**Chemistry**

**YOUR CHOICES + YOUR ACTIONS = YOUR FUTURE!!!**

**Packet#1**

**Unit#1: SI Units and Measurements**

 (BRING THIS WITH YOU TO EVERY CLASS)

*“Success is not the result of spontaneous combustion. You must set yourself on fire.”*

***Edmodo Group Code:*** *ozm60q* (http://www.edmodo.com)

***Class Website:*** http://mrgchem.weebly.com

***Mr. Gutierrez’s email:*** gutierrezbr@elizabeth.k12.nj.us

Text Messaging Reminders: Text @cpchemp to 442-333-4172



*Note: You are expected to work on this packet during the allotted class practice time.*

|  |  |  |
| --- | --- | --- |
| **Packet** | **Followed All Classroom Policies** | **Class work/ Homework Participation** |
| /35 | Completed Class Notes | / | Monday | / |
| /35 | Completed Classwork | / | Tuesday | / |
| /5 | Writing Name on Every Page | / | Wednesday | / |
| /25 | Handed Packet in on Time  | / | Thursday | / |
| /100 | Total Points | / | Friday | / |
|  |  | / | Total Points | / |

Name of Chemist:

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

Period: \_\_\_\_\_\_\_\_\_\_\_

*\*All Classnotes + Questions MUST be finished for HOMEWORK if not done in class.*

***DUE \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_***

**Unit#1: Measurements and Calculations**

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**Additional Resources:**

**\*Tutoring with Mr. Gutierrez:** Meet Mr. Gutierrez in student cafeteria after school or during 10th period.

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| **Date: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_****Objectives: 1) SWBAT define chemistry and the three branches of chemistry. 2) SWBAT compare and contrast basic research, applied research, and technological development.** |
|  |

Class Notes:

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Chemistry as a Science***Chemistry is defined as the study of the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, and \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ of matter, the processes that matter undergoes, and the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_changes that accompany these processes.*The Six Main Branches of Chemistry

|  |  |  |  |
| --- | --- | --- | --- |
|  | Definition | Examples | Image |
| *Organic* | Study of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ compounds |  |  |
| *Inorganic* | Study of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ not containing \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  |  |  |
| *Physical* | Study of the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ and \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ of matter and their relation to \_\_\_\_\_\_\_\_\_\_\_\_\_\_ |  |  |
| *Biochemistry* | Study of substances and \_\_\_\_\_\_\_\_\_\_\_\_\_ occurring in \_\_\_\_\_\_\_\_\_\_\_\_ things |  |  |
| *Theoretical* | The use of \_\_\_\_\_\_\_\_\_\_\_\_ and \_\_\_\_\_\_\_\_\_\_\_\_ to understand the principles behind chemical behavior and to \_\_\_\_\_\_\_\_\_\_\_\_ and \_\_\_\_\_\_\_\_\_\_\_\_\_ the properties of new compounds |  |  |
| *Analytical* | The \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ of the components and \_\_\_\_\_\_\_\_\_\_\_\_\_\_ of materials |  |  |

**Types of Research**1. *Basic Research*
2. *Applied Research*
3. *Technology Development*
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| **Date: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_****Objectives: 1) SWBAT define chemistry and the three branches of chemistry. 2) SWBAT compare and contrast basic research, applied research, and technological development.** |
|  |

**Chemistry as a Science**

***Class Work (Independent Practice):*** Finish as many questions as you can during class. Refer to your notes and ask at least three classmates before asking me for help. If you do not finish these questions in class, you must finish them for homework.

1. In your own words, define *chemistry*.
2. List and define the six main branches of chemistry. Provide an example for each branch.
3. Compare and contrast basic research, applied research, and technological development.
4. Scientific and technological advances are constantly changing how people live and work. Discuss a change that you have observed in your lifetime and that has made life easier or more enjoyable for you.

