Science Is A Verb Vocabulary

Word	Definition
Analysis	The step in the scientific method where data is used to solve a problem.
Coefficient	The number in FRONT of a formula.
Control	The conditions which remain constant during the experiment
Conversion Factor	A number or ratio (in fraction form) that is used to convert from one unit type to another. The given units cancel out, leaving the desired target units.
Data	That which is measured or observed during an experiment.
Dependent Variable	The variable on the Y-axis that changes as a result of changing the independent variable.
Direct Relationship	A relationship where the increase of the independent variable results in the increase of the dependent variable.
Experiment	An activity designed to test the specifics of the hypothesis.
Exponent	A number that expresses a “power”, is written as a superscript.
Extrapolation	Extending the graph beyond the data points to predict values beyond that which was plotted to get desired information.
Given	Information which is provided to you in the form of a number and a unit.
Hypothesis	An “if-then-because” statement used to design an experiment to test an idea.
Independent Variable	The variable on the X-axis that the experimenter has control over.
Indirect Relationship	A relationship where the increase of the independent variable results in the decrease of the dependent variable, or vice versa.
Interpolation	Reading between plotted data points on a graph to get desired information.
Line Of Best Fit	A straight line that best represents the slope of the data being analyzed. Can be approximated by hand, or done with linear regression methods.
Precision	The place to which a measurement was made.
Problem	A specific issue that can be resolved through application of the scientific method.
Scientific Method	A series of logical processes designed to solve problems.
Significant Figures	The number of digits actually recorded by a measuring device during a measurement.
Target	The desired result of a mathematical problem, that which you are solving for.
Unit	A symbol which identifies the type of measurement that has been made. This needs to be placed after every measured number and every calculated answer.
Variable	The value that changes during the experiment

MATERIALS NEEDED FOR COURSE

- Notebook (spiral, one-subject will be enough)
- PENCILS, pens
- Pocket folder
- Calculator. Graphing calculators may be banned from the Regents Exam, so have a spare scientific calculator handy.
- Reference Tables (provided)
- One cranial cavity, stuffed full of brains.

CLASS RULES

-BE ON TIME
-STAY ON TASK
-NO FOOD OR DRINKS (WILL BE CONFISCATED)
-NO HATS, ELECTRONIC MUSIC DEVICES OR CELL PHONES (WILL BE CONFISCATED)
-CELL PHONES MAY NOT BE USED AS CALCULATORS
-DO NOTHING TO INTERFERE WITH THE LEARNING OF OTHERS

WHAT TO EXPECT FROM A TYPICAL CLASS PERIOD

When you enter the class, you will be greeted by some form of review, either questioning, a quiz or a "white board review". If it is a white board review, grab a board, marker and eraser rag. Place your answer to the posed question on the board and hold it up. Do not erase it until the all-clear has been given.

At the beginning of each unit, you will receive two packets. The first one contains all of the notes for the unit, including sample problems, diagrams and the unit's vocabulary words. Each topic represents one day's worth of work. The number of topics in the unit packet represents the number of days in the unit. Add one day for the review and the test. Each day's topic lists the homework assignment, which can be found in the second packet.

The second packet contains all of the work that you have to do for the unit. As you finish each topic, you will bring the packet to the front of the room, where it will be checked for correctness. If correct, you will receive point value for the work (usually 10 points) and you may begin the next topic. If incorrect, you will be advised which sections need to be corrected and assistance in correcting those sections. The entire packet is due, complete, before the test is given. Any work not graded with a final grade prior to the test will be given a grade of zero. This allows you to work at your own pace, either to stay with the class or work ahead.

The material will be presented to you and you will be given examples of problems to solve or phenomena to explain and apply. Most days, you will be given ample time to complete the assignment in class. Some days, especially right after a test, you will be asked to complete the first topic, almost always an introductory topic, on your own for homework. It is highly recommended that you use a PENCIL to complete all assignments.

At the end of the unit, you will be given a practice test to take. The day of the test, we will start by going over the practice test. This will be followed by a five-question vocabulary quiz and the test. The vocab quiz will be based on the list of vocab words on the front of that unit's notes packet.

IN CLOSING

If asked to refer to a particular reference table, then refer to it. If asked to try solving a problem, then work it out. Participation is required to successfully complete this course. Sitting around like a lump will gain you nothing. This is definitely a course where your grade is almost entirely determined by the effort you put into it. If you choose to participate, get involved and do what has to be done, you will do extremely well. If you decide to do nothing or act in a disruptive manner, you are virtually guaranteed to do horribly. It is entirely up to you what kind of grade you want to get. You really do have control over your destiny in this class. Take advantage of that fact.

Regents Chemistry: TROUBLESHOOTING

PROBLEM	SOLUTIONS
I failed a test.	You did not study. Studying does not mean reading your notes. Studying means DOING. Doing your worksheets over again, rewriting your notes into another notebook, using flash cards for vocabulary and other problems are all ways of actively studying. Studying is not a passive task. A sweat should be broken.
But I did study and I sill failed!	Did you seek extra help the day then you didn't understand something? When did you start studying? Your homework period each day should be half studying and half homework. Studying is a cumulative process, not something you spend an hour on the day before the test.
I think I am going to fail the marking period.	Did you do all of your homework? Each homework missed can add up to a point or more off your marking period average.
I lost my Reference Tables.	Xerox a copy from someone else.
I don't know how to use my calculator.	Come in and I will show you how.
I didn't bring anything to write with.	Borrow something from someone in the class. I don't lend out writing implements.
I lost the textbook.	It will cost you $50 to replace it.
Someone in the family died/was in the hospital/etc. so I couldn't do the homework.	Bring in a note from your parents to let me know that this is a legitimate excuse. Bring homework in next day with the note.
I couldn't do the homework.	Did you seek extra help?
I don't have the time to come for help.	Make the time. There is always time.
I think I am going to fail the Regents exam.	Unlikely. Did you buy a red Barron's book? Are you taking all of the old tests and correcting yourself, checking the explanations for the ones you got wrong? This process should start at the beginning of May and go right through to the test.

What is Chemistry?
Chemistry is the study of matter, the changes matter undergoes and the energy involved in these changes. It is the universe and how it works, the interactions between particles and energy changes.

Syllabus: units to be taught throughout the year

1) Science Is A Verb	8) Reactions
2) Matter & Energy	9) Kinetics, Thermodynamics and Equilibrium
3) Phases of Matter	10) Solutions
4) Atomic Structure: The Nucleus	11) Acids and Bases
5) Atomic Structure: Electron Configuration	12) Electrochemistry
6) Periodic Table and Bonding	13) Organic Chemistry
7) Compounds	

Tips for Studying Chemistry:

Result (Grade) = Effort of Student x (Text Quality + Time of Day of Class + Teacher + #. of Friends in Class + you fill in the blank)

The point is that the most important variable here is **YOUR EFFORT! If your effort is zero, then your grade will be zero.**

· I think it is interesting how "A" students tend to get those grades, regardless of the teacher. They take responsibility for their own learning rather than blaming external factors for their lack of success.

Chemistry is different from any other science course you have taken:
· The material is new and more abstract, More problem solving, More math.

Therefore, you need to approach Chemistry with a more serious attitude and:
1) Be consistent in your study efforts.
2) Practice, practice and practice those homework problems!

