Your name: _____ Period: _____

Regents Chemistry - Part 1

Measurement

Contained inside are all of the notes that you will need to bring to class every day. You will fill them all in, during class, or outside of class, with the help of our slideshows. If you ever forget these notes, get some paper and take your notes the "old fashioned way" and then fill these in later.

You need your reference tables every day too, and a calculator.
I have lots of reference tables and some calculators too, but mine are ugly.

Pencils are better because you will make a lot of boo boos.

Don't just sit there and be passive, learn.

Day One Welcome and Let's start learning Copy the objective of today's class in blank #1.
Keep filling in the blanks.

1.

2. What is the chemistry formula for water? _____
3. The H stands for the element _____ which happens to be element # _____
4. The O stands for the element _____ which happens to be element # _____
5. The "little 2" means that there are _____
6. There is no "little 1" by the oxygen, why not?

7. Both hydrogen and oxygen are special elements in that they do not exist as single atoms when they are pure, not bonded to other atoms. Their real formula would be

   _____ and _____ because they are DIATOMIC elements, which means that they are paired together when they are pure, when they are in their "elemental" state.

8. The skeleton formula for the synthesis reaction that combines $H_2 + O_2$ to form water is written this way:

   _____

9. The arrow means:

10. It's pretty obvious that we are missing one atom of oxygen on the right side of the arrow. Are we allowed to "lose" matter like this?

11. There is something called the LAW OF CONSERVATION OF MATTER which is written this way:

12. So there must be a bit more to the reaction, since we can't lose even a single atom. Watch how it's balanced, then copy the balanced chemical reaction below

13. Skip this number, ok?
14. There are about 16 different kinds of chemical reactions that we will learn about this year. This one is called SYNTHESIS, which

    means combining 2 or more _____ into the _____

15. In this reaction there are 2 reactants, who's names are _____ + _____

16. There is only one product, which has a science name of _____

    but we can call it _____ too.

This reaction will release a LOT of energy, a FIREBALL of flame and heat, and NOISE. It's safe, but it might surprise you too. Look at this photo, that's how you will protect your ears. Let the sound hit your face, and blast past your hands. Let the sound bounce off of the wall behind you, and then catch it with your hands. Try not to blink! This will look a lot like burning, which is casual talk for COMBUSTION, but it's not that. The butane lighter is combusting. The candle is also a combustion reaction, but the balloon will just be really fast, really loud SYNTHESIS. When energy is released in a chemical reaction, we call it EXOTHERMIC.

17. The balanced "thermochemical reaction" will look like this:

Let's watch, try not to blink, and promise me that you will tell your families about your first day of chemistry!

Tonight for Homework:

A. Read the whole1st Day Handout, your parents NEED to look it over as well.
B. Fill in the Student Information Handout neatly. Numbers and letters need to be clear.
C. Get pencils, a calculator, and if you can a really big loose leaf binder to hold all of your old notes. We will retire everything once we are done with the topic. You will save them all, in order, to study for the 1st quarter cumulative celebration of knowledge, the Midterm, and the Regents Examination next June.
D. Get psyched, we are going to learn A LOT and we're going to have fun too. I can't wait.

Measurement Class #1 Percent Error and Density

Objective: Learning about Percent Error and how to make Density Calculations.
When we measure in chemistry we need to make the best measurements we can. We will try to be

18. ACCURATE

19. We will also try to be PRECISE:

20. Mostly we'll try to be BOTH accurate and precise.

21. Our measurements are called the _____ values.

22. The real measurements, the truth, which we usually get from science tables are called the

_____ values.

23. Take out a ruler and measure this page top to bottom in centimeters. My measure is _____ cm.

24. Measure it again to the nearest 10th of a centimeter now. _____ cm.

25. The actual length is 27.9 cm. How far "off" was your measurement in cm? _____

That boo boo is called your ERROR, which is vocabulary but we won't use it much ever again.

26. What we really want to use to measure how close we measured to accurate - THAT is called percent error.
Write the formula for percent error in the box at left. It's on the back of your reference table.
Below, we'll write it out in short hand. You must know both. Don't forget the % sign after the 100!