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| --- |
| **Date: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_****Objectives: 1) SWBAT name SI units for length, mass, time, and volume. 2) SWBAT transform a statement of equality to a conversion factor.** |
|  |

Class Notes:

**Introduction to SI Units**

A ***quantity*** is something that has \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ or \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

Scientists all over the world have agreed on a single measurement system called \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, abbreviated \_\_\_\_\_\_\_\_.

A **unit** is \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

For example, “money” is a quantity and its unit is “dollars”.

***The Seven SI Base Units***

|  |  |  |
| --- | --- | --- |
| *Quantity* | *Definition of Quantity* |  *UNIT* |
| **Mass** |  |  |
| **Temperature** |  |  |
| Length |  |  |
| Time |  |  |
| Amount of substance |  |  |
| Electric Current | Amount of electricity flowing | ampere |
| Luminous Intensity | How bright light is | candela |

***Derived SI Units***

|  |  |  |  |
| --- | --- | --- | --- |
| *Quantity* | *Definition of Quantity* | *UNIT* | *Derivation* |
| Volume |  |  |  |
| Density |  |  |  |
| Molar Mass | The mass of one mole of substance |  | mass/amount of substance |

In science, NUMBERS WITHOUT UNITS ARE MEANINGLESS!!!

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| **Date: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_****Objectives: 1) SWBAT name SI units for length, mass, time, and volume. 2) SWBAT transform a statement of equality to a conversion factor.** |
|  |

**Introduction to SI Units**

***Class Work (Independent Practice):*** Finish as many questions as you can during class. Refer to your notes and ask at least three classmates before asking me for help. If you do not finish these questions in class, you must finish them for homework.

1. A quantity is something that has \_\_\_\_\_\_\_\_\_\_\_ or \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.
2. Scientists all over the world have agreed to using the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ for measurements.
3. Fill out the following chart that includes all 7 SI base units.

|  |  |  |  |
| --- | --- | --- | --- |
| **Quantity**  | **Quantity Symbol** | **Unit Name** | **Unit Abbreviation** |
| Length |  |  |  |
|  | *m* |  |  |
| Time |  |  |  |
|  |  | kelvin |  |
|  |  | ampere |  |
| Amount of substance |  |  |  |

1. Mary wants to know how long it takes her car to turn on. Which *unit* will she use to express her answer.
2. You’re working in the lab and want to know how hot a beaker is. What *quantity* are you trying to measure?
3. What is volume?
4. How do you calculate volume?
5. Fill out the following table that includes derived SI Units.

|  |  |  |  |
| --- | --- | --- | --- |
| **Quantity** | **Unit** | **Unit Abbreviation** | **Derivation** |
| Area |  |  |  |
|  | Cubic meter |  |  |
|  |  | kg/m3 |  |
|  |  |  | Mass/amount of substance |
| Molar volume |  |  |  |
|  |  | M |  |
| Energy |  |  |  |

|  |
| --- |
| **Date: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_****Objectives: 1) SWBAT calculate density given mass and volume. 2) SWBAT to solve for an unknown quantity given two known values.** |
|  |

**Density**

**Density** is the ratio of \_\_\_\_\_\_\_\_\_\_\_\_ to \_\_\_\_\_\_\_\_\_\_\_\_\_. In other words, it is \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

Mathematically:

The units for density are kg/m3, g/mL, g/cm3. (Note: 1 g/mL = 1 g/cm3)

Density Calculation Example(s):

**DO NOT FORGET TO WRITE YOUR UNITS.**

*Density Facts*

* Density is considered to be a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ property of a substance.
* If an object has a density that is LESS than the fluid it is in, the object will \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.
* If an object has a density that is GREATER than the fluid it is in, the object will \_\_\_\_\_\_\_\_\_\_\_\_\_.
* The density of water is known to be as 0.998 g/mL at 20 degrees Celsius.

