<u>Math Review for General Chemistry I</u>

Many sciences, such as chemistry, have a lot of its own "terms" and ways of expressing problem solving. Also like many of the sciences, chemistry has a bit of math. This set of readings and exercises will help prepare you for future chemistry courses.

Some of the mathematical features of chemistry include exponents, scientific notation, orders of operation, algebra, unit conversion, and dimensional analysis.

For exponents and scientific notation, you may recall that for the following, $\mathbf{X^2}$, the "X" can be called the *base* and the "2" is considered the *exponent*. Sometimes, the exponent can be referred to as the *power*. For example, if you raised X to the power of 3, it would look like X^3. On a computer, sometimes exponents are typed out as **^3**. If something is written out as **X^3**, it is the same as $\mathbf{X^3}$**.**

Another thing to note is that when we express division by hand, we normally show the divisor as a horizontal line separating two numbers by top and bottom. The top number is considered the *numerator* and the bottom number is called the *denominator*. Written out, a division problem can look like: $\frac{X}{Y}$

For example, one-half would look like: $\frac{1}{2}$

This is not so easy to write out with a computer, so a "slash" (/) or a symbol (÷) may be used to express a division problem. An examples of these would look like:

One-third = 1/3 *or* 1÷3

Note: the format " 1/3 " is more common than " 1÷3 "

For multiplication written out, **x** or • between two numbers means that these numbers are being multiplied. For example: 2 x 2 = 4 *or* 2 • 2 = 4

To recap writing format:

$$\frac{1}{2} = {}^{1}\!/_{2} = 1 \div 2$$

Section 1: Exponentials (working with 10^x)

- Base → 10
- Exponent → x
- An exponent of 0 = 1 **ALWAYS** even if the base of the exponent is different than 10

As described earlier, exponents can be <u>any</u> number, including negative numbers or numbers with decimals. Exponents with decimals are more complex, and we won't get into those in these readings because they are not common and are usually done with a calculator.

An exponent tells us how many times the base is being multiplied by *itself*. In other words, the <u>base</u> is the number being multiplied, and the <u>exponent</u> is how many times it is multiplied. For example, 6^4 means that the <u>base</u>, 6, is being multiplied <u>four times</u> to give us 6 x 6 x 6 x 6.

Negative exponents have a special exception to how they are mathematically solved. A negative exponent means the the <u>base</u> is switch to its *inverse* and then multiplied by itself (in this case is the inverse). The *inverse* of a number is the "flipping/switching" of numbers either above or below the divisor line. Numbers in the top (numerator) are moved to the bottom (denominator) and numbers that were in the bottom are now moved to the top. Examples of inverses are:

3 → 1/3
5 → 1/5
7/9 → 9/7

If we have 4^{-3}, we are multiplying the *inverse* of 4 by itself, <u>three times</u>. Written out, that would look like: ¼ x ¼ x ¼.

<u>Positive Exponents:</u>

- An exponent of 1 = the number multiplied by 1
- *Cheat Method:* if 10 has a **positive** exponent, the number in the exponent tells how many <u>zeros</u> there are
    Examples: 10^2 = 100
    10^6 = 1000000

Question 1a: 10^5 = ?

<u>Negative Exponents:</u>

- Negative exponents: put 10^x as a fraction in the **denominator**
    Example: $10^{-x} = 1/10^x$ → multiply itself as a fraction
- If a negative exponent is <u>already</u> in the denominator, it becomes a **positive** exponent
    Example: $1/10^{-3} = 10^3$
- *Cheat Method:* if 10 has a **negative** exponent, the <u>decimal</u> (10.0) is moved to the **left** corresponding with the number in the exponent
    Example: 10.0^{-2} = 0.1

Question 1b: 10^{-4} = ?