%E =

% Error =

27. Let's calculate your percent error on this measurement. If you happened to get 27.9 cm exactly, good for you, use 28.3 cm instead. Write the formula again, shorthand style.

28. Let's use your eyes to measure the mass of the teacher in POUNDS. My measure his mass to be

    _____ pounds. According to the LOUSY school scale, the actual value is _____ pounds.

29. Calculate your percent error, write the formula in shorthand first.

30. If your %E is positive, that means your measured value…

31. If your %E is negative, that means your measured value…

32. If you have no sign, positive or negative, that means…

33. Percent error ALWAYS gets a sign, or else…

34. You measure the density of Cu to be 8.75 g/cm^3. What element is this, what is the density of this element (and how did you figure that out?)

35. Write the percent error formula in shorthand, calculate your percent error carefully. Get a SIGN too!

36. Is your measured value in this problem more than or less than the actual value? _____

Does your percent error sign make sense? _____

37. The formula for Density is on the back of the reference table. Copy it now, then in short hand.

Density = _____ D = _____

38. A bar of metal is 27.73 g and has volume of 4.70 cm^3. Is it gold? (start with a formula, look at table S)

39. What metal might it be instead? _____

40. You measure a hunk of aluminum to be 363 grams and have volume of 148 mL. What is your measured density? What is your percent error?

Measurement Class #2 Temperature Conversions, Centigrade and Kelvin (and NOT Fahrenheit)

41. Centigrade is another way to say Celsius, but centi- reminds us of cents, and there are _____ units of temperature from melting ice to boiling water temperature. It's a Metric Temperature Scale. (good)

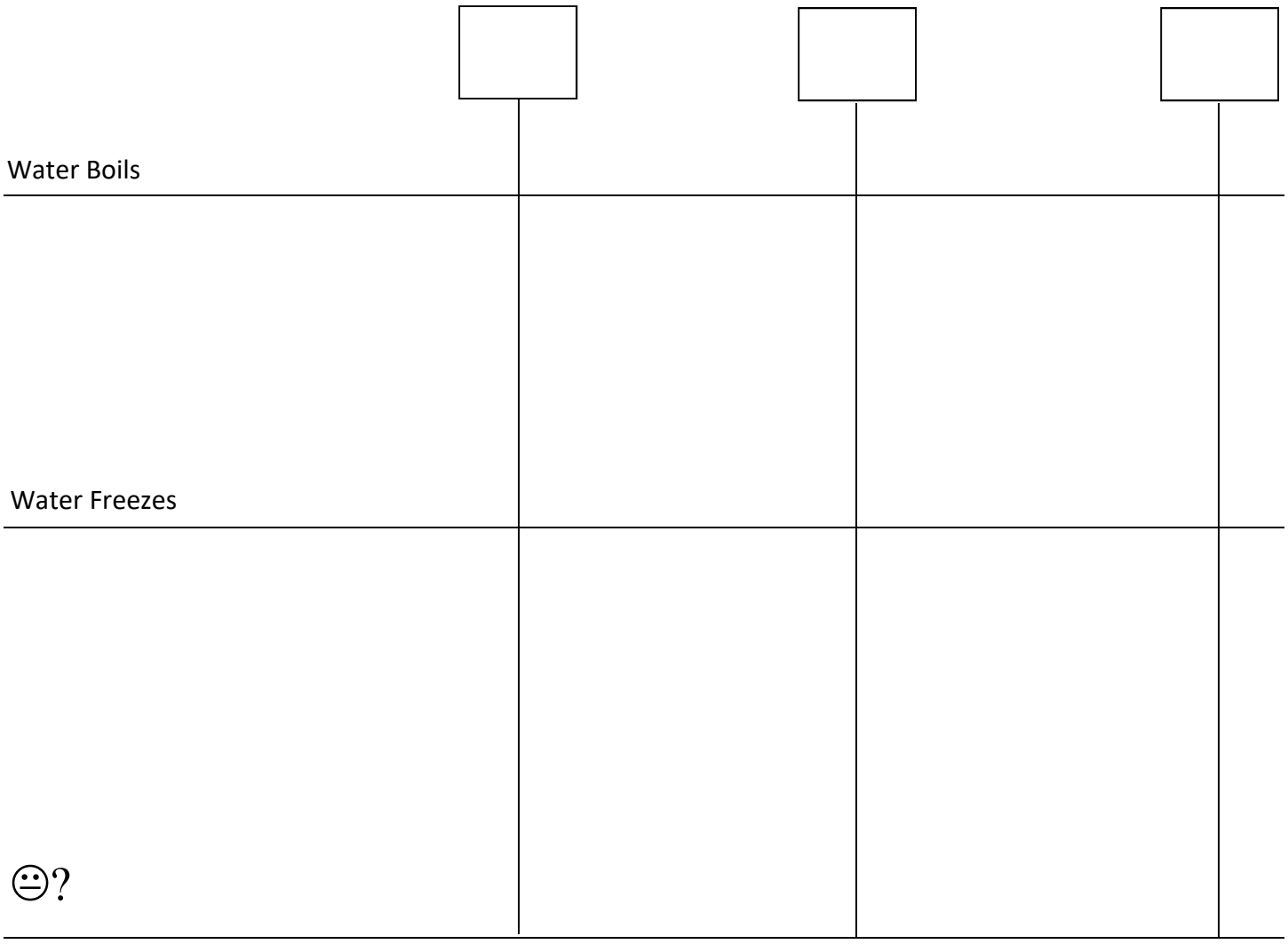
42. Another scientific temperature scale is called the _____ scale. It's named after a guy named