***What are some benefits of knowing the density of an object****?*

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| **Date: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_****Objectives: 1) SWBAT calculate density given mass and volume. 2) SWBAT to solve for an unknown quantity given two known values.** |
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**DENSITY**

***Class Work (Independent Practice):*** Finish as many questions as you can during class. Refer to your notes and ask at least three classmates before asking me for help. If you do not finish these questions in class, you must finish them for homework. Show ALL your work for ALL calculations.

1. A box has a mass of 45 grams and a volume of 9 cm3. What is the density (D) of the box?

D =

*m* =

V =

1. An object will float in water if its density is \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ than the density of water.
2. An object will sink in water if its density is \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ than the density of water.
3. An object has a mass of 100 grams and a volume of 20 cm3. What is the density of the object?

Will the object float or sink in water? How do you know?

1. An object has a volume of 100 cm3 and a mass of 25 grams. What is the density of the object?

Will the object float or sink in water? How do you know?

1. In which of these units can density be expressed?

a. liters per gram ( L/g)

 b. grams per milliliter (g/mL)

 c. milliliters per cubic centimeter (mL/cm3)

 d. cubic centimeters per milliliter (cm3/mL)

1. In order to calculate the density of an object we need to know the object’s \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ and \_\_\_\_\_\_\_\_\_\_\_\_\_
2. An object’s mass is 36 grams, its volume is 9 cm3. What is the density of the object?

Will the object float or sink in water? How do you know?

1. You are given a volume of 45 cm3 of Tellurium. According to one periodic table, its density is 6.240 g/cm3. Calculate the mass of the Tellurium sample you were given. Show all your work.
2. An object’s density is 45 g/cm3. You are given 20 grams of this object. Calculate the volume of what you were given. Show all your work.
3. The density of sucrose (sugar) is 1.59 g/cm3 at 20 degrees Celsius. You place the sugar on a digital balance and it reads 425 grams. How much space does the sugar consume?
4. Diego puts a marker in a beaker of gasoline, which has a density of 0.67 g/mL. What information does he need in order to determine whether or not the bottle cap will float in the gasoline? How might one obtain this information?

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| **Date: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_****Objectives: 1) SWBAT transform a statement of equality to a conversion factor. 2) SWBAT convert one SI unit to another using a conversion factor.** |
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**Unit Conversions**

***Conversion Factors***

A **conversion factor** is a \_\_\_\_\_\_\_\_\_\_\_\_\_\_ derived from the \_\_\_\_\_\_\_\_\_\_\_ between two different units that can be used to \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

Examples of a Conversion Factor:

***How to Convert from One Unit to Another:***

|  |  |
| --- | --- |
| ***Description of Step*** | ***Calculation*** |
|  |  |

***SI Prefixes***

|  |  |  |  |
| --- | --- | --- | --- |
| *Prefix* | *Unit Abbreviation* | *Meaning* | *Examples* |
| **kilo** | k | 1000 | 1 kilometer (km) = 1000 meters (m) |
| **hecto** | h | **100** | 1 hectometer (hm) = 100 meters (m) |
| **deka** | da | **10** | 1 dekameter (dam) = 10 meters |
|  | **--** |  | **1 meter (base)** |
| **deci** | d | **1/10** | 10 decimeters = 1 meter |
| **centi** | c | **1/100** | 100 centimeters = 1 meter |
| **milli** | m | **1/1000** | 1000 millimeters = 1 meter |

Other base words include:

1. Liter
2. Gram
3. Seconds

(A prefix comes before a base word. The SI prefixes come before the base units.)

***How to Convert from One SI Unit to Another:***

|  |  |
| --- | --- |
| ***Description of Step*** | ***Calculation*** |
|  |  |

**Why is knowing how to convert from one unit to another important?**

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| **Date: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_****Objectives: 1) SWBAT transform a statement of equality to a conversion factor. 2) SWBAT convert one SI unit to another using a conversion factor.** |
|  |

**Unit Conversions**

***Class Work (Independent Practice):*** Finish as many questions as you can during class. Refer to your notes and ask at least three classmates before asking me for help. If you do not finish these questions in class, you must finish them for homework. Show ALL your work for ALL calculations. (YOU MUST USE A **CONVERSION FACTOR**.)