More Examples:

1. $10^3 = 10 \times 10 \times 10 = 1{,}000$
2. $10^7 = 10 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10 = 10{,}000$
3. $10^{-6} = 1/10^6 = 1/10 \times 1/10 \times 1/10 \times 1/10 \times 1/10 \times 1/10 = 1/1000000$ *or* 0.000001
4. $10^1 = 10$

   **** the exponent **1** shows that there is <u>one</u> zero
5. $10^0 = 1$

   **** the exponent **0** shows that there are <u>no</u> zeros

<u>Answers to Questions:</u>

1a: $10^5 = 10 \times 10 \times 10 \times 10 \times 10 =$ **100,000**

1b: $10^{-4} = 1/10 \times 1/10 \times 1/10 \times 1/10 = 1/10000 =$ **0.001**

Section 2: Scientific Notation (a <u>number</u> x 10^x**)**

Scientific notation is used as a method to consolidate the length of a number. For example, 140,000,000 is a pretty large number to write out, but scientific notation shortens that number to 1.4×10^8. This also helps prevent mistaking commas for decimals, and vice versa as well as shorten numbers for significant digits/rounding to the nearest chosen value (tenth, hundredth, etc).

In scientific notation, we always see a number multiplied by the base of **10**, with any possible number for an exponent including negative numbers.

The most important thing about this notation is that the number being multiplied by 10^x always needs to be **in-between 1 and 10.** This means that you can use the numbers, 1, 1.00001, 9.99999, or 10. There's a multitude of numbers in-between 1 and 10, but those are just some acceptable examples.

- When a number (**1<**number**<10**) is multiplied by 10^x, it's considered to be in *scientific notation*

  Correct Examples: 7.8×10^4, 9.99×10^3

  Wrong Notations: 0.34×10^6, 53.28×10^9

<u>To convert into scientific notation:</u>

- the number needs to be **less than** 10, but **greater than** 1

Remember "ID"

←-------------------------------- I D------------------------→

(move decimal to the left, exponent ***increases***) (move decimal to the right, exponent ***decreases***)

Examples: $372.6 \times 10^5 \rightarrow 3.726 \times 10^7$

→ the decimal point had to move two places to the *left* to be less than 10, but greater than 1, so **two** was *added to* the exponent

$0.00512 \times 10^9 \rightarrow 5.12 \times 10^6$

→ the decimal point had to move three places to the *right* to be less than 10, but greater than 1, so **three** was *subtracted from* the exponent

$0.0962 \times 10^{-4} \rightarrow 9.62 \times 10^{-6}$

→ the decimal point had to move two places to the *right* to be less than 10, but greater than 1, so **two** was *subtracted from* the exponent (-4-2 = -6)

- The exponent in 10^x tells how many **decimal places** to move a decimal in the <u>number</u>
  - *Positive Exponents* (10^x) → move decimal to the **right**

- *Negative exponents* (10^{-x}) → move decimal to the **left**
  ****Zeros might need to be added in front of the first number (see example below)

**** this is different than 10^x (base with exponent) on its own because the decimal point in the number is being moved, not the decimal point in the number 10

Examples:

1. $6.40 \times 10^2 = 640$
2. $3.851 \times 10^1 = 38.51$
3. $2.89 \times 10^{-4} = 0.000289$
4. $8.65 \times 10^{-1} = 0.865$

Question 2a: The molecule OReOs has a molecular weight of 392.4364 g/mol. What is this weight in scientific notation?

Question 2b: The Molar Gas Constant (R) is equal to 0.08206 L•atm/K•mol. What is this number in scientific notation?

Question 2c: Coulomb's Constant (k_e) is equal to 8.987551×10^9 N•m^2/C^2. What is this number expressed in non-scientific (numerical) notation?

Note: If a constant or any number has a label (i.e N•m^2/C^2), make sure to include the label in your scientific notation/numerical answer. If a number has a label and is being multiplied by another number with a label (i.e (5 miles/hour) x (1 hour)), make sure the labels are multiplied or cancelled out.

Example #1: (5 miles/hour) x (hour) = 5 miles
→ the hour label occurs once in the numerator and once in the denominator, cancelling it out.

Example #2: (2 miles/hour) x (2 miles) = 4 miles^2/hour
→ the label "miles" occurs in the numerator once for each, therefore multiplying "miles" by itself to get miles^2.

Answers to Questions:

2a: **3.924364 x 10^2 g/mol**

2b: **8.206 x 10^{-2} L•atm/K•mol**

2c: **8,987,551,000 N•m^2/C^2**

Exponential Math

Exponential math can be described as the addition, subtraction, multiplication, or division of numbers with exponents. This can get tricky especially when numbers are expressed in scientific notation and are multiplied by each other. There are two methods to multiply two numbers in scientific notation by each other. Whichever is found to be the most understandable is what should be used for a "go-to" method for calculations. Since exponents can get tricky, it's very useful to write every number and calculation out. Try not to leave out any "mental math" that was done.

