Math Basics

A word to the wise: General Chemistry is not a math course, so don't worry, most of the topics you cover this summer will be less mathy than what you see on this sheet. That said, many problems will require that you use exponents, logarithms, scientific notation, etc. so it's good to get comfortable with them right away.

Exponents Basics

$$\begin{aligned}(5^2)\cdot(5^3) &= (5\cdot 5)\cdot(5\cdot 5\cdot 5)\\ &= (5\cdot 5\cdot 5\cdot 5\cdot 5)\\ &= 5^5\end{aligned}$$

So, $b^M \cdot b^N = b^{(M+N)}$

Additionally, $5^{-2} = \frac{1}{5^2}$

So, $\frac{b^M}{b^N} = b^{(M-N)}$

$$\begin{aligned}(5^2)^3 &= (5\cdot 5)^3\\ &= (5\cdot 5)\cdot(5\cdot 5)\cdot(5\cdot 5)\\ &= 5^6\end{aligned}$$

So, $\left(b^M\right)^N = b^{(M\cdot N)}$

$$\begin{aligned}(5\cdot 2^3)^2 &= (5\cdot 2^3)\cdot(5\cdot 2^3)\\ &= (5\cdot 5)\cdot(2^3\cdot 2^3)\\ &= 5^2\cdot(2^3)^2\end{aligned}$$

So, $\left(a\cdot b^M\right)^N = a^N \cdot b^{(M\cdot N)}$

$$\begin{aligned}(25)^{1/2} &= \sqrt{25}\\ &= 5\end{aligned}$$

So, $b^{M/N} = \left(\sqrt[N]{b}\right)^M$

And finally, remember that anything raised to the 0^{th} power = 1.

So, $b^0 = 1$

Logs Basics

First, a quick intro: logarithms are just exponents in disguise. I always think of logarithms in terms of their exponential form, and encourage you to do the same.

What do I mean by this?

$5^2 = 25$ is equivalently expressed as $\log_5 25 = 2$.

With logs, as with exponents, we have three parts. I call them the base, the goal, and the power. You don't need to do this; it's just what makes sense to me.

$\log_b g = p \quad \Leftrightarrow \quad b^p = g$ These say exactly the same thing.

The base of the logarithm (b) is also the base of your corresponding exponential expression.
The "goal" of the logarithm (g) is the value your exponential expression spits out (i.e. your goal).
The "power" of the logarithm (p) is the power necessary to raise your base (b) to the goal (g).

$\log a = c$ means $\log_{10} a = c$ $\left(10^c = a\right)$. 10 is the implied base in the "common" log.

$\ln a = c$ means $\log_e a = c$ $\left(e^c = a\right)$. The irrational number e is the implied base in the "natural" log.

Log Laws

$$\log_b M + \log_b N = \log_b \left(M \cdot N\right) \qquad \log_b M - \log_b N = \log_b \left(\frac{M}{N}\right)$$

$$k \cdot \log_b M = \log_b \left(M^k\right) \qquad \log_b c = \frac{\log_a c}{\log_a b} \quad \text{(where } a \text{ is any allowable base)}$$

You can derive the log laws using the laws of exponents, but the derivations are not intuitive, so I haven't included them here. If you're curious, ask me or look them up online.

Scientific Notation

–3,000 = –3.000 x 10^3 0.000056 = 5.6 x 10^{-5} 5.97 x 10^{-7} = 597 x 10^{-9} = 597 nm

Also, although you will rarely see scientific notation used for "normal" sized numbers, you can always use scientific notation.

e.g. 12 = 1.2 x 10^1 and 7 = 7 x 10^0