I find that the most common reasons for failure are:
1) Too little study time. We recommend that you study a minimum of 15 minutes per night, for a total of 75 minutes per week. All of us tend to underestimate how much time we study. Remember, Einstein said that 99 % of success is perspiration and 1% is inspiration. Reading your notes as a method of study is worse than useless…unless you have a photographic memory. ACTIVE studying is the only method that really works.
2) Lack of student preparation. I find that the major deficit is math skills. You need to be comfortable with numbers and basic algebra.
3) Lack of consistent effort. Chemistry is not a good class to cram in. Study regularly and consistently. Our brains work in-between study times, i.e. in the shower, while walking to class, etc. It's amazing how sometimes our brain just needs simple time to digest a concept. Make your time work for you.
4) The wrong approach to studying. Rereading the text and taking notes from the text are not the best way to study. Chemistry is not a spectator sport. The most important thing you can do for your learning is to do the homework problems and practice tests.
5) Overconfidence in understanding the material. It is fine to start solving problems with the teacher's guidance, but you must put in time at home. <u>On the test, you need to be able to do homework problems without the teacher's help.</u>

Here are some ideas for ensuring your success in Chemistry:

1) Come to after-school help with specific questions about the course material and homework problems.

2) Rewrite your class-notes and rework through the class exercises.

3) In order to understand a concept rather than simply memorize a definition, try either writing an explanation in your own words or explaining it to someone else.

4) Study groups can be good because many of us learn by talking and discussing. However, beware that this can be a timewaster if you tend to drift away from chemistry.

5) Retake old quizzes, old tests and review sheets.

6) Buy the review book and do the problems in there.

7) Distill your notes into graphic organizers such as attribute webs, flow charts and Venn diagrams.

8) Create a "cheat sheet" in which you will have all of the things you need to know for the test.

9) After doing several problems, create new ones to do by taking existing questions and changing the numbers. When you get good at that, then try creating brand-new problems of your own.

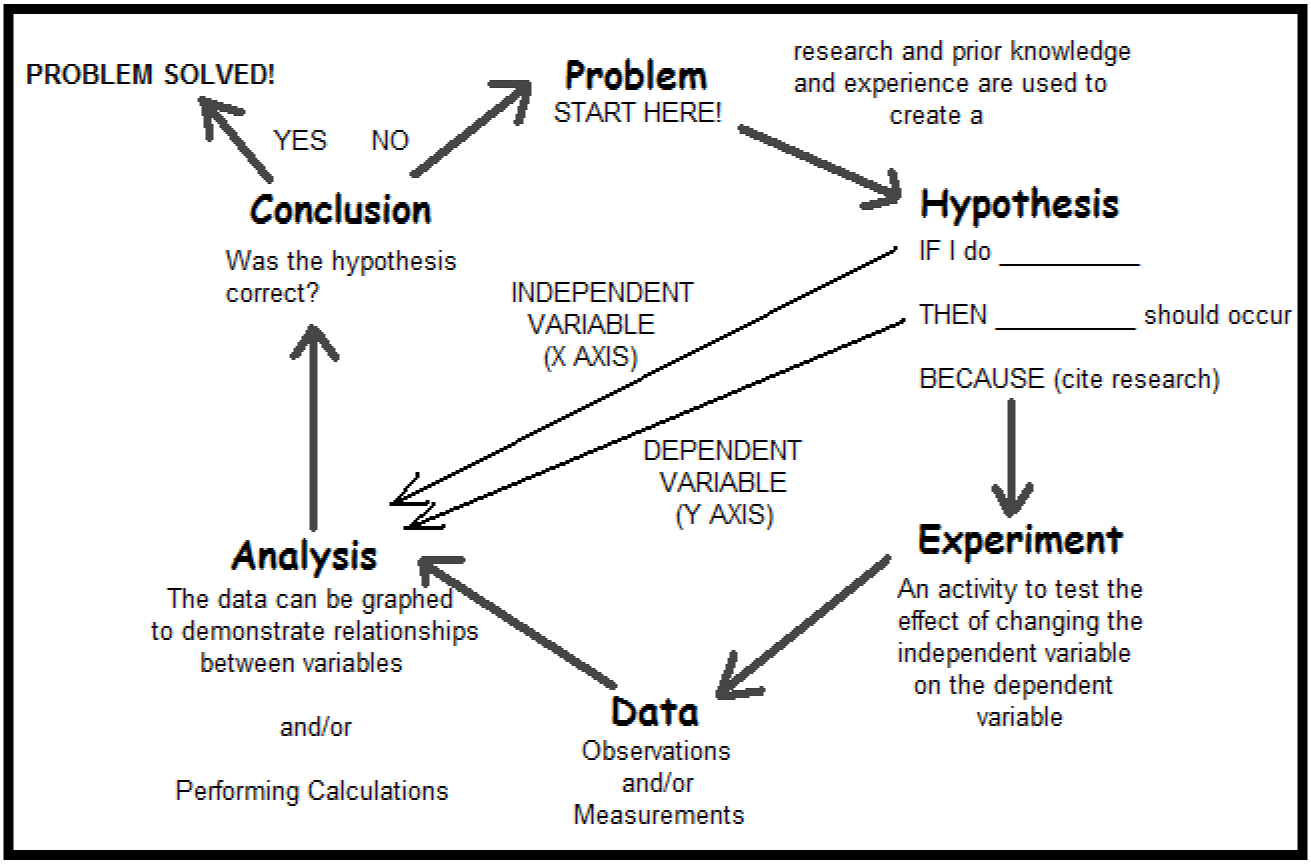
10) Be prepared to do work in class and pay attention to all details being presented. Ask questions when you need to.

1) Scientific Method (HW: p. 18)

Essential Question: How can problems be solved in a systematic manner?

Scientific Method

You got a problem? YOU GOT A PROBLEM???? Then solve it, using the Scientific Method! It is a logical sequence of steps designed specifically to solve problems!



Pharmaceutical companies apply the scientific method in determining what the best medications for a condition are, and what the best dosage is.

Automotive mechanics use the scientific method to diagnose and repair car problems.

Computer technicians use the scientific method to diagnose and repair computer problems.

Doctors use the scientific method to diagnose and heal illnesses or injuries.

Politicians use the scientific method to craft their election campaigns.

Arson investigators use the scientific method to determine the cause of fires and determine their point of origin.

Forensic investigators use the scientific method to determine the nature and perpetrators of crime.

Business executives use the scientific method to analyze profit reports and create new business plans.

2) Measurement (HW: p. 19-20)

Essential Question: How do we give meaning and dimension to our descriptions of the world around us?

Measurement gives the universe meaning! How tall are you? How much do you weigh? How old are you? How fast can you run? How much volume do you displace? All of these questions are designed to give us reference to the world around us.

Metric System
1) Devised in 1960 by the General Conference of Weights and measures
2) Called Le Systeme International d'Unites (SI)
3) Conversions are all in base 10
4) Prefixes used to determine the magnitude of a particular unit (Kilo means 1000, centi means $1/100^{th}$)

METRIC UNITS (Reference Table D)

Symbol	Name	What It Measures
m	Meter	Distance (length, height, width, from here to there)
G	Gram	Mass (how much matter something contains)
Pa	Pascal	Pressure (force exerted over an area)
K	Kelvin	Temperature (the average kinetic energy of a system)
Mol	Mole	Amount of substance (6.02×10^{23} things in a mole)
J	Joule	Heat (stored, or potential, energy of a substance)
S	Second	Time (from one point in time to another)
L	Liter	Volume (cubic length: 1 liter = 1 dm^3, 1 milliliter = 1 cm^3)
Ppm	Parts per million	Concentration (mass of solute/mass of solvent X 1000000)
M	Molarity	Concentration (moles of solute/L of solution)

METRIC PREFIXES (Reference Table C)

