  |  | **f.** | 4 x 10-6 |  |

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|  | **Scientific Notation** | **Decimal Equivalent** |  |  | **Scientific Notation** | **Decimal Equivalent** |
|  | 103 | 1000 |  |  | 2 x 103 | 2,000 |
| **a.** |  | 10  |  | **a.** |  | 400 |
| **b.** |  | 100 |  | **b.** |  | 60,000 |
| **c.** |  | 100,000,000 |  | **c.** |  | 750,000 |
| **d.** |  | 0.1 |  | **d.** |  | 0.005 |
| **e.** |  | 0.0001 |  | **e.** |  | 0.0034 |
| **f.** |  | 1 |  | **f.** |  | 0.06457 |

1. Perform the indicated operation and express the answer and scientific notation.

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|  | **Operation** | **Scientific Notation** |
| **a.** | (0.314) × (0.006313× 106) |  |
| **b.** | (1.11265 × 10-13) + (2.22 × 10-16) |  |
| **c.** | (3.3456 × 1020) ÷ (2.244 × 1025) |  |
| **d.** | (1.999 × 106) × (1.999 × 109) |  |

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| ***Unit Conversion***  |

1. Convert the following values to other appropriate units.

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|  | **Value** | **Converted Value** | **Converted Value** |
| **a.** | 12 inches | **feet** | **miles** |
| **b.** | 4 feet | **inches** | **meters** |
| **c.** | 27 inches | **cm** | **meters** |
| **d.** | 1 yard | **inches** | **meters** |
| **e.** | 1 meter | **centimeters** | **millimeters** |

**For analysis questions 6 through 8, express your answer in *scientific notation.***

1. There are an estimated 1011 stars in a typical galaxy, and there are an estimated 1011 galaxies in the Universe. How many stars are there in the Universe? Show your work.

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| Enter Answer Here |

1. If there are 2.8 × 108 people in the US, and there are 4 × 107 people in Canada, how many people are there in the US and Canada combined? How many more people live in the US than in Canada? Show your work.

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| Enter Answer Here |

1. There are 6.02 × 1023 atoms in the chemical quantity called a mole. How many atoms are in ½ of a mole? How many atoms in one hundredth of a mole? Show your work.

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| ***Algebraic Solutions*** |

1. Solve the following equations for the variable indicated.

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| a) $v=\frac{x}{t} (for t)$ | b) $F=G\frac{mM}{R^{2}} (for R)$ | c) $L=σAT^{4} (for T)$ |

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| ***Percent Difference*** |

1. Calculate the percentage difference (% difference) for the following case:

During their experiment, two lab partners conducted several trials to determine the value of acceleration of a racquet ball dropped from a height of 2 meters and they found that the average value of acceleration was 9.78 m/s2. However, their reference manual states that the accepted value of free-fall acceleration is 9.81 m/s2. Find the percentage difference between the accepted value and the measured value. Show your work.

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| Enter Answer Here |

*This lab manual was written by Justin Mason, Old Dominion University, and copied to be made available on this website by Corey Sargent, Old Dominion University, Fall 2021*