Chemistry A: Form TR1-19A Name ______________________________

REVIEW Date _________________ Period _____

Test Review № 1

Skills:

- Be able to express numbers in proper scientific notation
- Be able to multiply, divide, add and subtract numbers in scientific notation
- Be able to distinguish between accuracy and precision
- Be able to use significant figures properly when taking measurements.
- Know the rules for counting significant figures
- Know how perform calculations with the right number of significant figures in the final answer.
- Know how to use factor label method
- Know the fundamental units, what is meant by a fundamental unit and what the purpose of fundamental units are.
- Know how perform calculations with the right number of significant figures in the final answer.
- Know how to calculate percent error.
- Be able to distinguish among elements, compounds, and mixtures.
- Know some element symbols.

Metric Units and Prefixes. The metric system uses a system of prefixes to show fractions and multiples of the basic units. The basic units are meters (m) to measure distance, grams (g) to measure mass, and liters (L) to measure volume. Some of the important prefixes are shown to the right.

Kilo (k)	=	1,000	=	10^{3}
Deci (d)	=	0.1	=	10^{-1}
Centi (c)	=	0.01	=	10^{-2}
Milli (m)	=	0.001	=	10^{-3}
micro (μ)	=	0.000001	=	10^{-6}
nano (n)	=	0.000000001	=	10^{-9}
pico (p)	=	0.000000000001	=	10^{-12}

Factor Label Conversions. Any mathematical problem that has units lends itself to solution by"Unit Analysis" or the "Factor Label Method." Using definitions, it is possible to convert one unit to another. Every definition can be turned into two conversion factors with a numerical value of one. Multiplying by a factor equal to one does not change the value, but selecting the correct factor causes units to cancel giving the desired result. See the sample problem to the right.

Sample Problem: How many meters are 1,472 ft

Definitions 1 ft = 12 in; 1 in = 2.54 cm; 1 cm = 0.01 m

$$1{,}472\,ft \times \frac{12in}{1ft} \times \frac{2.54cm}{1in} \times \frac{0.01m}{1cm} = 449m$$

Scientific Notation. When numbers are very large or very small, they are easier to interpret when written in scientific notation. Scientific notation also makes it easier to show the number of significant digits. Numbers written in scientific notation have two parts: the first part is a number between 1 and 10; the second part is 10 raised to any whole number exponent. The two parts are multiplied by each other. Numbers are converted to scientific notation by moving the decimal point of the original number to get a number between 1 and 10. Keep track of the number of places the decimal has been moved and the direction to get the exponent. Addition and subtraction in scientific notation follow a few simple rules: (1) numbers must be a multiple of the same power of 10; (2) the first factor can then be added or subtracted; and (3) the power of 10 is not affected. Multiplication follows a different set of rules: (1) multiply the first factors; and (2) add the exponents. Division follows still a third set of rules: (1) divide the first factors; and (2) subtract exponents. See the examples on the next page.

Addition

Example

$1.35 \times 10^5 + 2.9 \times 10^4$

Procedure

① $2.9 \times 10^4 = 0.29 \times 10^5$

② $0.29 \times 10^5 + 1.35 \times 10^5 = 1.64 \times 10^5$

Multiplication

Example

$(2.0 \times 10^4) \times (1.5 \times 10^3)$

Result

3.0×10^7

Division

Example

$$\frac{3.0 \times 10^5}{2.0 \times 10^3}$$

Result

1.5×10^2

Significant Figures. The accuracy of measurement is limited by the tools we use. Measuring devices are often marked off in divisions of equal size. The things we measure often fall between these marks. For this reason, it is necessary to estimate one place beyond the smallest measurement of any measuring device. The last digit of any measured value, therefore, can be considered estimated. No more than one estimated digit can be included in any measurement or calculation done with the measurement. This is ensured by keeping track of significant figures. The trailing zeros (zeros at the end of the number) in numbers without an expressed decimal, are place holders and are not significant figures. The leading zeros (zeros before the first nonzero digit) in numbers with an expressed decimal, are place holders and are not significant figures. The number 0.00250 has three significant figures.

There are rules to keep extra uncertain numbers from cropping up in your calculations.

multiplication and division - the number of significant figures in a product or quotient is the same as the measurement with the smaller number of significant figures.