    Lord _____, no relation to Lord Vader from Star Wars.

43. There are 100 units of temperature from melting water to boiling water temperature. It's a Metric Temperature Scale too.

    This scale DOES NOT USE degrees, just _____

44. Let's fill in this chart now (even with the F scale).



	Pros	Cons
Fahrenheit		
Centigrade or Celsius		
Kelvin		

To convert from Centigrade to Kelvin, or from Kelvin to Centigrade, we use the SAME formula. It's on the back of the reference table, let's copy it now. Write it big, like you care.

45. The boiling point for water is 100°C. Convert that to Kelvin, use a formula.

46. The melting point of iron is _____ Kelvin. Convert that to centigrade with a formula.

47. Chlorine gas boils at _____ Kelvin. Convert to centigrade with a formula.
Is this COLD or HOT? Explain what you mean

48. You have 416 cm^3 of iron. What is it's mass? (hint, write density formula, fill it in neatly)

49. You measure the density of gold to be 19.7 g/cm^3. What is your percent error?

50. You measure the melting point of lead to be 615 Kelvin. What is your percent error?

51. You measure 18.25 grams of silver on the scale. What is the volume of this silver?

52. Convert the room temperature of 26.0°C into Kelvin. Round to three digits.

53. You measured the density of pure water to be 0.975 g/cm^3, but everyone knows that water's density is exactly 1.00 g/cm^3. What's your percent error?

Measurement Class #3 Significant Figures

Significant figures are all of the numbers that you MEASURE that are important. There is a difference between what you measure and what you look up on a table, or even what you already "know".

They are the numbers that mean something, that are not place holders. They are used to figure out how many places we are allowed to round our calculator answers to. Just because the calculator says something does not make it real. The SF will control how many places your real answers are allowed to have. There are several easy rules, which you will have to master.

For each of these measures, we will write how many SF are present, and what rule applies.

62. Let's look over these measurements, and write the number of SF present. The first one is an example

54	127.25 grams	5 SF	All digits that are not zeros are significant
55	107.25 grams		All digits are significant, any zero that is IN BETWEEN SF is also significant
56	0.625 meters		"Leading" zeros are not SF. From the left, the first SF is a digit
57	100. grams		Because of the decimal point, that last zero is a SF. The zero in the middle is between SF
58	100 meters		No decimal, the last zero is not a SF, the middle one is not between SF
59	2.245×10^4 atoms		we only have SF in the coefficient, or front part of scientific notation
60	14.50 grams		a zero at the "end" of a number and AFTER a decimal point is a SF
61	Density of water is 1.00 g/mL		Unlimited SF means that with an equality that you will use in a math problem, or numerical facts from tables will not limit your answer, but your measurements will.