1. Express 1000 meters in kilometers (km).
2. 1000 liters (L) = \_\_\_\_\_\_ deciliters (dL).
3. 1000 centimeters (cm) = \_\_\_\_\_\_\_\_ meters (m).
4. 5 kilograms (kg) = \_\_\_\_\_\_\_\_ grams (g).
5. 6 decimeters (dm) = \_\_\_\_\_\_\_\_ meters (m).
6. 5000 centiliters (cL) = \_\_\_\_\_\_\_ liters (L).
7. 70, 000milliseconds (s) = \_\_\_\_\_\_\_\_\_ seconds (s).
8. 5000 meters (m) = \_\_\_\_\_\_\_\_\_\_ kilometers (km).
9. Express 8,000 grams (g) in centigrams (cg).
10. 1 day = \_\_\_\_\_\_\_ hours.
11. 1 day = \_\_\_\_\_\_\_\_\_ seconds.
12. 12 grams = \_\_\_\_\_\_\_\_centigrams
13. 15 Liters = \_\_\_\_\_\_\_\_milliliters
14. 63.9 seconds = \_\_\_\_\_\_\_\_\_\_kiloseconds

***Application of SI Unit Conversions:***

1. One cereal bar has a mass of 37 g. What is the mass of 6 cereal bars? Is that more than or less than 1 kg? Explain your answer.

1. Wanda needs to move 110 kg of rocks. She can carry l0 hg each trip. How many trips must she make? Explain your answer.
2. Dr. O is playing in her garden again She needs 1 kg of potting soil for her plants. She has 750 g. How much more does she need? Explain your answer.
3. Weather satellites orbit Earth at an altitude of 1,400,000 meters. What is this altitude in kilometers?

5. Which unit would you use to measure the capacity? Write milliliter or liter next to each letter.

a) a bucket

b) a gasoline tank

 c) a water storage tank

d) a carton of juice

6. Circle the more reasonable measure:

a) length of an ant (5mm or 5cm)

b) length of an automobile (5 m or 50 m)

c) distance from NY to LA (450 km or 4,500 km)

d) height of a dining table (75 mm or 75 cm)

8. Will a tablecloth that is 155 cm long cover a table that is 1.6 m long? Explain your answer.

9. A dollar bill is 15.6 cm long. If 200 dollar bills were laid end to end, how many meters long would the line be?

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| **Date: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_****Objective: SWBAT determine number of significant figures in measurements.** |
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**Significant Figures**

All measurements are ­­\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_—no measuring device can give perfect measurements without experimental uncertainty. ***Significant figures* (a.k.a. “sig. figs.”)** are the reliable digits in a measurement based on the \_\_\_\_\_\_\_\_\_\_ of the measuring device. Significant figures is only used when you’re MEASURING something, not counting.

**RULE #1: All nonzero digits are significant.**

32445 = \_\_ sig figs 67.345996 = \_\_\_\_ sig figs

2348.23 = \_\_\_ sig figs 98 = \_\_\_\_ sig figs

3 = \_\_\_\_ sig fig 1.14 = \_\_\_\_ sig figs

**RULE #2: Zeros are weird and come in 4** **flavors**

**RULE #2.1 *Leading Zeros:* The zeros that come BEFORE nonzero digits are NOT significant. (They are “Leading Zeros” because they come first.)**