Factor	Prefix	Symbol	Example (Mass)	Example (Distance)
10^3 (thousand)	**Kilo-**	**k**	**1 kg = 2.2 pounds**	**1 km = 0.621 miles**
10^0 (one)	-	-	**1 g = 0.0353 ounces**	**1 m = 3.28 feet**
10^{-1} (tenth)	**Deci-**	**d**	**1 dg = 0.0000353 ounces**	**1 dm = 3.94 inches**
10^{-2} (hundredth)	**Centi-**	**c**	**1 cg = 0.00000353 ounces**	**1 cm = 0.394 inches**
10^{-3} (thousandth)	**Milli-**	**m**	**1 mg = 0.000000353 ounces**	**1 mm = 0.0394 inches**
10^{-6} (millionth)	**Micro-**	**μ**	**1 μg = 0.000000000353 ounces**	**1 μm = 0.0000394 inches**
10^{-9} (billionth)	**Nano-**	**n**	**1 ng = 0.000000000000353 ounces**	**1 nm = 0.0000000394 inches**
10^{-12} (trillionth)	**Pico-**	**p**	**1 pg = 0.000000000000000353 oz.**	**1 pm = 0.0000000000394 in.**

What unit is best used for:

Measurement	Unit	Why?
Distance between two cities	kilometer	Use instead of miles
Volume of a container of milk	liter	Use instead of gallons or quarts
Your weight	kilograms	Use instead of pounds
Length of a pen	Centimeter	Use instead of inches
Mass of a candy bar	grams	Use instead of ounces
Time it takes for a class period	kiloseconds	Use instead of hours
How tall you are	meters	Use instead of feet or yards

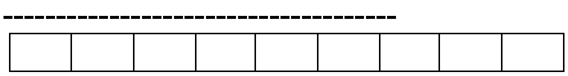
Math Rules For Chemistry:

1) N^3: No Naked Numbers. All measurements and answers to math problems must have units written after the numbers.

2) No Work, No Credit. You must show all of the following when doing math problems: the equation you are going to use, the equation rearranged algebraically to solve for the variable you are looking for, the rearranged equation with numbers and units substituted in for all of the variables (numerical setup) and the final answer, rounded properly with units after.

UNCERTAINTY IN MEASUREMENT

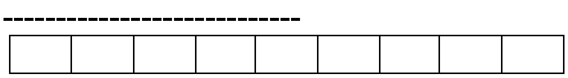
Measurements are made one place beyond where the measuring device is marked. For example, a ruler marked to the nearest tenth of a centimeter can be read to the hundredths place by estimating how far between the lines the measurement falls.



cm 1 2 3 4 5 6 7 8 9

Device is marked to the **ONES** place, so read to the **TENTHS** place

Measurement: 6.2 cm ← the 2 in the tenths place is ESTIMATED



cm .1 .2 .3 .4 .5 .6 .7 .8 .9

Device is marked to the **TENTHS** place, so read to the **HUNDREDTHS** place

Measurement: 0.48 cm ← the 8 in the hundredths place is ESTIMATED

cm 10 20 30 40 50 60 70 80 90

Device is marked to the **TENS** place, so read to the **ONES** place

Measurement: 67 cm ← the 7 in the ones place is ESTIMATED

ROSENGARTEN'S RULES FOR DETERMINING PRECISION:

1) If the measurement has a decimal point in it, the precision is the place furthest to the right in the measurement.

In the measurement 23.004 cm, there is a decimal point, so the precision of the measurement is the furthest place to the right, or the thousandths place. **23.004 cm**

In the measurement 0.3320 g, there is a decimal point, so the precision of the measurement is the furthest place to the right, of the ten thousandths place. **0.3320 g**

In the measurement 330. mL, there is a decimal point, so the precision of the measurement is the furthest place to the right, or the ones place. **330. mL**

2) If the measurement does not have a decimal point in it, the precision is the place where either the rightmost integer is, or where a zero with a line over it is.

The measurement 2300 km has no decimal point in it, so the precision is where the rightmost integer is, or the hundreds place. **2<u>3</u>00 km**

For the measurement 23$\overline{0}$0 km, there is no decimal point, so the precision is where the zero with the line over it sits, or the tens place.

23$\overline{0}$0 km

<u>"Rosengarten's Rule For Significant Figures"</u>

"The number of significant figures in a measurement equals the total number of digits from and including the first (leftmost) integer in the measurement all the way to the limit of precision of that measurement."

In the examples below, the significant figures are <u>underlined</u> and the precision is in **bold**.

In the measurement 23.285 cm, the first integer is the 2 in the tens place. The precision of the measurement is the thousandths place.

<u>23.28**5**</u> cm ← five significant figures.

In the measurement 8000 sec, the first integer is the 8 in the thousands place. The precision is the thousands place.

<u>**8**</u>000 sec ← one significant figure.

In the measurement 40. L, the first integer is the 4 in the tens place. The precision is the ones place.

<u>4**0.**</u> L ← 2 sig figs

In the measurement 2300 g, the first integer is the 2 in the thousands place. The precision is the hundreds place.

<u>2**3**</u>00 g ← two significant figures.

In the measurement 23$\overline{0}$0 g, the first integer is the 2 in the thousands place. The precision is the tens place.

<u>23**$\overline{0}$**</u>0 ← three significant figures.

In the measurement 200.0 L. the first integer is the 2 in the hundreds place. The precision of the measurement is the tenths place.

<u>200.**0**</u> L ← four significant figures.

In the measurement 0.713 kg, the first integer is the 7 in the tenths place. The precision is the thousandths place.

0.<u>71**3**</u> kg ← three significant figures.

In the measurement 0.09053 kJ, the first integer is the 9 in the hundredths place. The precision is the hundred thousandths place.

0.0<u>905**3**</u> kJ ← four significant figures.

In the measurement 0.050600 mol, the first integer is the 5 in the hundredths place. The precision is the millionths place.

0.0<u>5060**0**</u> mol ← five significant figures.

3) Rounding (HW: p. 21-22)

Essential Question: How do you round off the answers to math problems?

Addition and Subtraction

The answer can only be as precise as the least precise of the measurements to be added or subtracted. The answer must be rounded to the place of precision of the least precise of the measurements. In the examples, the place of precision is underlined in the measurements.

WHEN ADDING OR SUBTRACTING NUMBERS, RIGHT THERE IN YOUR FACE
LOOK FOR THE ONE THAT'S LEAST PRECISE AND ROUND IT TO THAT PLACE!

Round the following number to the	Rounded answer	Round the following number to the	Rounded answer
23.337 to the nearest tenth	**23.3**	10000 to the nearest tenth	**10000.0**
23.337 to the nearest hundredth	**23.34**	10000 to the nearest one	**10000.**
23.337 to the nearest one	**23**	10000 to the nearest ten	**$100\bar{0}0$**
23.337 to the nearest ten	**20**	10000 to the nearest hundred	**$10\bar{0}00$**

Examples:

a) $33.\underline{5}$ cm + $7.8\underline{8}$ cm + $0.97\underline{7}$ cm = 42.357 cm ROUNDED = **42.4 cm**
tenths *hundredths* *thousandths*
Since TENTHS goes out the least far, round the answer to the nearest TENTH.

b) $2\underline{3}000$ km + $8.\underline{7}$ km = 23008.7 km ROUNDED = **23000 km**
thousands *tenths*
Since THOUSANDS goes out the least far, round the answer to the nearest THOUSAND.

c) $6\underline{7}00$ mL - $78.\underline{7}$ mL = 6621.3 mL ROUNDED = **6600 mL**
hundreds *tenths*
Since HUNDREDS goes out the least far, round the answer to the nearest HUNDRED.

IF YOU HAVE SOME MEASUREMENTS TO MULTIPLY OR DIVIDE ROUND TO THE FEWEST SIG FIGS, COUNTING FROM THE LEFTWARDS SIDE!