<u>Adding/Subtracting</u>

- Numbers with exponents are added/subtracted AFTER the numbers are broken down from an exponent

  Examples: $10^2 + 10^3 = 100 + 1{,}000 = 1{,}100$
  $(4 \text{ x } 10^1) + (6 \text{ x } 10^3) = 40 + 6{,}000 = 6{,}040$

Question 3a: $10^7 - 6^3 = ?$

<u>Moving Exponents</u>

- to/from fraction form
- Numerator (top) to Denominator(bottom): $10^4 \rightarrow 1/10^{-4}$
  $10^{-3} \rightarrow 1/10^3$
- Denominator (bottom) to Numerator (top): $1/10^4 \rightarrow 10^{-4}$
  $1/10^{-3} \rightarrow 10^3$

****sign of the exponent changes

Question 3b: What is 9^{-2} in fraction form?

<u>Multiplying</u>

- Exponents are **added**
  $10^a + 10^b = 10^{a+b}$

  Examples: $10^2 + 10^4 = 10^{4+2} = 10^6 = 1{,}000{,}000$
  $10^{-3} + 10^6 = 10^{-3+6} = 10^3 = 1{,}000$

- In *scientific notation*, multiplying two sets (<u>number</u> x 10^x) can be done by multiplying the two <u>numbers</u> to get a product (<u>number</u>$_1$ x <u>number</u>$_2$) and then multiplying the two bases with exponents ($10^x{}_1$ X $10^x{}_2$) to get a product. These two products can then be multiplied.

  Link for a video example: https://bit.ly/2c3Q1bS

Example: $(7 \times 10^4) \times (3 \times 10^2) = ?$

Variables:
$\underline{Number_1} = 7$
$\underline{Number_2} = 3$
$10^x{}_1 = 10^4$
$10^x{}_2 = 10^2$

Equation:
$(\underline{number_1} \times \underline{number_2}) \times (10^x{}_1 \text{ X } 10^x{}_2) = ?$

Input variables into equation to get:

$(7 \times 3) \times (10^4 \times 10^2) = (21) \times (10^{4+2}) = (21 \times 10^6) = 21{,}000{,}000$

Question 3c: If one donut has 1.95×10^2 calories and I consume 1.2×10^2 donuts every 5 years, how many calories will I have consumed from donuts after 25 years?

Note: make sure all math is written out each time a calculation is done, even if it's as simple as 2x3 - no skipping around!

Dividing

A common mistake with exponential math is that adding/subtracting numbers *with* exponents means that the exponents are added/subtracted. The only time where exponents are added or subtracted is from **multiplication or division**.

- Exponents in the denominator (bottom) are subtracted from the exponent in the numerator (top)
  $10^a/10^b = 10^{a-b}$

  Examples: $10^3/10^2 = 10^{3-2} = 10^1 = 10$
  $10^{-4}/10^2 = 10^{-4-2} = 10^{-6} = 1/10^6 = 1/1{,}000{,}000$ *or* 0.000001

- In *scientific notation*, dividing two sets (number x 10^x) can be done two ways:
  1. Multiply each set out and divide the two products

     Example: $(3 \times 10^3) / (4 \times 10^2) = 3{,}000 / 400 = 7.5$

  Or

  2. Divide the two numbers to get one quotient, then divide the two bases with exponents (10^x) to get another quotient, and multiply those two quotients to get a product. (**refer to video link above for example)

     Example: $(3 \times 10^3) / (4 \times 10^2) = (¾) \times (10^3/10^2) = 0.75 \times 10^{3-2} = 0.75 \times 10^1 = 0.75 \times 10 = 7.5$

Question 3d: If I have a molecule that has a total electron charge of 3.844×10^{-18} C and one electron has a charge of 1.602×10^{-19} C, how many electrons does this molecule have?

Raising an Exponent to a Power

When there is an exponent raised to a power (number with an exponent multiplied by an exponent on its own), the exponents are **multiplied**. The base number remains *unchanged* and only the exponents change.