0.0023 = \_\_\_\_ sig digs 0.03532 = \_\_\_\_ sig digs

0.2 = \_\_\_\_\_ sig dig 0.32123 = \_\_\_\_ sig digs

0.0000000099999= \_\_\_\_ sig digs 0.000003=\_\_\_\_ sig digs

**RULE #2.2 *Sandwich Zeros:* The zeros SANDWICHED between nonzero digits are significant.**

1.009 = \_\_\_\_\_ sig figs 45.390206 = \_\_\_\_\_ sig figs

230,004 = \_\_\_\_ sig figs 0.4502 = \_\_\_\_ sig figs

0.0101 = \_\_\_\_\_ sig figs 10.003 = \_\_\_\_\_ sig figs

**RULE #2.3 *Ending* *Zeros*: The zeros at the end of a number and to the right of a decimal point are significant.**

100 = \_\_\_ sig fig 1203.00 = \_\_\_\_ sig figs

100. = \_\_\_ sig figs 0.0109300 = \_\_\_\_ sig figs

0.04500 = \_\_\_ sig figs 98,090 = \_\_\_\_ sig figs

**RULE #2.4 *Point Zeros*: The zeros to the left of a decimal point are significant if a decimal point is explicitly placed at the end of a number.**

1000 = \_\_\_ sig figs 8000. = \_\_\_ sig figs

1000. = \_\_\_ sig figs 8000 = \_\_\_ sig figs

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| **Date: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_****Objective: SWBAT determine number of significant figures in measurements.** |
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**Significant Figures**

***Class Work (Independent Practice):*** Finish as many questions as you can during class. Refer to your notes and ask at least three classmates before asking me for help. If you do not finish these questions in class, you must finish them for homework.

Paying very close attention to the rules mentioned in the previous page, determine number of significant figures in each measurement.

1. 959.09 liters \_\_\_\_ significant figures
2. 58000. centiseconds \_\_\_\_\_ significant figures
3. 46.00 grams \_\_\_\_\_ significant figures
4. 9000. kilograms \_\_\_\_\_ significant figures
5. 0.0000000000003 meters \_\_\_\_\_ significant figures
6. 26.6 grams \_\_\_\_\_ significant figures
7. 3440. cm \_\_\_\_\_ significant figures
8. 900000000 L \_\_\_\_\_ significant figures
9. 9000.4 s \_\_\_\_\_ significant figures
10. 100.009 K \_\_\_\_\_ significant figures
11. 0.00000045 cm \_\_\_\_\_ significant figures
12. 90.00023 km \_\_\_\_\_ significant figures
13. 54.59 dam \_\_\_\_\_ significant figures
14. 99.23 hm \_\_\_\_\_ significant figures
15. 0.006 700 0 kg \_\_\_\_\_ significant figures
16. 910 m \_\_\_\_\_ significant figures
17. 89.345 kg \_\_\_\_\_ significant figures
18. 98.000 ks \_\_\_\_\_ significant figures
19. 76.10 g \_\_\_\_\_ significant figures
20. 1003 cm \_\_\_\_\_ significant figures
21. 23400 mm \_\_\_\_\_ significant figures
22. 23.90 dL \_\_\_\_\_ significant figures
23. 92.910 kL \_\_\_\_\_ significant figures
24. 1.908 mm \_\_\_\_\_ significant figures
25. 19.609 kg \_\_\_\_\_ significant figures
26. 0.0000485 K \_\_\_\_\_ significant figures
27. 98000 A \_\_\_\_\_ significant figures
28. 98000. A \_\_\_\_\_ significant figures

|  |
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| **Date: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_****Objective: SWBAT perform mathematical operations involving significant figures.** |
|  |

**Mathematical Operations with Significant Figures**

**Addition & Subtraction:**

The answer must have as many \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ as the measurement having the\_\_\_\_\_\_\_\_\_\_ of decimal places.

**1) \_\_\_\_\_\_\_\_\_ the number of decimal places in each number.**

**2) Add or subtract the numbers**

**3) \_\_\_\_\_\_\_\_\_ the answer to the appropriate number of decimal places\*\***

Examples:

A child grows from a height of 56.87 centimeters to a height of 78.3 centimeters. What is the amount that the child grew, with the correct number of significant digits?

**Multiplication & Division**

The answer may contain only as many significant digits as the measurement with the *\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_* of \_\_\_\_\_\_\_\_\_\_\_.