Multiplication and Division

The answer can contain only as many significant figures as the measurement with the least number of significant figures. The sig figs in the following measurements are in **bold** type.

Round the following number to the	**Rounded answer**	**Round the following number to the**	**Rounded answer**
23.337 to 4 sig figs	**23.34**	10000 to 6 sig figs	**10000.0**
23.337 to 3 sig figs	**23.3**	10000 to 5 sig figs	**10000.**
23.337 to 2 sig figs	**23**	10000 to 3 sig figs	**10$\bar{0}$00**
23.337 to 1 sig figs	**20**	10000 to 1 sig fig	**10000**

a) **67.23** cm	X	**9.22** cm	= 619.584 cm^2	ROUNDED = **620. cm^2**
4 sig figs		*3 sig figs*		

Rounding the answer to 3 sig figs, you need to put the decimal point to show that the 0 is a sig fig.

b) **2$\bar{0}$**0 cm	X	**3.333** cm	= 666.6 cm^2	ROUNDED = **670 cm^2**
2 sig figs		*4 sig figs*		

Rounding to 2 sig figs makes the ones place a place-holding 0 so that the first two integers are the sig figs.

c) **3**0 g	/	**3** mL	= 10 g/mL	ROUNDED = **10 g/mL**
1 sig fig		*1 sig fig*		

Sometimes, you don’t need to do anything to your answer. One sig fig is all you need!

d) **30.** g	/	**3.0** mL	= 10 g/mL	ROUNDED = **10. g/mL**
2 sig figs		*2 sig figs*		

To show that 10 has 2 sig figs, put a decimal point after the ones place.

e) **30.0** g	/	**3.00** mL	= 10 g/mL	ROUNDED = **10.0 g/mL**
3 sig figs		*3 sig figs*		

To show that 10 has 3 sig figs, take the answer out to the tenths place.

4) Scientific Notation (HW: p. 23)

Essential Question: How is the data compression in .mp3 and ZIP files mirrored in scientific notation?

SCIENTIFIC NOTATION: Expressing a number as a multiple of a power of ten. Used to take looooong numbers and compress them so that they can be more easily calculated.

Handling large numbers
Take the significant figures from the number, put them into the form N.NNN X 10^x power, where N.NNN represents the significant figures (assuming four sigs for N.NNN) and x is the number of places after the first significant figure back to the ones place. In the following examples, the sig figs have been **bolded**.

(First sig fig) . (rest of the sig figs) X 10 $^{\text{(\# places after the first sig fig back to the ones place)}}$

The Earth is **4 6**00 000 000 years old. **Number in scientific notation: 4.6 X 10^9**

1) The first sig fig is the 4, followed by the decimal point, then the other sig fig, 6. (coefficient of **4.6**)
2) After the 4, there are 9 places back to the ones place. (exponent of **X 10^9**)

There are **33 40**0 000 000 000 000 000 molecules in one mL of water. **Number in scientific notation : 3.34 X 10^{19}**

1) The first sig fig is the 3, followed by the decimal point, then the other sig figs, 3 and 4 (coefficient of **3.34**)
2) After the first 3, there are 19 places back to the ones place. (exponent of **X 10^{19}**)

Number	Converted to Scientific Notation
3240000	**3.24 X 10^6** ← first 3 sig figs are 3, 2 & 4, and there are 6 places after the 3 to the ones.
300.	**3.00 X 10^2** ← the decimal point in 300. means that the number has 3 sig figs
300	**3 X 10^2** ← there is only one sig fig (the 3), so that is all that goes into the coefficient.
78000000000	**7.8 X 10^{10}**
$23\overline{0}0000$	**2.30 X 10^6** ← the line over the 0 in the ten thousandths place makes that zero a sig fig, so it must be included in the coefficient.

Rewriting numbers in scientific notation back into decimal form

Number	Converted to Decimal Form
4.73 X 10^6	**4730000** ← the first thing you write are the sig figs 4, 7 and 3. There are 6 places after the 4 back to the ones place, so put enough zeroes in to account for that.
2.00 X 10^4	**$20\overline{0}00$** ← 2.00 has 3 sig figs, so you must put a line over the second zero to account for that.
2.0 X 10^4	**$2\overline{0}000$** ← same as above, but there are only 2 sig figs
2 X 10^4	**20000** ← there is only one sig fig, so all of the 0's that come after are placeholders.
3.71 X 10^8	**371000000**

HANDLING SMALL NUMBERS
Write the significant figures in the same form as before, and count the number of zeroes, including the one in the ones place. This becomes a negative exponent.

(First sig fig).(rest of the sig figs) X $10^{-\text{(\# places before the first sig fig back to the ones place)}}$

An atom of carbon weighs 0.000 000 000 000 000 000 000 **1993** g. **Number in scientific notation: 1.993 X 10^{-22}**
1) The first integer is 1, followed by the decimal point, followed by the rest of the digits (coefficient of **1.993**)
2) There are 22 places in front of the first integer back to the ones place (exponent of **X 10^{-22}**)

The distance between H atoms in a molecule of H_2 gas is 0.000 000 0**370** mm. **Number in S.N.: 3.70 X10^{-8}**
1) The first integer is 3, followed by the decimal point, followed by the rest of the digits (coefficient of **3.70**)
2) There are 8 places in front of the first integer back to the ones place (exponent of **X 10^{-8}**)

Number	Converted to Scientific Notation
0.03	3 X 10^{-2} ← 2 places in front of the 3 back to the ones place. (X 10^{-2})
0.030	3.0 X 10^{-2} ← the 0 after the 3 needs to be put into the coefficient. (3.0)
0.0300	3.00 X 10^{-2} ← the two 0's after the 3 need to be put into the coefficient. (3.00)
0.00000760	7.60 X 10^{-6} ← there are 6 places in front of the 7 back to the ones place. (X10^{-6})
0.0020	2.0 X 10^{-3} ← you must include the zero at the end, because it is a sig fig.

Number	Converted to Decimal
8 X 10^{-3}	0.008 ← Write 0.00 (for X 10^{-3}), then the sig fig 8.
8.0 X 10^{-3}	0.0080 ← add the 0 after the 8, because it shows up in the coefficient (8.0).
8.00 X 10^{-3}	0.00800 ← add the two 0's after the 8, because they show up in the coefficient (8.00).
4.3 X 10^{-4}	0.00043 ← write 0.000 (for X 10^{-4}), then the sig figs 4 and 3.
6.70 X 10^{-6}	0.000000670 ← you must include the zero at the end, because it is a sig fig.

Comparing relative magnitudes of two numbers in scientific notation:

1)The larger the positive exponent, the larger the number.

Circle the larger value in the pairs below (a is done for you, you do b and c):

a) [2.0 X 10^{6}] or 3.0 X 10^{4} b) 5.7 X 10^{12} or 1.3 X 10^{7} c) 3.3 X 10^{9} or 9.7 X 10^{2}

2) The smaller the negative exponent, the larger the number.

Circle the larger value in the pairs below (a is done for you, you do b and c):

a) 2.0 X 10^{-6} or [3.0 X 10^{-4}] b) 5.7 X 10^{-12} or 1.3 X 10^{-7} c) 3.3 X 10^{-9} or 9.7 X 10^{-2}

5) Conversion (HW: p. 24-26)

Essential Question: How can units be used to solve problems for you?

In chemistry, you will be using many different formulas. If you know how units work and how they cancel out, you will always be able to set a problem up correctly and be able to solve for what you need to find. To give you an introduction to the use of units in problem-solving, we will use metric conversions. Sure, you can do metric conversions using the "jump-the-decimal-point" method, but we won't be doing that here. In this topic, you will learn how to make a conversion factor and how to use it to solve problems.