- Exponents (x) are raised by the power (y)
  $(10^x)^y = 10^{(x)\cdot(y)}$

  Examples: $(10^8)^2 = 10^{8 \times 2} = 10^{16}$
  $(10^3)^{-4} = 10^{3 \times -4} = 10^{-12}$ *or* $1/10^{12}$

When there is more than one number in a parentheses being raised to a power (i.e $(2 + 10^3)^2$ or $(2 \times 10^3)^2$), the numbers are calculated differently.
For **addition or subtraction** within the parentheses: the numbers in the parentheses are added first and the sum of these numbers are raised to the power *outside* the parentheses.
Examples: $(3 + 7^2)^2 = (3 + 49)^2 = 52^2 = 2{,}704$
$(6^3 - 32)^4 = (216 - 32)^4 = 184^4 = 1{,}146{,}228{,}736$ *or* 1.146228736×10^9

For **multiplication or division** within the parentheses: the power outside the parentheses is *distributed* to each number inside the parentheses **or** calculations can be done inside the parentheses and then add the exponent to the results of that calculation
Examples: $(4 \times 10^3)^2 = (4^2) \times (10^{3\times2}) = 16 \times 10^6 = 16{,}000{,}000$ *or* 1.6×10^7
$(4 \times 2)^3 = (8)^3 = 512$
$[(2^2)/5]^4 = [(2^{2\times4})/5^4)] = 2^8/5^4 = 256/625 = 0.4096$ *or* 4.096×10^{-1}

Question 3e: $[(3 \times 2^2)/5]^3 = ?$

Answers to Questions:

3a: $10^7 - 6^3$ = 10,000,000-216 = **9,999,784**

3b: 9^{-2} = **$1/9^2$**

3c: (1.95×10^2 calories) x (1.2×10^2 donuts every five years) X (5 years)

**5 came from (twenty-five years total/# donuts every five years)

Method 1: (1.95 x 1.2) x ($10^2 \times 10^2$) x (5)
= (2.34) X (10^{2+2}) x (5)
= (2.34×10^4) x 5
= (23,400) x (5)
= **117,000** calories from donuts after 25 years

Method 2: (1.95×10^2) x (1.2×10^2) X (5)
= (195 calories) x (120 donuts every five years) x (5 years)
= **117,000** calories from donuts after 25 years

3d: (3.844×10^{-18} C) / (1.602×10^{-19}) = ? electrons

- Method #1 is not recommended for this since the exponents are such large numbers
  = (3.844/1.602) x ($10^{-18}/10^{-19}$) electrons
  = (2.4) x ($10^{-18-(-19)}$) electrons
  = (2.4) x (10^{-18+19}) electrons
  = 2.4×10^1 electrons
  = **24 electrons**

3e: $[(3 \times 2^2)/5]^3$
= $[(3^3 \times 2^{2x3})/5^3]$
= $(27 \times 2^6)/125$
= (27 x 64) / 125
= 1728 / 125
= **13.824**

Orders of Operation

Follow PEMDAS (complete math in order starting with P, then E, then M/D, then A/D)

P = parentheses Ex: $(3-2)^3 + (4+1)^{(3x3)} \rightarrow (1)^3 + (5)^{(9)}$

E = exponents Ex: $2^2 + 6 - 5^3 \rightarrow 4 + 6 - 125$

M = multiplication Ex: (3 + 8 x 9) → (3 + (8x9)) → (3 + 72)
D = division (5 + 6 ÷ 3) → (5 + (6÷3)) → (5 + 2)

A = addition * doesn't matter what order
S = subtraction

Links for Video Examples: https://bit.ly/2bMVP4s
https://bit.ly/2HKWmb4

Note: this is another mathematical concept where all calculations should be written out as they are done to avoid missing numbers or messing up an answer

Question 4: $(20 \div 4)^2 + ((16-3)^3 \times 5^2) = ?$

Answer to Question:

4: $(20 \div 4)^2 + ((16-3)^3 \times 5^2)$ Result of:

