The Latticework:

Chemistry

What I noted since the really big ideas carry 95% of the freight, it wasn't at all hard for me to pick up all the big ideas from all the big disciplines and make them a standard part of my mental routines. Once you have the ideas, of course, they are no good if you don't practice – if you don't practice you lose it. So, I went through life constantly practicing this model of the multidisciplinary approach. Well, I can't tell you what that's done for me. It's made life more fun, it's made me more constructive, it's made me more helpful to others, it's made me enormously rich, you name it, that attitude really helps…

…It doesn't help you just to know them enough just so you can give them back on an exam and get an A. You have to learn these things in such a way that they're in a mental latticework in your head and you automatically use them for the rest of your life.

– Charlie Munger,

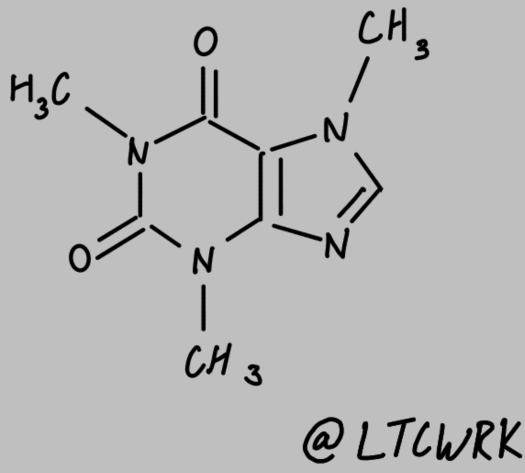
2007 USC Gould School of Law Commencement Speech

Chemistry

The big ideas from chemistry also fall into the first bucket of our Three Bucket framework and are broadly applicable and helpful in understanding the world around us.

For example, the language from chemistry is particularly beautiful and useful when describing how ideas spread, how teams communicate and work together, how to approach mastery, how to think about self-improvement, and much more. As Spanish essayist Miguel de Unamuno said, “Chemistry ought to be not for chemists alone.”

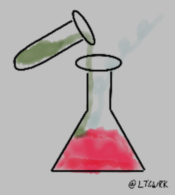
Given chemistry’s long and robust history, these ideas can and should serve as a fundamental “hanger” in our mental latticework.



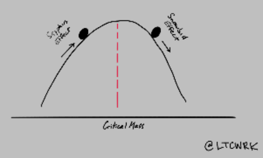
> Nothing in life is to be feared, it is only to be understood. Now is the time to understand more, so that we may fear less.
>
> – Marie Curie

The Big Ideas of Chemistry:

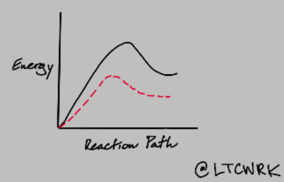
1. Chemical Reactions



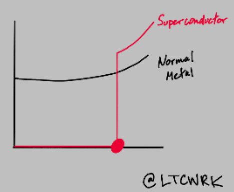
2. Critical Mass



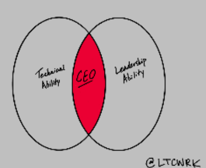
3. Catalysts



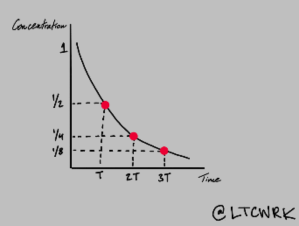
4. Phase Transitions



5. Alloying



6. Half-Life

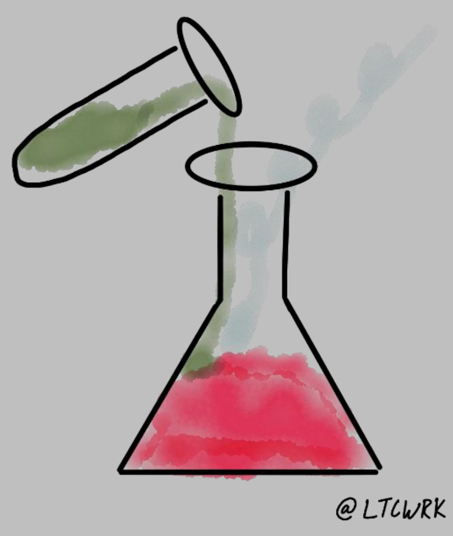


Chemical Reactions

Chemical reactions involve processes in which reactants (match head, oxygen) produce products (heat, light) known as new compounds. Most elements exist as chemical compounds which are collections of two or more elements held together by relatively strong attractive forces. These forces (chemical bonds) greatly influence the properties of compounds. Weak bonds between particles of an element/compound can also contribute to the properties of the material.