To convert a measurement from one metric unit to another, you must know the **difference in magnitude** between the two prefixes and use that difference to create a conversion factor:

$$\frac{\textit{How many of the smaller units there are in one of the…}}{\text{Larger Unit.}}$$

Use Reference Table C. If there is no prefix (m, g, L, etc.) then the power of ten is 10^{0}. The prefix is underlined so you can verify its magnitude against Reference Table C. The smaller unit is *italicized*.

Given Unit	Magnitude	Target Unit	Magnitude	Difference between units	Conversion Factor
m	*10^{0}* (no prefix)	**km**	10^{3}	3 powers of ten (1000)	**1000 m/km**
cg	10^{-2}	**mg**	*10^{-3}*	1 power of ten (10)	**10 mg/cg**
μL	*10^{-6}*	**cL**	10^{-2}	4 powers of ten (10 000)	**10 000 μL/cL**
mm	*10^{-3}*	**km**	10^{3}	6 powers of ten (1 000 000)	**1 000 000 mm/km**
kg	10^{3}	**cg**	*10^{-2}*	5 powers of ten (100 000)	**100 000 cg/kg**
mL	*10^{-3}*	**L**	10^{0} (no prefix)	3 powers of ten (1000)	**1000 mL/L**

To use the conversion factor:

Given amount X or / by the conversion factor = target (answer)

1) If the given unit is also the numerator unit on the conversion factor, then DIVIDE to cancel it out.

100. ~~m~~ / 1000 ~~m~~ /km = 0.100 km

2) If the given unit is also the denominator unit on the conversion factor, then MULTIPLY to cancel it out.

100. ~~cm~~ X 10 mm/ ~~cm~~ = $10\bar{0}0$ mm

NOTE: the number of significant figures in your final answer equals the number of sig figs in the number you are converting.

Examples:

a) Convert 20.0 mm to m: Given: 20.0 mm Target: m

Conversion Factor: mm = 10-3, m = 100, 3 powers of ten difference (1000) = **1000 mm/m**

Solve (divide to cancel out given unit and be left with target unit): 20.0 ~~mm~~ / 1000 ~~mm~~ /m = **0.0200 m**

b) How many km are there in 150. m? Given: 150. m Target: km

Conversion Factor: km = 10^3, m = 10^0, 3 powers of ten difference (1000) = **1000 m/km**

Solve (divide to cancel out given unit and be left with target unit): 150. ~~m~~ / 1000 ~~m~~ /km = **0.150 km**

c) How many m are there in 20. km? Given: 20. km Target: m

Conversion Factor: m = 10^0, km = 10^3, 3 powers of ten difference (1000) = **1000 m/km**

Solve (multiply to cancel out given unit and be left with target unit): 20. ~~km~~ X 1000 m/~~km~~ = **$2\bar{0}$ 000 m**

d) How many km are there in 100. cm? Given: 100. cm Target: km

Conversion Factor: km = 10^3, cm = 10^{-2}, 5 powers of ten difference (100 000) = **100 000 cm/km**

Solve (divide to cancel out given unit and be left with target unit): 100. ~~cm~~ / 100 000 ~~cm~~/km = **0.00100 km**

e) How many mm are there in 630. km? Given: 630. km Target: mm

Conversion Factor: mm = 10^{-3}, km = 10^3, 6 powers of ten difference (1 000 000) = **1 000 000 mm/km**

Solve (multiply to cancel out given unit and be left with target unit): 630. ~~km~~ X 1 000 000 mm/ ~~km~~ = **$63\bar{0}$ 000 000 mm**

Practical Problem:

How much will it cost to buy 4.0 grams of ammonium nitrate if it costs $22.35 per kilogram?

First, convert grams to kilograms so you can compare costs on an even basis:

(4.0 g) / (1000 $^{g}/_{kg}$) = 0.0040 kg

Then, determine how much this many kg will cost using proportions:

$$\frac{\$22.35}{1.0\ kg} = \frac{\$\ X}{0.0040\ kg}$$

X = $ 0.089, or 9 cents.

6) Graphing (HW: p. 27-28)

Essential Question: How can we make sense of data and use it to make predictions?

Changing one thing in an experiment (**independent variable**) will often cause something else to change (**dependent variable**).

1) Measuring reaction rate as temperature is increased by applying heat:

temperature is the independent variable, **reaction rate** is dependent variable.

2) Measuring volume of gas trapped in a cylinder as pressure is applied?

pressure is the independent variable, **volume** is dependent variable.

Graphs should contain the following features:

1) X and Y axes with the independent variable in the X axis (with units) and the dependent variable on the Y axis (with units).

2) A numerical scale representing uniform increases in each variable.

3) A title: (Dependent Variable) vs. (Independent Variable) - for example 1, above, this would be **"Reaction Rate vs. Temperature"**.

4) Data points, circled with "point protectors". These circles serve two purposes: to make the point more visible and to represent the margin of error associated with estimated digits.

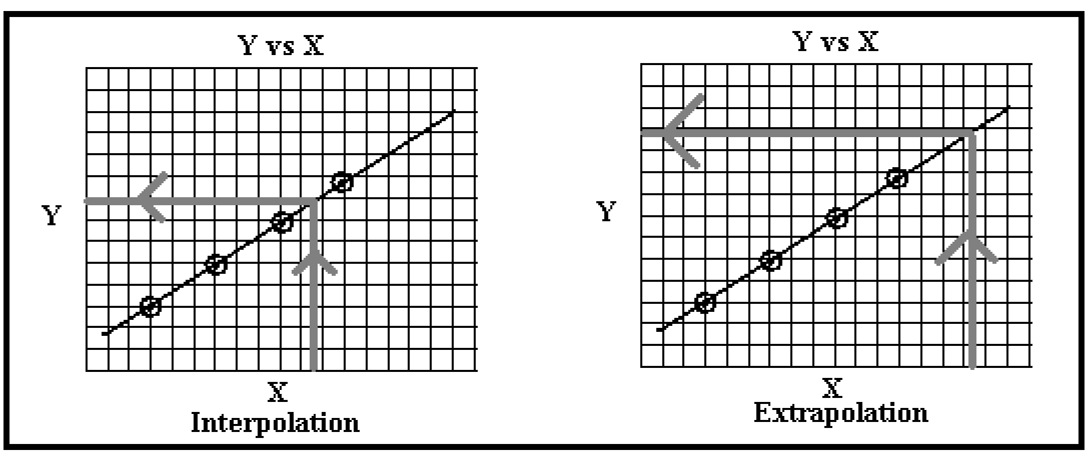
5) A line either connecting the data points or in a curve of best fit between the points.

Interpolation and Extrapolation: When data is graphed and a line drawn, one can make estimations about information that is either between data points or outside the range of the data points.

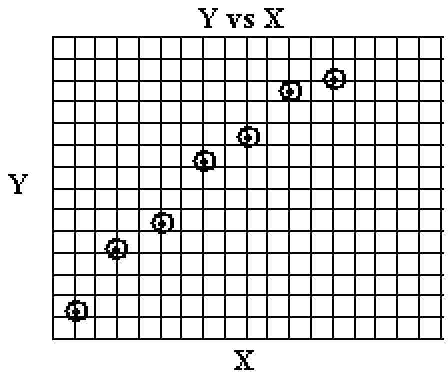
1) Reading between the data points to get information is called INTERPOLATION.

2) Extending your graph line and reading outside your data range is called EXTRAPOLATION.