$= (5)^2 + ((13)^3 \times 5^2)$ ← *parentheses*

$= 25 + (2197 \times 25)$ ← *exponents*

$= 25 + 54925$ ← *multiplication*

= **54,950** ← *addition*

Algebra

Algebra involves **variables** within a mathematical expression. For example, 3x + 5x. A variable is the letter the coincides with a number. Notice that in front of each variable (letter) is a number. This number is referred to as a **coefficient**. Coefficients are essentially "attached" to the letter through multiplication. If a variable is by itself (for example, x), it's coefficient is 1. Anything multiplied by 1 is unchanged so usually the "1" isn't written out in front of the variable. Since the variable's numeric value is unknown, the coefficient and variable stay next to each other. Variables can be substituted for numbers. For example, if x=2, then 3x + 5x equals 3(2) + 5(2), which equals 6+10, or 16. In this case, x was the variable and it was substituted for the number 2. Algebraic expressions are often are used to solve for the number that corresponds for the variable (in other words, "solving for *x*" or whatever the variable may be). They are also used to input different values into an expression for an output of different answers. A variable is essentially a value that can have a *variation* of substitutions.

Distributing Algebraic Expressions

- Distribute number/variable *outside* the parentheses to *each* term inside the parentheses by multiplication

  ***remember to keep signs (from addition/subtraction) or change signs (from multiplication/division)

  Examples: 6(5x - 3) → 30x - 18
  9(2x + 8y) → 18x + 72y

- Variables (i.e. x, y, a, etc) are also distributed. If a variable is being multiplied by itself, exponents are added for the exponents of the letter only. If a variable is being multiplied by a different variable, the exponents for each variable remain the same.

  Examples: $6x(3x + 4) \rightarrow 18x^2 + 24x$
  $3x^4(4x + 7) \rightarrow 12x^{4+1} + 21x^4 \rightarrow 12x^5 + 21x^4$
  $5y^2(2x + 2y - 1) \rightarrow 10y^2x + 10y^3 - 5y^2$

Question 5a: $8x^2y(4x - 2y + 3) \rightarrow ?$

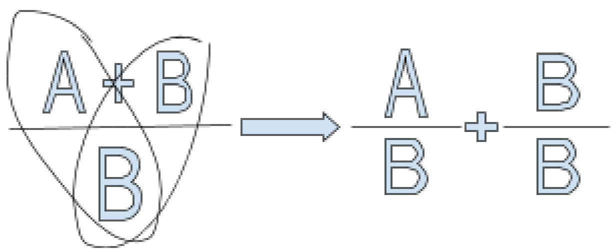
Simplifying Algebraic Expressions

"Like terms" refers to terms that have the same variable with the same exponent. If we have a variable by itself, like x, it's exponent is 1. Numbers without a variable are considered like terms. For example in the expression, 1 - 2x + 3, one and three are *like variables* and can be added to equal 4.

- Combine **like** terms
  Examples: $3x + 6x \rightarrow 9x$
  $7x - 6y - 2x + 40 - y - 25 \rightarrow (7x - 2x) + (-6y - y) + (40 - 25) \rightarrow 5x - 7y + 15$

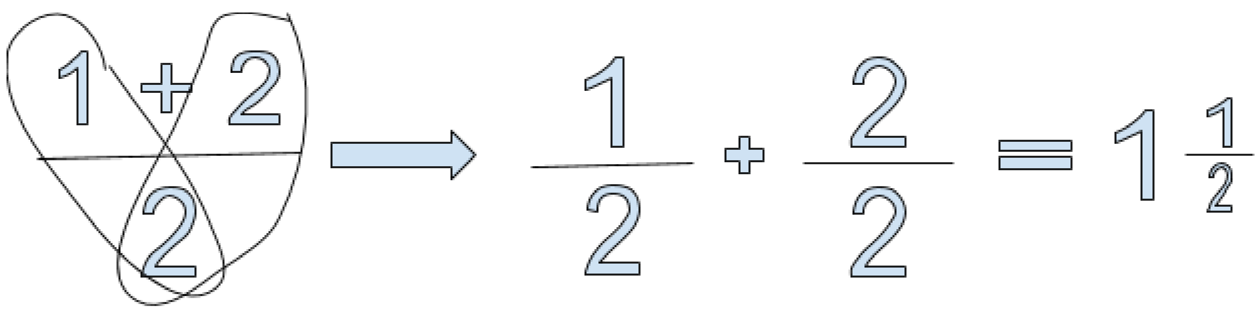
- Terms can only be combined in addition/subtraction if they have the <u>same exponent</u>
  Example: $5x^2 + 3x^2 + 9x^9 \rightarrow 8x^2 + 9x^9$
  *Notice that $9x^9$ couldn't be combined with the other two terms because it has a different exponent than them.