200. grams of Mg 3 SF	35.66 grams Cu	100 cm	100. mm	4,005,033 atoms
0.552°C	1.552°C	10.552°C	23.00552°C	6.02×10^{23} atoms
1.00 g/mL	1.000 g/mL	1.00000 g/mL	0.0000005 grams	3.550×10^{-17} grams
The answer to a density problem with mass of 125 grams and volume of 35 mL	Calculate density with mass of 1025 gm + volume of 350 mL	The temperature in K when you convert 24.5°C → Kelvin.	the answer of $2.5\ cm^3 \times 5.6788\ g/cm^3$ =	
If there are 454 grams = 1 pound, the number of grams in 3.750 pounds when you convert it.		The equality of 1000 grams = 1 kilogram		12.00 inches

63. You measure the density of nickel metal to have density of 9.1 g/cm^3. What is your % Error with the correct number of SF?

64. You measure your floor to be 14.5 feet X 15 feet and you want a rug. How big of a rug do you need in square feet? (SF count)

65. You measure the mass of metal to be 74.35 grams and it's volume to be exactly 12.0 mL. What is the density of this metal with correct SF?

66. You know that 12 inches = 1 foot, how many inches are in 8,375 feet? (SF count!)

67. How many SF are in these measurements?	0.0000164 g/cm^3 (density of a gas)	7180 K (melting point)
303 K (a melting point)	3560. K (a boiling point)	640 grams (mass of a liquid)

Sig Figs, or SF are the highest value topic of the year. SF are in all lab reports from now on, they're on every celebration and midterm, most HW and most classwork assignments. You will be measuring all sorts of stuff, and doing all types of calculations all year long. Figuring out the RIGHT answer requires you to follow the rules of SF. Learn SF or else.

Measurement Class #4 Dimensional Analysis or Math Conversions

Converting from one unit to another is going to happen a lot in chemistry. We already have done conversions between Kelvin and centigrade, and converted mass and volume into density. But other conversions will need to be done as well. Some are easy, one step conversions, but some are multiple step, and require this "technique" of dimensional analysis, which is just scary talk for unit conversion math. Here goes.

Nothing says LOVE more than a dozen roses. How many roses are a dozen? _____ there, you did dimensional analysis in your head.

How many roses are in 3 dozen roses? _____ Ha, again. You converted dozens of roses into roses.

If 12 inches = 1 foot, how many inches are in 4.0 feet? _____ another conversion, from feet to inches.

68. Let's look at what your brain was doing. First you decide your "starting point" and put that number "over 1" as a fraction.

Your starting point	X	Your conversion factor	=	Your answer with proper SF
	X		=	
2 SF		Unlimited SF		Limited to 2 SF

69. Convert 1.24 kilograms into grams (1 kg = 1000 g). (watch SF)

70. Convert 56,750 mL into liters (1 L = 1000 mL). (watch SF)

71. Assume you are EXACTLY 16.33 years old right NOW. Convert that into minutes.

72. Convert the 400. meter race into yards so the football players can easily compare that length to their field.
1 inch = 2.54 centimeters

73. Below are a set of equalities that are meaningless. This problem is to practice finding your "starting point" and cancelling out units properly, to get the right answer. This is mental exercise and you should take it as a personal challenge.

How many blinks are in 244 winks? (round to the nearest whole blink)

6.75 zinks = 1.09 blinks

34 winks = 3.4 jinx

0.95 pinks = 2.0 zinks

7.0 jinx = 2.11 pinks

74. It's exactly 7.10 miles to Binghamton High School from Vestal High School according to mapquest.com
Convert that distance into meters. (1 inch = 2.54 cm 1 mile = 5280 feet 100 cm = 1 m)

Measurement Class #5 Scientific Notation for fun and personal enjoyment

Really big and really small numbers are often presented in scientific notation, and look like this:

6.02×10^{23} atoms is one mole of atoms or the density of helium is 1.64×10^{-4} grams/mL

The front part of the number is called the coefficient, and the back part is called the power of ten.