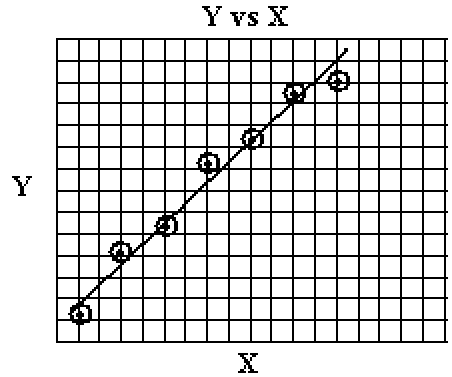
When you do either, you must keep the rules of precision in mind. If your graph reads to the nearest tenths, the estimated interpolation or extrapolation must be read to the nearest hundredth.



Best Fit Line (Average Line): Notice how the line of best fit gives approximately the same number of data points above and below it, while maintaining a good idea of the slope of the data? Use a ruler and a pencil to create this line of best fit. GRAPHS SHOULD ALWAYS BE DONE WITH A PENCIL AND A RULER.



With Data Points

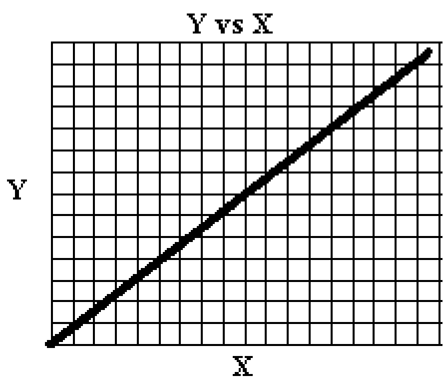


With Line of Best Fit

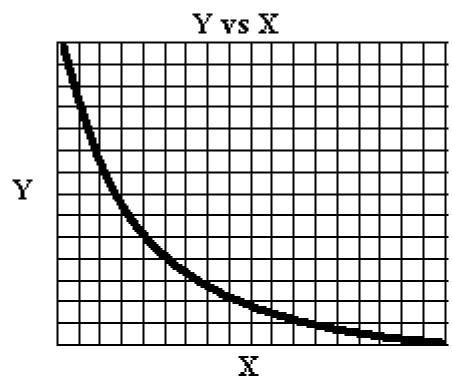
Relationships: Graphs show relationships between the dependent and the independent variable. This can be used to make predictions about behavior of physical and chemical phenomena.

Direct Relationship: As the independent variable is increased, the dependent variable also increases.

Indirect (Inverse) Relationship: As the independent variable is increased, the dependent variable decreases.



Direct Relationship



Indirect (Inverse) Relationship

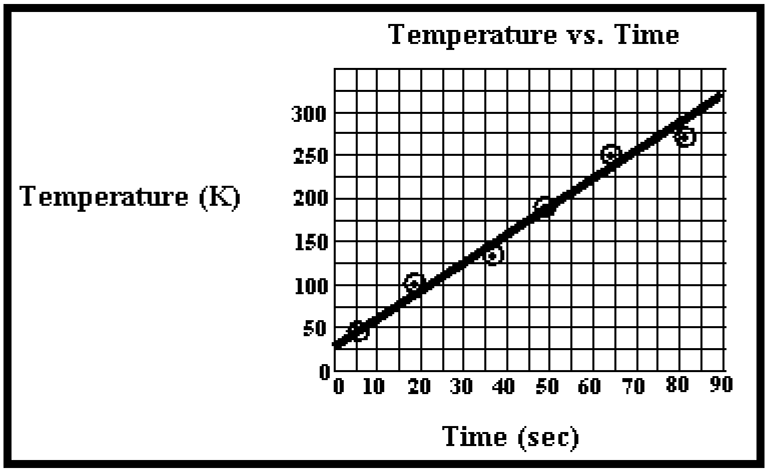
As the temperature is **increased** on a solution of salt dissolved in water, the solubility of the salt **increases**. This is a

DIRECT relationship.

As the pressure on a sample of confined gas is **increased**, its volume will **decrease**. This is an

INDIRECT relationship.

A Good Graph



1) **Labeled Axes:** dependent on the Y axis, independent on the X axis, both with appropriate units

2) **Title:** Dependent Variable vs. Independent Variable

3) **Data Points:** with point protectors around them

4) **Best Fit Line:** showing the average slope of the linear data

5) **Scaled:** regular interval spacing for the scales on both axes

6) **Size:** The data should take up more than a quarter of the graph paper itself. The larger the graph, the easier it is to interpolate and extrapolate from

If you are not told to draw a best fit line, then connecting the data points individually is the way to go.

Student Name:________________________________ Grades: _____, _____, _____, _____, _____, _____
Sci Met, Measure, Round, Sci Not, Conv, Graph

1) Scientific Method Homework

1) You arrive home on a lovely Tuesday afternoon and grab your CD player to catch up on some tunes. You slide the headphones on to enjoy the delicious music, but when you press PLAY, nothing happens! You decide to play the scientific method game to figure out what's wrong.

1) Match the statements below on the right with the parts of the scientific method listed on the left by connecting them with drawn lines:

1) Problem	Batteries are in correctly.
2) Hypothesis	Batteries are in wrong.
3) Experiment	POSITION OF BATTERIES IS NOT THE PROBLEM
4) Data	Checked position of the batteries against the diagram on the CD player
5) Draw Conclusion	CD player won't work!!

2) List two other possible hypotheses for why the CD player is not working.

a)____

b)____

3) For one of your hypotheses above, explain how you could work through the scientific method to test the hypothesis:

Chosen Hypothesis:____

Design Experiment to Test Hypothesis:

____

____

____

Expected results if hypothesis is true:____________________________________

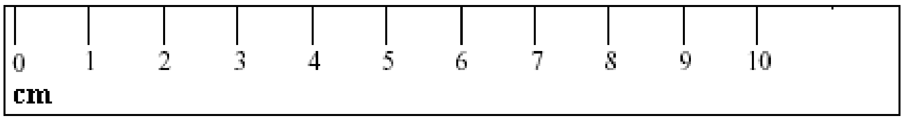
____

2) Measurement Homework

1) Measure the length of a paper clip on each ruler pictured below. The measurements will not be the same for each one, due to a difference in precision. Use the same paper clip for all three measurements and record your readings:

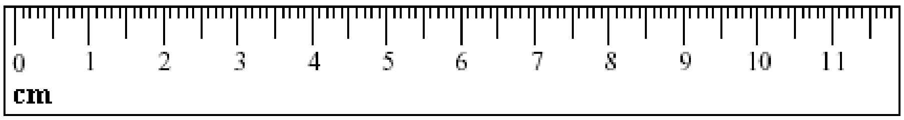
Length of Paper Clip

_______________ **cm**



Length of Paper Clip

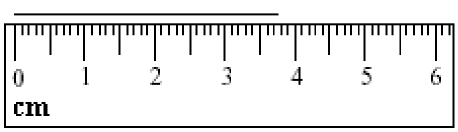
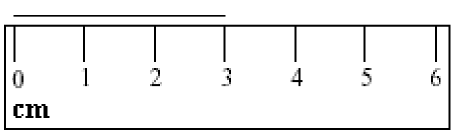
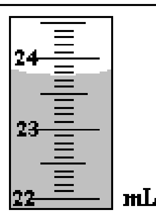
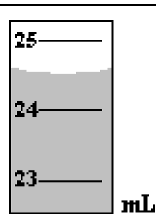
_______________ **cm**



Length of Paper Clip

_______________ **cm**

2) For the following measuring devices, record the reading, the precision (place) the measurement was made to and the number of significant figures in the measurement.

Example	Reading	# of Sig Figs	Precision
1) 			
2) 			
3) 			
4) 			

3) Circle the place where the precision is and underline the significant figures in the measurements below. Write the number of significant figures in the measurement to the right of each measurement.