Problem

$3.1415 \times 2.25 = 7.068375$

Correct number of Significant Figures = 3

Solution 7.07

addition and subtraction - the smallest decimal place in the sum or difference is equal to the smallest decimal place in the measured quantity with fewer decimal places

Problem

$6.357 - 2.4 = 3.957$

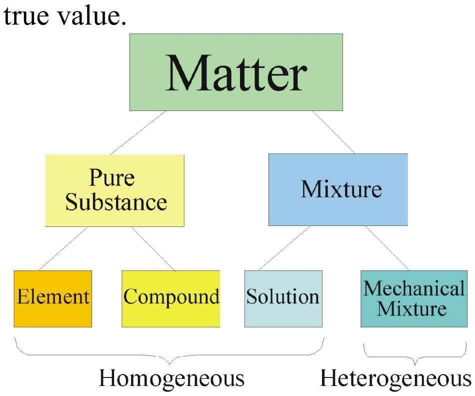
Smallest Decimal Place = 0.1 (fewer places than 0.001)

Solution 4.0

Percentage Error. The actual size of the error – the difference between the observed value and the true value – is known as the **absolute error**. The sign of the absolute error is not important. The size of the error is more important than whether the value is over or under. The real measure of how far off a value is, is the percentage error. It is the size of the error, the absolute error, compared to the true value.

$$\text{Percent error} = \frac{|\text{observed value} - \text{true value}|}{\text{true value}} \times 100\%$$

Matter. Matter is anything that has mass and takes up space. Pure matter can be classified as elements or compounds. Elements are simple substances that can't be broken down by chemical means. Gold is an example. Compounds are composed of two or more elements chemically combined. The properties of elements are not retained when they combine to form a compound. Mixtures are composed of two or more substances blended together. A solution is a homogeneous mixture. A mechanical mixture has two or more phases. The properties of the substances in a mixture are retained. This fact is useful for separating a mixture. For example, a mixture of iron and sand can be separated using a magnet, because the iron is still magnetic. A solution is a homogeneous mixture. It consists of a solute and a solvent. The solvent is the continuous phase. A mechanical mixture is a heterogeneous mixture. It has two or more phases. Solutions in water appear clear,



while mechanical mixtures in water often appear cloudy. Suspensions are mechanical mixtures in which the particles settle over time. Colloidal dispersions are mechanical mixtures that don't settle over time. They have smaller particles than suspensions, but larger particles than solutions. Mechanical mixtures can scatter a beam of light making it look like headlights in fog. This is called the tyndal effect.

Element Symbols. In 1814 Jöns Berzelius, a Swedish chemist, devised the system of symbols used by scientists. The goal of his symbols was to make it easy to write chemical observations in shorthand that could be easily understood. Many symbols are just the first letter of the element's name, upper case. Carbon, for example is C. Other symbols have two letters from the element's name, with the first being upper case and the second being lower case. Examples include calcium, Ca, and cadmium, Cd. Some element's symbols are based on the Latin name such as copper (Cu = cuprum) and lead (Pb = plumbum)

Answer the questions below by circling the number of the correct response

1. Which is the equivalent of 750. calories? (1) 0.750 kcal (2) 7.50 kcal (3) 75.0 kcal (4) 750. kcal

2. Which of the following could represent an object's mass? (1) 2.54 cm (2) 9.50 L (3) 8.46 kg (4) 0.95 ps

3. Which is the equivalent of 1250. microliters? (1) 1.250 L (2) 1.250 kL (3) 1.250 cL (4) 1.250 mL

4. Which of the following could represent the space an object occupies? (1) 3.4 cm (2) 4.2 L (3) 4.6 kg (4) 6.3 ps

5. Which is the equivalent of 0.500 ks? (1) 500. s (2) 50.0 s (3) 0.000500 s (4) 5.00 s

6. Which of the following conversions could be used to determine the number of µL in 1.25L?

   (1) $1.25L \times \frac{1\mu L}{0.000001L}$ (2) $1.25L \times \frac{0.000001L}{1\mu L}$

   (3) $0.000001L \times \frac{1\mu L}{1.25L}$ (4) $1\mu L \times \frac{0.000001L}{1.25L}$

7. What is the numerical value of the conversion factor $\frac{1km}{1{,}000m}$?

   (1) 1 (2) 0.001 (3) There is no way to tell (4) 1,000

8. Based on the fact that the density of water is 1 g/mL, what does the following expression show?

   $$3.0L \times \frac{1{,}000mL}{1L} \times \frac{1g}{1mL} \times \frac{1kg}{1{,}000g}$$

   (1) the number of liters in 3.0 g of water
   (2) the number of grams in 3.0 L of water
   (3) the number of liters in 3.0 kg of water
   (4) the number of kilograms in 3.0 L of water