In organic and inorganic chemistry, weak food, water, or other bonds can be rearranged through chemical processes and reactions so that enormous energy is released.

Similarly, in team chemistry, the "bonds" we have with our teammates or counterparties are weak or strong based upon win/win, all-in relationships. When weak human bonds based on win/lose, lose/win, or lose/lose are rearranged into stronger "win/win" bonds, enormous energy is released.



The purpose of Navy Seal Hell Week is to weed out recruits who can't or won't make a total commitment to the group.

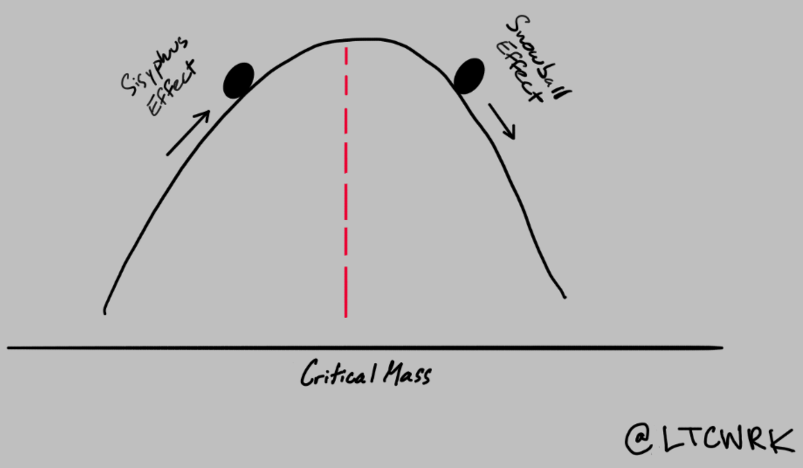
– Elite Teams Get the Job Done, Fortune Magazine

Critical Mass

Critical mass is like an avalanche.

Snow slowly builds up on the mountainside, eventually leading to an unstable condition where the wrong minor movement, sound, or disturbance can cause a destructive force to be unleashed.

This is a universal principle with wide-ranging applications, including learning, mastery, habit formation, sand piles, earthquakes, landslides, superfluidity, and more – you may not see results for some time but once you reach critical mass, you will see tremendous results quickly! Hard wood grows slowly, and it takes bamboo years to set up its underground, unseen root structure before it can grow as quickly as it does.



At a certain scale, a system reaches a critical mass or a limit where the behavior of the system may change dramatically. It may work better, worse, cease to work or change properties. Small interactions over time slowly accumulate into a critical state – where the degree of instability increases. A small event may then trigger a dramatic change like an earthquake. A small change may have no effect on a system until a critical threshold is reached. For example, a drug may be ineffective up until a certain threshold and then become effective, or it may become more and more effective, but then become harmful.

– Peter Bevelin, Seeking Wisdom

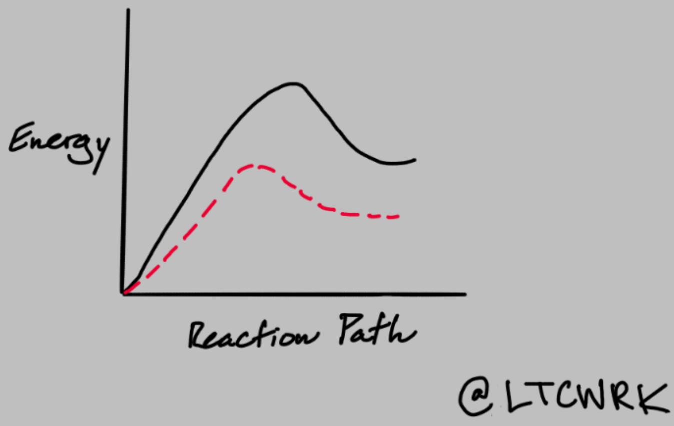
Catalysts

A catalyst is a substance which increases the rate of a chemical reaction, decreasing the activation energy needed to start the chemical reaction.