Measurement	# Of Sig Figs	Measurement	# Of Sig Figs	Measurement	# Of Sig Figs
2 0 0 0 cm		0 . 6 0 0 cm		1 1 . 3 cm	
2 $\bar{0}$ 0 0 cm		0 . 0 5 0 9 cm		1 1 . 3 0 cm	
2 0 $\bar{0}$ 0 cm		0 . 4 4 0 0 3 cm		3 cm	
2 0 0 0. cm		0 . 0 0 0 0 5 6 cm		3 . 0 cm	
2 0 0 0 . 0 cm		0 . 0 0 0 9 9 0 cm		3 . 0 0 7 cm	
3 0. cm		2 0 0 . 0 0 6 cm		3 $\bar{0}$ 0 0 cm	
3 2 . 0 cm		3 0 . 0 2 0 cm		9 0 cm	
3 3 . 5 cm		9 7 . 2 8 5 cm		3 3 3 0 2 cm	
3 9 0 . 0 7 cm		0 . 0 0 9 5 3 cm		6 8 . 0 0 cm	

4) Write the following numbers, precise to the noted precision or number of significant figures:

Number	Precise to the nearest…	Answer	Number	Precise to the nearest…	Answer
Forty-two	Tenth	42.0	Three hundred twenty	3 sig figs	
Three thousand	2 sig figs		Seventeen	4 sig figs	
0.3	3 sig figs		Sixteen thousand	Hundred	
Six	Thousandth		0.4	Thousandth	

3) Rounding Homework

Be sure to consider the number of significant figures or precision in each of the following problems. For this exercise, consider all numbers to be measurements. Include the units in your answers. Write the UNROUNDED answer first, then the ROUNDED answer, drawing a box around your rounded answer.

1) ADDITION

Problem	Unrounded Answer	Rounded Answer, with units
4.732 cm + 16.8 cm + 0.781 cm =		
32.0 MW + 0.0059 MW =		
0.00372 g + 0.2187 g + 0.44 g =		
0.0202 km + 0.0303 km + 0.044 km =		
345 mmol + 0.788 mmol =		
93.667 cg + 81.1 cg =		

2) SUBTRACTION

Problem	Unrounded Answer	Rounded Answer, with units
22.95 mg – 6.4 mg =		
33.728 cL – 1.323 cL =		
32.32 J – 0.0049 J =		
378.98 kg – 16 kg =		
1.00345 km – 0.0023 km =		
960 cg – 0.00323 cg =		

3) MULTIPLICATION

Problem	Unrounded Answer	Rounded Answer, with units
37.66 KW X 2.2 h =		
14.922 cm X 2.0 cm =		
98.11 kg X 200 m =		
381 m X 0.21 m =		
143 $/L X 341 L =		
200. $/kg X 30 kg =		

4) DIVISION

Problem	Unrounded Answer	Rounded Answer, with units
4792 g / 24 cm^3 =		
7139 g / 1426 cm^3 =		
3.00 cal / 300 g =		
19.82 g / 24.2 km =		
64.77 g / 9.11 mol =		
144.0 g / 10 L		

F) OK, here is a practical problem in which you will combine all of your skills. The equation you will use is D = m/v (density = mass / volume). Remember to show a proper numerical setup (with units) and solve, making sure your final answer is properly rounded for the type of math you did:

1) A ring, supposedly made of pure silver (Ag) has a mass of 20.445 grams. When its volume is taken by water displacement, it is found to have a volume of 1.95 mL. Calculate the density of the ring:

2) Based on the actual density of silver (Ag) found on Reference Table S, could this ring actually be made out of silver? Briefly explain your answer:

4) Scientfic Notation Homework

A) Convert each of the following into scientific notation:

Number	Scientific Notation
200	
250.	
1000	
200 000	
2100.	
0.01	
0.010	
0.000 55	
0.0070	
0.0205	
602 300 000 000 000 000 000 000	
0.000 000 000 000 000 000 160	

B) Convert each of the following into standard decimal notation:

Scientific Notation	Standard Decimal Notation
$3.56 \text{ X } 10^{3}$	
$7.982 \text{ X } 10^{11}$	
$8.3400 \text{ X } 10^{15}$	
$7.02 \text{ X } 10^{-4}$	
$6.6 \text{ X } 10^{34}$	
$2.030 \text{ X } 10^{-18}$	
$3.0 \text{ X } 10^{3}$	
$4.3 \text{ X } 10^{-5}$	

C) Ksp is a measurement of the solubility of a salt. The larger the value of Ksp is, the more salt can dissolve in water. Which of the following Ksp values would indicate the salt with the highest solubility?

1) $4.3 \text{ X } 10^{-6}$ 2) $5.7 \text{ X } 10^{-7}$ 3) $9.8 \text{ X } 10^{-8}$ 4) $3.2 \text{ x } 10^{-9}$

D) Perform the following calculations using your calculator:

1) $5.6 \text{ X} 10^{7} + 4.6 \text{ X } 10^{8}$ = ________________________________

2) $4.70 \text{ X } 10^{5}$ x $7.3 \text{ X } 10^{-3}$=______________________________

3) $1.00 \text{ X } 10^{8}$ / $4.7 \text{ X } 10^{10}$=______________________________

4) $8.2 \text{ X } 10^{-4}$ x $3.01 \text{ X } 10^{5}$=______________________________

5) Conversion Homework

A) Perform the following conversions, showing all work and units:

1) How many milligrams are equal to 9.62 grams?

2) How many liters are equal to 1460 milliliters?

3) How many millimeters are equal to 0.8051 kilometers?

4) How many kiloseconds are equal to 500. milliseconds?

5) How many micrometers are equal to 2.05 kilometers?

6) How many picometers are equal to 0.359 nanometers?

7) How many cm are equal to 2.2 km?

8) How many kilograms are equal to 9.26 decigrams?

9) Convert 83 cm into meters.

10) Convert 459 L into milliliters.

11) Express 1123 pg in nanograms.

B) Company A sells calcium hydroxide (used for removing excess fluoride from wastewater treatment) for $16.22 per Kg. Company B sells it for $0.08 per g.

1) How many Kg can you purchase from each company for $1000.00?

2) Which company is less expensive to buy from?

C) Your budget for an experiment is $15,387. The costs for this experiment include four chemicals (A, B, C and D) and maintenance costs in the form of time, equipment and utilities. Given the costs for each component, determine how many times you can run this experiment within your budget. How much money will be left over?

COST PER COMPONENT PER RUN OF EXPERIMENT
Each time you run the experiment, you need to spend for each of the following components:

COMPONENT	AMT. NEEDED	COST	COMPONENT	COST
Chemical A	157 g	$23.06/kg	Time	$100.00
Chemical B	37 g	$17.22/kg	Equipment	$137.17
Chemical C	1.2 kg	$37.92/kg	Utilities	$112.57
Chemical D	7.3 mg	$177.05/kg		

Cost Per Experiment:_______________
SHOW YOUR WORK BELOW, ORGANIZING IT IN A WAY THAT CAN BE EASILY FOLLOWED

Number Of Times The Experiment Can Be Run:_______________

Amount of Money Left Over When All Experiments Have Been Run:_______________

POWER PLANT EFFICIENCY

NOTE - Although the focus of industrial measurements is the metric system, the power generation industry still uses English units. This problem will apply to the fictitious Rossville Generating Plant in Excalpia, New York.

Thermal electric power plants, whether fueled by oil, coal, gas, nuclear or refuse, are nothing more than energy conversion facilities. Their purpose is to take materials rich in stored energy and, through a series of chemical, mechanical, heat, kinetic and magnetic processes, produce a form of electricity, which is easy to transport and which leads itself to a wide array of uses. The efficiency with which this occurs, however, continues as a well guarded secret of utility engineers. Let's take a closer look at our efficiency in the form of **heat rate**.