9. Which of the following conversions could be used to determine the number of centimeters in 15 mm?

   (1) $\frac{1}{15mm} \times \frac{0.001m}{1mm} \times \frac{1cm}{0.01m}$

   (2) $15mm \times \frac{1mm}{0.001m} \times \frac{0.01m}{1cm}$

   (3) $15mm \times \frac{0.001m}{1mm} \times \frac{0.01m}{1cm}$

   (4) $15mm \times \frac{0.001m}{1mm} \times \frac{1cm}{0.01m}$

10. Which of the following is written in proper scientific notation? (1) 0.25×10^3 (2) 2.5×10^2 (3) 25×10^1 (4) 250

11. What is the value of the expression below in proper scientific notation?

    $$\frac{1.3 \times 10^3}{6.5 \times 10^4}$$

    (1) 0.2×10^{-1} (2) 2.0×10^{-2} (3) 0.2×10^7 (4) 2.0×10^6

12. What is the product of 1.5×10^2 and 2.0×10^3? (1) 3.0×10^5 (2) 3.5×10^5 (3) 3.0×10^6 (4) 3.5×10^6

13. What is the sum of 1.5×10^4 and 1.0×10^3? (1) 1.5×10^7 (2) 2.5×10^7 (3) 1.6×10^7 (4) 1.6×10^4

14. What is the difference between 4.1×10^3 and 2.1×10^2? (1) 2.0×10^1 (2) 3.9×10^1 (3) 2.0×10^3 (4) 3.9×10^3

15. Light travels at 186,000 mi/s. If a mile is 5,280 ft, there are 12 in in a foot, and 2.54 cm in an inch, what is the speed of light in meters per second?

16. How many millimeters are in 2,450 nm?

17. According to an accepted chemistry reference. the heat of vaporization of water is 540. calories per gram. A student determined in the laboratory that the heat of vaporization of water was 620. calories per gram. The student's results had a percent error of (1) 13, (2) 80., (3) 15, (4) 87

18. In an experiment the gram atomic mass of magnesium was determined to be 24.7. Compared to the accepted value 24.3, the percent error for this determination was (1) 0. 400, (2) 2, (3) 24.7, (4) 98.4

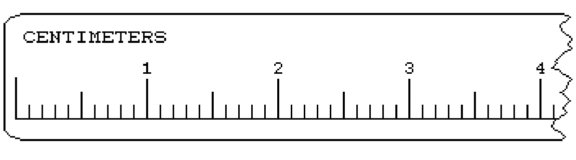
19. A student determined the melting point of a substance to be 55.2 K. If the accepted value is 50.1 K, the percent error in her determination is (1) 5.1, (2) 10., (3) 9.2, (4) 12

20. In an experiment, a student found that the percent of oxygen in a sample of $KClO_3$ was 42.3%. If the accepted value is 39.3%, the experimental percent error is

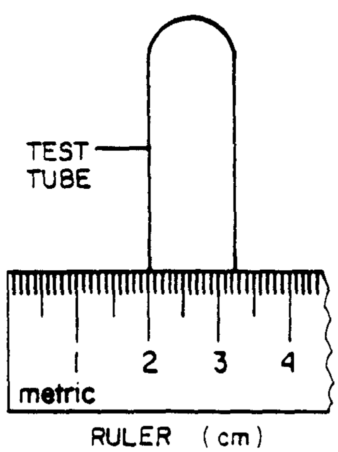
(1) $\frac{42.3}{39.3} \times 100\%$ (3) $\frac{3.0}{42.3} \times 100\%$

(2) $\frac{39.3}{42.3} \times 100\%$ (4) $\frac{3.0}{39.3} \times 100\%$

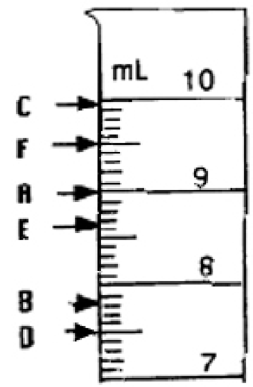
21. The drawing to the right shows a line below a portion of a ruler. Based on the drawing, which of the following is an appropriate value for the length of the line? (1) 3.652 cm (2) 3.65 cm (3) 3.7 cm (4) 4 cm



22. A student has to measure the diameter of a test tube in order to calculate the tube's volume. Based on the diagram at the right, the tube's diameter is closest to
(1) 1.25 cm
(2) 2.32 cm
(3) 3.25 cm
(4) 12.5 cm