1. **Do not round any of the answers until you \_\_\_\_\_\_\_\_ all operations**
2. **\_\_\_\_\_\_\_\_\_\_\_ the number of significant figures in each number**
3. **Multiply or divide**
4. **\_\_\_\_\_\_\_ to the lowest number of significant figures\*\***

 Examples:

The area of a rectangular patio is found by multiplying the length by the width. Jared determines the length to be 10.825 meters. His friend, Audrey, determines the width to be 3.5 meters. What is the area of the patio with the correct number of significant digits?

**\*\*RULES FOR ROUNDING**

* **Rule 1:** If the digit to be removed is less than 5, the preceding digit stays the same; if it is equal to or greater than 5, round the preceding digit up. Ignore all other numbers.

 3.04999 = 3.0

 3.05999 = 3.1

* **Rule 2:** In a series of calculations, carry the extra digits through to the final result, ***THEN*** round

 3.05 x 5.555 x 3.0 = 50.82825 = 51

 NOT

 3.1 x 5.6 x 3.0 = 52.08 = 52

**FROM NOW ON, WHEN DEALING WITH MEASUREMENTS, MAKE SURE YOU REPORT YOUR ANSWERS USING SIGNIFICANT FIGURES!**

***Summary of Significant Figure Rules***

|  |
| --- |
|  |

|  |
| --- |
| **Date: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_****Objective: SWBAT perform mathematical operations involving significant figures.** |
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**Mathematical Operations with Significant Figures**

***Class Work (Independent Practice):*** Finish as many questions as you can during class. Refer to your notes and ask at least three classmates before asking me for help. If you do not finish these questions in class, you must finish them for homework.

Give the number of significant figures for each of the following measurements.

1) A sample of orange juice contains 0.0108 g of vitamin C. \_\_\_\_\_\_\_

2) In yesterday’s bicycle race, 110 riders started. \_\_\_\_\_\_\_\_

|  |
| --- |
| 3) 2500 \_\_\_\_\_\_4) 0.00119 \_\_\_\_\_\_5) 0.000000001 \_\_\_\_\_6) 4.56 x 105 \_\_\_\_\_\_7) 1.023 x 10-8 \_\_\_\_\_\_ |

Carry out the following mathematical operations and give each result to the correct number of significant figures.

11) 5.18 x 0.0208

12) (0.0036) x (8.123) ÷ 4.3

13) 21 + 13.8 + 130.36

14) 116.8 – 0.33

15) (1.33 x 2.8) / 8.41

a) 986.72 / 5.12 =

g) 45.20 x 0.0071 =

i) 10. x 300. =

d) 400.20 + 3.010 =

f) .009430 - 4310.9 =

h) 9.0/3.0=

j) 10.0/3=

|  |
| --- |
| **Date: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_****Objective: SWBAT convert measurements from decimal form to scientific notation.** |
|  |

**Scientific Notation Part 1**

**Scientific notation** is a simpler way of writing very \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ numbers and very \_\_\_\_\_\_\_\_\_\_\_\_\_\_ numbers. Who wants to write all those zeros?

A number in scientific notation has the form of M x 10n, where M is a number between 1 and zero and n is a whole number.

**Converting Numbers in Decimal Form to Scientific Notation:**

Example A:

*Standard Notation* = 5,980,000,000,000,000,000,000,000

*Scientific Notation* =

1. If it is not explicitly written, always assume that the decimal point is at the end.
2. Move the decimal point to the LEFT until you have a number that is between 1 and 10.
3. Take the number that is between 1 and 10 and make that the coefficient (number in front) and multiply that by 10n where n is the number of times you moved to the left.

Example B:

*Standard Notation =* 0.0000000009

*Scientific Notation* =

If you need to move the decimal point to the right, the exponent will be NEGATIVE.

**YOU TRY!**

Convert the following numbers into scientific notation.

1. 9,800,000
2. 4,554,000,000
3. 0.000045

**Significant Figures and Scientific Notation**

When you are working with scientific notation, expand, and then determine the number of significant digits.