When trying to make something happen, be aware that activation energy is always required (even if minimal) and to be on the lookout for catalysts which decrease the energy needed to do so.

For example, if trying to establish a new habit, find ways to alter your environment to make it easier. If trying to be healthier, avoid having junk food in the house. If you're looking to read more, unplug your tv.

People, technology, culture, leadership, innovation, and more can all be considered catalysts. They can reduce the "activation energy" – the energy required to reach escape velocity – and decrease the effort necessary to change. Keep a close eye out for these catalysts as they can leverage your efforts.



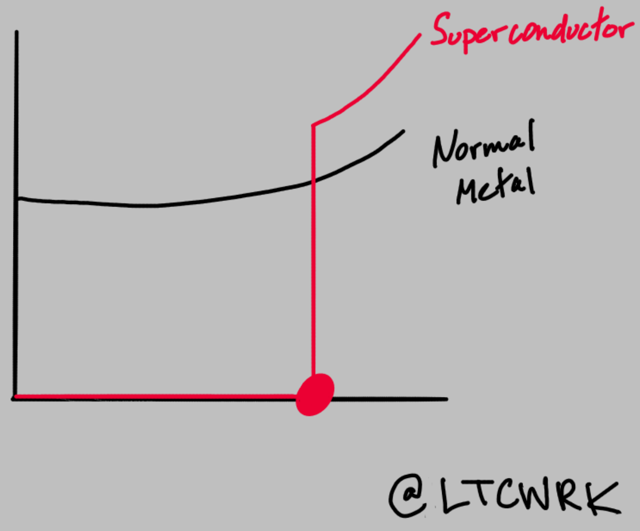
Part of the activation energy required to start any task comes from the picture you get in your head when you imagine doing it. It may not be that going for a run is actually costly; but if it feels costly, if the picture in your head looks like a slog, then you will need a bigger expenditure of will to lace up. Slowness seems to make a special contribution to this picture in our heads. Time is especially valuable. So, as we learn that a task is slow, an especial cost accrues to it. Whenever we think of doing the task again, we see how expensive it is, and bail.

– James Somers, Speed Matters

Phase Transitions

Phase transitions are the point at which elements transition from one phase to another. In this unique phase, fractions of a degree make all the difference in this state and can lead to Lollapalooza Effects (water freezing, electrons lining up to become superconductive, tornadoes emerging, etc.)

When pursuing anything challenging and feeling the wall of resistance, we must believe that we are perpetually on the cusp of hitting exponential growth. This will help drive motivation, deliberate practice, innovation, so that we can breach the critical threshold and reach the next phase transition.



Although all people are different, and all teams are different, what makes emergent properties and the phase transitions between them so interesting is that they are so predictable. We will see why organizations will always transform above a certain size, just like water will always freeze below a certain temperature, traffic will always jam above a critical density of cars, and one burning tree in a forest will always explode into a wildfire in high winds. These are all examples of phase transitions. Each person and team may be a puzzle. But in the aggregate, as Sherlock Holmes might say, the likelihood that any group will experience a phase transition becomes a mathematical certainty.