For separating out division problems that contain addition/subtraction in the numerator only, the separated divisors are <u>added</u>.



B/B then equals 1 to simplify to→ A/B + 1

To put this into perspective with a numeric example, we'll say A = 1 and B = 2



Separating the division problem out, we see that we get 1 ½. If we didn't separate out this problem, we would have 3/2, which equals 1 ½.

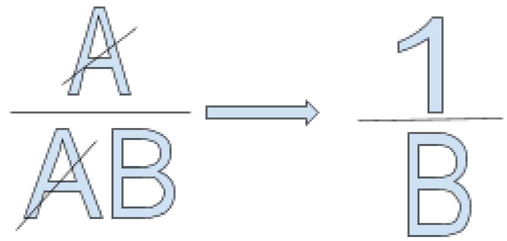
Division problems that contain addition/subtraction in the *denominator* **cannot** be separated.

Examples: x/xy → 1/y (because the x's cancel out)
2x/3x4y → 2x/3x + 2x/4y → ⅔ (x's cancel out) + x/2y
(2x + 5) / 2x → 2x/2x + 5/2x → 1 + 5/2x

Cancel out variables from division for **like terms** *only* if it involves multiplication in the numerator or denominator

For example: A x B, **not** A + B

A/AB → 1/B



For simplifying variables with **different exponents** in the numerator/denominator, it is the same process as exponential math. If there is addition or subtraction in the numerator, the expression is separated and then the exponents are added/subtracted as needed.

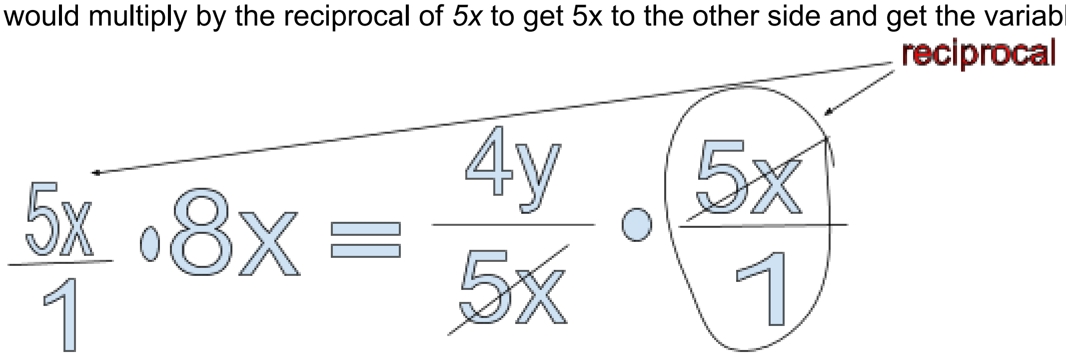
Example: $[(8x^3-4x^2)/2x] \rightarrow 8x^3/2x - 4x^2/2x \rightarrow 4x^{(3-1)} - 2x^{(2-1)} \rightarrow 4x^2 - 2x^1$

Note 1: The coefficients (numbers) in front of the variables are multiplied/divided with the variables. In the example above, we see that we have a coefficient of 8 in the numerator and a coefficient of 2 in the denominator. Since the exponents are different, they were subtracted (division = subtraction of exponent in the denominator from exponent in the numerator for **like variables**) but the coefficients were divided.

Note 2: Coefficients can be simplified (multiplied/divided) even if the variables are different.