2.70 x 107 = 27,000,000 = \_\_\_\_ sig digs

105.2 x 102 = 10,520 = \_\_\_ sig digs

90.2 x 105 = \_\_\_\_ sig digs

***Summary/Additional Notes of Scientific Notation***

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| **WHY DO WE USE SCIENTIFIC NOTATION???** |

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| **Date: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_****Objective: SWBAT convert measurements from decimal form to standard notation.** |
|  |

**Scientific Notation Part 1**

Convert each of the numbers from real to scientific notation.

( 1 ) 0.0015348

( 2 ) 0.005076

( 3 ) 15,622

( 4 ) 0.000015474

( 5 ) 1.7277

( 6 ) 2,530,000

( 7 ) 0.000012639

( 8 ) 1,099,600

( 9 ) 13,910

(10) 1,918.3

(11) 10.772

(12) 547,900

(13) 0.014042

(14) 0.00014694

(15) 0.07783

(16) 0.0017205

(17) 460.4

(18) 6.447

(19) 0.5603

(20) 0.0000508

(21) 0.0003147

(22) 0.013668

(23) 160.1

(24) 194.8

(25) 1,381.6

(26) 0.08739

(27) 1,694,500

(28) 119.5

(29) 2,537

(30) 0.000011112

(31) 0.19929

(32) 0.019975

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| **Date: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_****Objective: SWBAT convert measurements from scientific notation to standard notation.** |
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**Scientific Notation Part 2**

1. Translating from SCIENTIFIC NOTATION to STANDARD NOTATION with POSITIVE exponents MOVE THE DECIMAL RIGHT.

Examples:

6.89 x 102

4.987 x 105

2. Translating from SCIENTIFIC NOTATION to STANDARD NOTATION with NEGATIVE exponents MOVE THE DECIMAL LEFT.

9.08 x 10-2

2.7 x 10-5

**YOU TRY!**

1. 3.4 x 10-9

2. 9.15 x 107

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| **Date: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_****Objective: SWBAT convert measurements from scientific notation to standard notation.** |
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**Scientific Notation Part 2**

***Class Work (Independent Practice):*** Finish as many questions as you can during class. Refer to your notes and ask at least three classmates before asking me for help. If you do not finish these questions in class, you must finish them for homework. For questions involving calculations, SHOW ALL YOUR WORK.

1) 8.54 x 105 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

2) 2.101 x 10-8 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

3) 3.051 x 107 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

4) 5.94 x 10-3 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

5) 3.86 x 102 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Scientific Notation with Conversions**

*DIRECTIONS: Convert ALL numbers into scientific notation. Then use your calculator to perform the necessary math operations. SHOW ALL YOUR WORK.*

1. Einstein's famous equation says that E = mc2 where c is the speed of light

        c = 300,000,000 m/sec

How much energy is emitted if 2,000 kg of matter is destroyed?

1. The number of molecules in a mole is 602,000,000,000,000,000,000,000 – write this number in scientific notation.
2. The mass of a hydrogen atom is .00000000000000000000000167 kg. What is the mass of 75,000 atoms?
3. A computer can perform an addition calculation in 3.1 x 10-7 seconds.  How long will it take to perform 4 x 106  (4 million) addition calculations?
4. How many seconds are there in 70 years?
5. One Angstrom = 0.0000001 cm.  One light year is 5.86 x 1012 miles. How many angstroms are there in a light year?
6. What percentage of the US population plays professional baseball?  Assume that there are 30 teams and each team has 40 players.  Also the population of the US is 300,000,000.
7. The distance from the earth to the sun is 93,000,000 miles.  The speed of light is 3.0 x 108 meters per second.  How many minutes does it take for a solar flare to reach the earth?