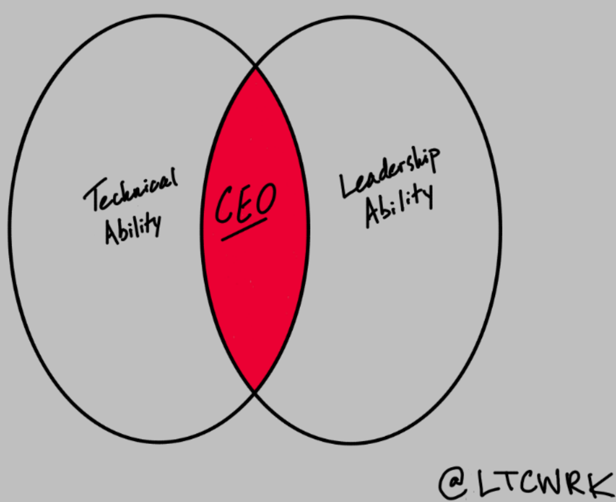
– Safi Bahcall, Loonshots

Alloying

A powerful example first heard from Paul Graham and later refined by Peter Kaufman is the concept of alloying as it relates to the combination of tin and copper, creating bronze.

In chemistry, the Mohs scale of hardness classifies how hard various minerals are. Talc is a 1 and diamond is a 10. In our example, tin is a 1.5 and copper a 3. These metals are not in close geographic proximity but, one day, thousands of years ago, somebody had the brilliant idea to combine these metals, creating a new alloy – bronze. You would think that when you combine these metals that the resulting alloy would be a 2.25 ((1.5+3)/2 = 2.25). However, we obviously don't get that or else this example would be a waste of time! What we get is 6! 1 + 3 = 6!

Similarly, people can use this same example and "blend in" characteristics which are typically not "in close geographic proximity" – characteristics which are not normally found together in people with their background, personality, disposition, status, etc. Instead of becoming a "purer" version of yourself, this new "alloy" is surprisingly strong.



Learn to sell, learn to build. If you can do both, you will be unstoppable.

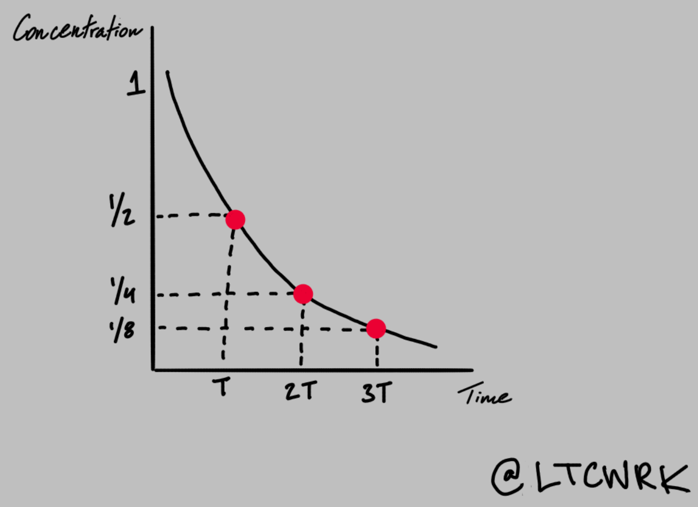
– Naval Ravikant, The Almanack of Naval Ravikant

Half-Life

Half-life is the time it takes for something to halve.

While half-life is typically associated with radioactive decay, for most people the more applicable aspect of half-life relates to knowledge and information. Although often not appreciated, knowledge and information decay over time, yet most people don't often question what they "know for sure."

Understanding half-life helps to determine drug dosages and the progression of decay in radioactive materials, but for more laymen's purposes, half-life can help us understand why it is important to focus on invariant principles. These principles have stood the test of time, proven robust, and therefore worthy of our time and attention.



We can see how information changes in the figures for how long it takes for a body of knowledge to double in size. The figures quoted by Arbesman (drawn from Little Science, Big Science … and Beyond by Derek J. de Solla Price) are compelling, including: Time for the number of entries in a dictionary of national biographies to double: 100 years; Time for the number of universities to double: 50 years; Time for the number of known chemical compounds to double: 15 years; Time for the number of known asteroids to double: 10 years… The doubling of knowledge increases the learning load over time. As a body of knowledge doubles so does the cost of wrapping your head around what we already know. This cost is the burden of knowledge. To be the best in a general field today requires that you know more than the person who was the best only 20 years ago. Not only do you have to be better to be the best, but you also have to be better just to stay in the game.

– Farnam Street, Half Life

As the African proverb goes, “If you want to go fast, go alone. If you want to go far, go together.”

Thank you for choosing to go together.