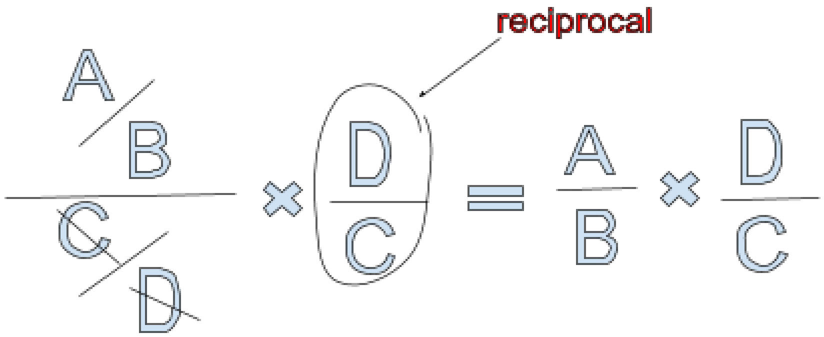
Question 5b: $[(9x^2 - 12y)/3x] = ?$

If there is division in the denominator, rewrite by multiplying by the **reciprocal** (flip it). The reciprocal is the term (i.e C/D) flipped so the values in the numerator and denominator are switched. Sometimes when simplifying an equation to find the value of something, reciprocals need to be used to isolate a variable by cancelling a term out from one side to get it to the other side. For example, the equation: 8x = (4y/5x), if we wanted to try to isolate the variable y, we would multiply by the reciprocal of *5x* to get 5x to the other side and get the variable *y* by itself.



This would then give us: $40x^2 = 4y$. If we wanted to go further to get *y* without a coefficient, we would divide both sides by *4*, which would give us: $y = 10x^2$.

Rewrite: A/B ÷ C/D → A/B x D/C



→ C/D is flipped to D/C because it's in the denominator and is multiplied to turn the problem from a division problem to a multiplication problem for easier problem solving.

Examples:

a. 7/6 ÷ 4/6 → 7/6 x 6/4 = 7/4
   (the 6's cancel out because there's a 6 in the numerator and a 6 in the denominator)
b. Gallon ÷ mile/gallon → gallon x (gallon/mile) = $gallon^2$/mile
c. Gallon ÷ gallon/mile → gallon x (mile/gallon) = mile
   (gallons in numerator and denominator cancel each other out)
d. $Gallon^2$ ÷ gallon/mile → $gallon^2$ x ($mile/gallon^1$) = gallon x mile
   (since there are two gallons in the numerator and only one in the denominator, the exponent from the denominator (^{1}) is subtracted from the exponent in the numerator (^{2})).

Question 5c: If I have the equation: 9y = (12x/3y) + 3y, what is the value of *x*?

Answers to Questions:

5a: $8x^2y(4x - 2y + 3)$

$= 32x^{2+1}y - 16x^2y^{1+1} + 24x^2y$

$= 32x^3y - 16x^2y^2 + 24x^2y$

5b: $[(9x^2 - 12y)/3x]$

$= (9x^2/3x) - (12y/3x)$

$= 3x^{2-1} - 4y/x$

$= 3x - 4y/x$

5c: $9y = (12x/3y) + 3y$

$9y - 3y = (12x/3y)$

$6y = 4x/y$

$(6y) \times (y) = 4x$

$4x = 6y^{1+1}$

$4x = 6y^2$

$x = 6y^2/4$

$x = 3y^2/2$

Standard Unit Conversion Table

Common Prefixes used with SI Units			
Prefix	Symbol	Meaning	Order of Magnitude
giga-	G	1 000 000 000	10^9
mega-	M	1 000 000	10^6
kilo-	k	1 000	10^3
hecto-	h	100	10^2
deka-	da	10	10^1
	base unit	1	10^0
deci-	d	0.1	10^{-1}
centi-	c	0.01	10^{-2}
milli-	m	0.001	10^{-3}
micro-	µ	0.000 001	10^{-6}
nano-	n	0.000 000 001	10^{-9}

Source: http://bobphysicsone.blogspot.com/2017/09/metric-prefixes.html

To convert **back** from a prefix, times by the “order of magnitude” of the prefix
→ (Prefix) x (10^x)

*base unit = gram

Examples: *5kg (kilograms) → grams:* 5kg x 10^3 = 5,000g (in other words, 1g is 1,000 times 1kg)
7,000mg (milligrams) → grams: 7,000 x 10^{-3}g = 7g

To convert **to** a prefix, switch the sign (positive to negative/negative to positive) of the exponent in the “order of magnitude” and then multiply
→ (base unit) x (10^{-x})

*base unit = gram

Examples: *5,000g → kg:* 5,000 x 10^{-3}kg = 5kg
7g → mg (milligrams): 7 x 10^3mg = 7,000mg

Note:

- prefixes **above** the base unit (deka-, hecto-, kilo- etc.) are larger than the base unit itself so the conversion to them **will be a smaller number** than the base units number (ex: 3,000 grams is only 3 kilograms)
- Prefixes **below** the base unit (centi-, milli-, micro- etc.) are smaller than the base unit itself so the conversion to them **will be a larger number** than the base units number (ex: 3 grams is 300 milligrams)

Question 6a: If my experiment calls for 500mg of Sodium Chloride (NaCl), but my scale only measures in grams, how many grams of sodium chloride will I need to measure?