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| **Date: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_****Objectives: 1) SWBAT distinguish between accuracy and precision. 2) SWBAT calculate percent error.** |
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**Accuracy and Precision**

**Accuracy** – how close a measurement is to \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Precision** – how close a measurement is to \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Precision versus Accuracy:**

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| --- | --- | --- | --- |
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*Example Problem:*

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| --- | --- | --- | --- | --- | --- | --- |
| **Team 1** | **Team 2** | **Team 3** | **Team 4** | **Team 5** | **Team 6** | **Team 7** |
| 2.65 cm | 2.75 cm | 2.80 cm | 2.77 cm | 2.60 cm | 2.65 cm | 2.68 cm |

Teams of students measured the length of an object and obtained the results above. The accepted value for the length was found to be 2.85 cm. Are the data they obtained above accurate, precise, both, or neither?

**Percent Error -** (Expressing Errors in Measurement)

Scientists often express their uncertainty and error in measurement by giving a percent error. The percent error is defined as:

% error =

*Percent Error Example Problems:*

1. While doing a lab, a student found the density of a piece of pure aluminum to be 2.85 g/cm3. The accepted value for the density of aluminum is 2.70 g/cm3. What was the student's percent error?
2. A student measured the specific heat of water to be 4.29 J/g · Co. The literature value of the specific heat of water is 4.18 J/g · Co. What was the student’s percent error?
3. A student took a calibrated 200.0 gram mass, weighed it on a laboratory balance, and found it read 196.5 g. What was the student’s percent error?

***Summary: Accuracy, Precision, Percent Error***

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| **Date: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_****Objectives: 1) SWBAT distinguish between accuracy and precision. 2) SWBAT calculate percent error.** |
|  |

**Accuracy and Precision**

***Class Work (Independent Practice):*** Finish as many questions as you can during class. Refer to your notes and ask at least three classmates before asking me for help. If you do not finish these questions in class, you must finish them for homework. For questions involving calculations, SHOW ALL YOUR WORK.

A measurement was taken three times. The correct measurement was 68.1 mL. Write whether the set of measurements is accurate, precise, both, or neither.

a)  78.1 mL, 43.9 mL, 2 mL

b)  68.1 mL, 68.2 mL, 68.0 mL

c)  98.0 mL, 98.2 mL, 97.9 mL

d)  72.0 mL, 60.3 mL, 68.1 mL

*In each of the following questions, calculate the percent error. Show your work!*

1. A student measured the string as 1.25 m long. The teacher said it was actually 2.12 m long. What was the student’s percent error?
2. The teacher said the volume of liquid was 500.0 mL. When measured, a student found it was 499.7 mL. What was the student’s percent error?
3. A standard mass of 250.0 g was placed on a balance. The balance said it had a mass of 243.9 grams. What is the balance’s percent error?
4. A teacher calculated the percent of sodium in the compound as 54%. The reference book said it was actually supposed to be 76%. What was the teacher’s percent error?

 5) There were 34 questions on a test. Even the best student in the class only got 22 correct. What was the best student’s percent error?

Make sure Mr. Gutierrez stamps/signs this by the end of the period. You CANNOT get the stamp/signature for a day later on. It is your responsibility to remind Mr. Gutierrez. You will NOT receive a stamp if you did not follow all classroom policies or actively work on the practice problems during the allotted class time.A stamp means you received all 10 points. No stamps means you’ve received zero points. If you completed some work, I may give you partial credit based on my discretion. ***If you are absent, write the date on the day you were absent and write the word “Absent.” DO NOT LOSE THIS SHEET!!!*** (If you lose this sheet, you will lose all of your participation points. NO EXCEPTIONS.)

|  |  |  |  |
| --- | --- | --- | --- |
| **Day of Week** | **Followed All Classroom Policies** (Respectful, on time, prepared, engaged…) | **Class work Participation** | **Homework** |
| *Monday* | /10 | /10 | /10 |
| *Tuesday* | /10 | /10 | /10 |
| *Wednesday* | /10 | /10 | /10 |
| *Thursday* | /10 | /10 | /10 |
| *Friday* | /10 | /10 | /10 |

**Teacher Comments:**