23. A graduated cylinder is filled to the level shown by the arrow labeled "E," in the diagram to the right. After standing for several days, enough water evaporates for the water level to drop to the arrow labeled "D." How much water has evaporated? (1) 1.2 mL (2) 1.15 mL (3) 8.65 mL (4) 8.7 mL



24. Which measurement contains a total of three significant figures? (1) 0.0100 g (2) 0.01 g (3) 0.010 g (4) 0.01000 g

25. Using the rules for significant figures, the sum of 0. 027 gram and 0.0023 gram should be expressed as (1) 0. 0293 gram, (2) 0.03 gram, (3) 0.029 gram, (4) 0.030 gram

26. How many significant figures are in 3100 mg? (1) 1 (2) 2 (3) 3 (4) 4

27. A block of wood has the following dimensions: 2.1 cm; 3.2 cm, and 4.5 cm. What is its volume (V = L × W × H) to the correct number of significant figures? (1) 30.24 cm^3 (2) 30.2 cm^3 (3) 30. cm^3 (4) 30 cm^3

28. What are the following values in proper scientific notation and to the correct number of significant figures?
   a. 5790×10^3
   b. 57900002
   c. 579.0×10^3

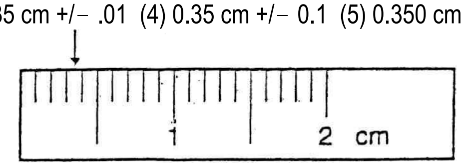
29. Complete the following calculations and write the answer to the appropriate number of significant figures. Answers should also be written in scientific notation.
   a. $(2.00 \times 10^6 - 1 \text{ x } 10^4)/2$ = -?-
   b. $(2.00 \times 10^4) \times (3.0 \text{ x } 10^3) + 5.0 \times 10^8$ = -?-
   c. [2.0 + 0.0000030+ 13.00]/[5.00] = -?-

30. How many significant figures are in each of the following measurements:
   a. 187.032 g
   b. 0.060100 m^3
   c. 1.30×10^{-12} kg

31. Convert: 2.00 g/mL to kg/cL.

32. Convert 50 micrograms to decigrams.

33. How should length indicated by the arrow along the ruler be recorded? (1) 0.30 cm +/− 0.1 (2) 0.30 cm +/− 0.01 (3) 0.35 cm +/− .01 (4) 0.35 cm +/− 0.1 (5) 0.350 cm +/− .001



34. Which of the following is NOT matter? (1) a chair (2) air (3) light (4) water

35. Which of the following is NOT a property of matter? (1) inertia (2) occupies space (3) composed of elements (4) weightlessness

36. Which of the following may be heterogeneous? (1) elements only (2) compounds only (3) mixtures only (4) elements or compounds

37. Which of the following is pure? (1) elements only (2) compounds only (3) mixtures only (4) both elements and compounds

38. Which of the following consists of more than one substance? (1) elements only (2) compounds only (3) mixtures only (4) either elements or compounds

39. Which of the following are types of matter? (1) elements only (2) compounds only (3) mixtures only (4) all of these

40. Which of the following is matter? (1) love (2) ideas (3) rock (4) heat

41. The tendency of matter to maintain its state of motion is known as (1) density, (2) inertia, (3) mass, (4) volume.

42. Which of the following is NOT composed of two or more types of atoms? (1) element (2) compound (3) solution (4) mechanical mixture

43. Which substance can be decomposed by a chemical change? (1) ammonia (2) iron (3) argon (4) helium

44. The symbol for potassium is (1) P, (2) K, (3) Sn, (4) Po.

45. The symbol for gold is (1) Ag, (2) Au, (3) Ga, (4) Na.

46. Sb is the symbol for (1) antimony, (2) sulfur, (3) mercury, (4) tin.

1. 1
2. 3
3. 4
4. 2
5. 1
6. 1
7. 1
8. 4
9. 4
10. 2
11. 2
12. 1
13. 4
14. 4
15. 2.99×10^8 m/s
16. 0.00245 mm
17. 3
18. 2
19. 2
20. 4
21. 2
22. 1
23. 2
24. 1
25. 3
26. 2
27. 3
28.
a. 5.79×10^6
b. 5.7900002×10^7
c. 5.790×10^5*
29.
a. 1×10^6
b. 5.6×10^8
c. 3.00
30.
a. 6
b. 5
c. 3
31. 0.0200 kg/cL
32. 5×10^{-4} dg
33. 3
34. 3
35. 4
36. 3
37. 4
38. 3
39. 4
40. 3
41. 2
42. 1
43. 1
44. 2
45. 2
46. 1