Temperature Formulas:

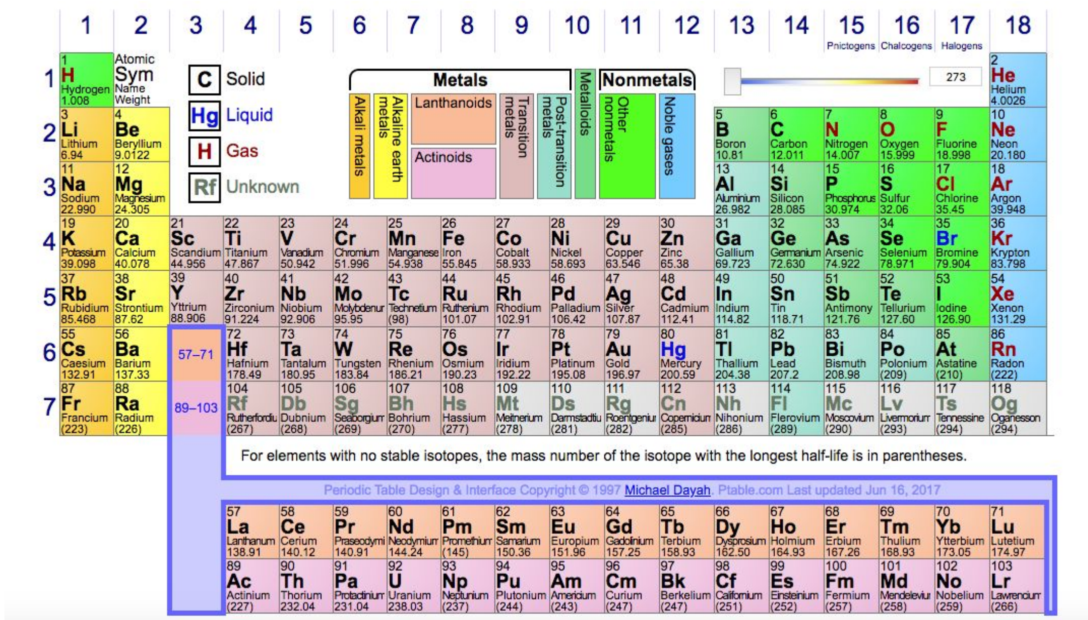
$^\circ C = (^\circ F - 32) \cdot \frac{5}{9}$ $^\circ F = \frac{9}{5}{}^\circ C + 32$ $K = {}^\circ C + 273$

Examples:

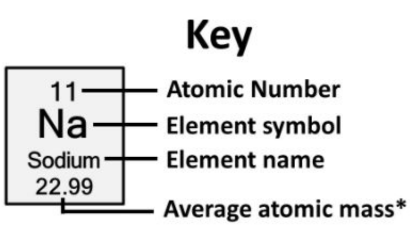
212 °F = ? °C	37 °C = ? °F	25 °C = ? K
°C = (212 - 32) * 5/9	°F = 9/5 * 37 + 32	K = 25 + 273
°C = (180) * 5/9	°F = 66.6 + 32	K = 298
°C = 100	°F = 98.6	

Source: https://i.pinimg.com/originals/d9/b1/2a/d9b12aafd1470a7cfc86e86a0db9bb0e.jpg

Question 6b: If my reaction requires a temperature of 85℉, but I only have a thermometer that measures in Celsius, what temperature degree would I need to get to in celsius?



Source: https://www.ptable.com/



<u>Atomic Number</u> - the number of protons in the nucleus of an atom

<u>Atomic Mass (weight)</u> - number of protons + neutrons in one atom

Source: http://slideplayer.com/slide/3913873/

Credit Given To: Dr. Yau, of Baltimore County Community College Website: http://faculty.ccbcmd.edu/~cyau/TutorialMathReviewForGenChemISp2006.pdf

Answer to Questions:

6a: 500mg x 10^{-3} = **0.5g NaCl**

6b: **29.44℃**