In our class the RULE for scientific notation is that the coefficient MUST BE greater than 1 but less than 10.

If your math works out differently, you must adjust your answer to an equivalent answer in the proper form.

Converting big and small numbers into scientific notation first.

75. 17,000,000,000 ants _____

76. 6,374,000 meters _____

77. 0.034 gram _____

78. 0.000000000154 meters _____

79. 0.0000083 meters _____

80. 4,500,000,000,000,000,000,000,000 years _____

Convert scientific notation into numbers

81. 6.02×10^{23} molecules _____

82. 3.5×10^{4} grams _____

83. 1.25×10^{-7} meters _____

84. 2.290×10^{3} Kelvin _____

85. Convert 36.8 kilograms into ounces, your answer to be given in <u>scientific notation</u>.
(hints: 454 g = 1 pound = 16 ounces) (1kg = 1000 grams) Round to correct SF

86. Convert 300. seconds into years, answer as scientific notation
(hint: your answer will be a small fraction of years, your exponent must be negative)

Rules to use scientific notation in math problems…

Multiplication Rule for Scientific Notation: _____

87. $(3 \times 10^5)(2 \times 10^2) =$ _____

88. 5.0×10^4
$\underline{\text{X } 3.0 \times 10^2}$

Division Rule for Scientific Notation: _____

89. $\dfrac{3.0 \times 10^4}{2.0 \times 10^2}$

90. $\dfrac{9.0 \times 10^5}{3.0 \times 10^3}$

91. Addition Rules for scientific notation: _____.

92. 6.5×10^7
$\underline{+ 2.2 \times 10^7}$

93. 6.2×10^8
$\underline{+ 1.5 \times 10^6}$

94. Subtraction Rules for scientific notation: _____

95. 8.5×10^3
$- 2.4 \times 10^3$

96. 7.1×10^5
$- 1.6 \times 10^4$

97. 8.72×10^{11}
$+ 1.72 \times 10^{10}$

98. 4.65×10^{14}
$- 2.25 \times 10^{15}$

99. 6.02×10^{23}
$\times 1.50 \times 10^2$

100. $(9.05 \times 10^{19}) \div (3.2 \times 10^{16}) =$

PRACTICE MATH for measurement. Do all of these in PENCIL please.

101. Convert 2450 mL into gallons. Show all units (3 SF) (1.06 Qt = 1 L)

102. How many millimeters are in 1000. yards? Put answer into scientific notation.

103. You have a special moment and discover a hunk of metal in your yard in the dirt. It's stamped "pure osmium" and "100.0 grams" as well. It looks pretty new and you even believe this is real. What is the volume of this hunk of metal in cm^3? Show a formula and all your work. Use SF.

104. REVIEW: determine how many significant figures are in each of these measurements:

5,600 grams_____ 5.600 kilograms_____ 4.305 mL_____

0.678°C_____ 0.00065 moles Hg_____ 1.400 seconds_____

105. Calculate the quotient: 4.569 g ÷ 2.0 cm^3 = _____

106. In each set of temperatures, decide which is the coldest, which is the hottest.

SET A: 10 K or 10 C or 10 F SET B: 280 K or 32°F or 6.0°C

107. Convert 125 grams into kilograms

108. Convert 34.75 liters into mL

109. You measure some pure niobium metal to have a density of 8.00 g/cm^3. What is your percent error? (hint, write the formula first)

110. Do what the math says to do: $(3.5 \times 10^6) \times (2.0 \times 10^2) =$

$(8.0 \times 10^8) \div (4.0 \times 10^{12}) =$

$(3.3 \times 10^8) + (1.2 \times 10^7) =$

$(5.64 \times 10^5) - (2.33 \times 10^4) =$

111. Look up the boiling point of aluminum, covert that into scientific notation. Also, convert the Kelvin into centigrade. (watch out for SF!)