Definition: Heat rate is the amount of fuel heat energy in BTU (British Thermal Units) required to to produce one kW-hr (kilowatt-hour) of electricity)

1) **The amount of electricity generated at the plant during the month of June was 610,641,000 kW-hr. In order to generate that much electricity, 962,515 barrels of oil had to be burned. Each barrel of oil contains exactly 42 gallons. Oil has a heat content of 151,915 BTU/gal. The oil temperature at the burner was set for 240°F. The INPUT heat rate represents the energy stored in the oil that is being burned, in BTU/kW-hr.**

   Calculate the input heat rate (BTU/kW-hr) of the Rossville Plant for the month of June. Convert all numbers to scientific notation. Use the units to solve the problem.

B) The efficiency of the process can be calculated using a percent:

Efficiency = (output/input) X 100%

In the problem above, you determined the energy input as a result of burning oil. The actual output of burning oil at maximum efficiency at the power plant is 3413 BTU/KW-hr. If the oil burned with 100% efficiency (with 100% of its stored heat going directly to electricity), then the heat rates of the input and output would be equal. There is no process that has 100% efficiency, as energy is lost as it makes the transition from being stored in the chemical bonds of oil to producing electricity.

Using the information you have, calculate the efficiency of the conversion process:

Bonus Question: Natural gas containing 1030 BTU per cubic foot will be burned in Rossville beginning in 2006. One hundred million cubic feet per day will be available in the period April 1 through October 31 of each year. How many barrels of oil can be saved each year by using all available natural gas instead? Solve this on a separate sheet of paper.

5) Graphing Homework

1) A student did an experiment to find out how light energy affects the temperature of soil. A light was placed over a dish of soil which contained a thermometer. The temperature of the soil was measured at the start of the experiment before the light was turned on, and then measured again each minute for five minutes once the light was turned on. The measurements were recorded on the data chart below:

Time (Minutes)	Soil Temperature (^oC)
0	19
1	23
2	24
3	25
4	28
5	31

a) Identify the dependent and independent variables:

Independent Variable:	
Dependent Variable:	

b) Create a graph for the above data on a piece of graph paper, including all of the elements of a proper graph. Leave plenty of room on either side of the data for extrapolation purposes. Draw a best-fit line to show the best slope for the data.

c) Extend the graph past 6 minutes. What soil temperature is predicted at 6 minutes according to this graph? Did you figure this out through interpolation or extrapolation? Explain how you know.

Predicted Soil Temp. at 6 minutes:	
Interpolation or Extrapolation?	
How do you know?	

d) What would the temperature be at 3.5 minutes? Did you figure this out through interpolation or extrapolation? Explain how you know.

Predicted Soil Temp. at 3.5 minutes:	
Interpolation or Extrapolation?	
How do you know?	

e) What type of relationship, direct or indirect, exists between these two variables? How can you tell?

2) Base your answers to the following questions on Reference Table H (Vapor Pressure of Four Liquids):

Ever notice how spilled water seems to disappear over time? Ever notice the odor and waves of vapor given off by gasoline as you fill your car at the pump? This is a result of **evaporation**, or the transition of liquid to gas at a temperature below the boiling point. If you were to compare the rate of evaporation of gas and water, you would notice that the gasoline evaporates much faster than the same amount of water under the same conditions. If you were to put these evaporating liquids into a container, seal them in and attach a pressure gauge, you would notice that as time went on, the pressure inside the container would increase as the vapor molecules added their pressure to that of the air already inside the sealed container. This pressure exerted by the vapor is called **vapor pressure**.

Reference Table H lists vapor pressures for four substances: propanone, ethanol, water and ethanoic acid.

You can determine two things from reading this graph: the **vapor pressure** of any of these liquids in kPa at a given temperature in ^{o}C, or the **boiling point** of the liquid in ^{o}C under a given pressure in kPa. Normal boiling point occurs at a temperature where the vapor pressure of the liquid is 101.3 kPa (note the dashed line across the middle of the graph to denote this).

Molecules are attracted to each other by **intermolecular attractive forces**. These forces hold molecules of liquid together so that they don't go flying apart to form a gas. The stronger these attractive forces are, the more energy is required to break them apart, therefore the temperature needed to boil them is higher.

INCLUDE UNITS IN YOUR ANSWERS TO 1, 2 and 3:

1) Given the following temperatures, determine the vapor pressures:

a. propanone at 50^{o}C ___________________ b. water at 73^{o}C ___________________

c. eth. acid at 45^{o}C ___________________ d. ethanol at 62^{o}C ___________________

2) Given the following exerted pressures, calculate the boiling point of the liquids:

a. propanone at 55 kPa _________________ b. water at 125 kPa ___________________

c. eth. acid at 25 kPa ___________________ d. ethanol at 162 kPa ___________________

3) Determine the normal boiling points of:

a) water ___________________ b) ethanoic acid ___________________

c) propanone ___________________ d) ethanol ___________________

4) Based on these normal boiling points, place the above liquids in order of increasing intermolecular attractive force strength (from weakest to strongest):

______________________, ______________________, ______________________, ______________________

Science Is Verb Review Sheet

1) Measure the length of the line below:

2) Complete the following chart:

Measurement	Precision	# Sig Figs	Measurement	Precision	# Sig Figs
2000 cm			0.030		
2100 cm			0.001		
2000. cm			0.1020		
30.0 g			0.00032		
32.00 mL			0.1230		
320 g			9.0		
460. mm			9.00		
371.040 kg			4210		

3) Solve and round off the following math problems:

Problem	Unrounded Answer	Rounded Answer
34.21 cm + 1.9 cm =		
420 kg + 0.23 kg =		
3.345 mL – 2.8 mL =		
22.56 g / 9.14 mol =		
72.35 cm X 2.88 cm =		
2.34 g / 8.9 mL =		
23.2 mm X 10 mm =		
23.2 mm X 10. mm		

4) Convert the following numbers to and from scientific notation:

Convert TO Sci Not	Answer	Convert FROM Sci Not	Answer
23000		4.7×10^{3}	
230.		1.0×10^{-2}	
230		2.10×10^{5}	
0.0045		2.00×10^{-3}	
0.00450		8.3×10^{4}	

5) Perform the following metric conversions, showing ALL work:

Convert to:	Show Work	Final Answer
12.0 mm to cm		
25.3 km to cm		
5.73 g to kg		

6) A chemist tries to determine the effect on increasing surface area of a solid solute on the time it takes for the solute to dissolve in a 100.0 g of distilled water at 25°C.

a) Write a hypothesis that could be used to design an experiment to achieve the objective the scientist has set:

b) List two things that should be controls (held constant) in this experiment:

1)

2)

c) Graph the following data, labeling it properly and drawing a best-fit straight line (DO NOT CONNECT THE DOTS):

Surface Area (cm^3) of a 1.00 gram sample of solid	Time it takes to dissolve the solid (sec)
2.00 cm^3	29 sec
3.00 cm^3	24 sec
4.00 cm^3	22 sec
5.00 cm^3	18 sec
6.00 cm^3	15 sec
7.00 cm^3	12 sec

d) What is the dependent variable?___________________________________

e) What is the independent variable?___________________________________

f) Is the relationship direct or indirect?_________________________________

g) Based on the hypothesis you wrote in a), above, and the graph you drew, was the hypothesis correct?

h) How fast would 8.00 cm^3 surface area dissolve in the water?_________________

i) Is this an example if interpolation or extrapolation?_______________________________

j) How much surface area can dissolve in 20 seconds?_______________________________

k) Is this an example if interpolation or extrapolation?_______________________________

7) Write one question you want to ask before the test is given (besides "What are the answers?):