Levels of Learning for the Sciences

Advanced math and science classes are often perceived as difficult because it goes beyond memorization by requiring higher level thinking skills. Here is a classification system for the levels of learning with examples from different types of science classes.

Increasing complexity ↓

Learning task	Biology	Chemistry	Math	Physics	Ways to Study
Remember Recall previously learned material	What is DNA?	Name the following compound	What is the difference-quotient definition of the derivative?	What is the formula for kinetic energy?	Make flash cards or create mnemonics
Comprehend/Understand Restate or reorganize material to show understanding	Explain the role of DNA in protein synthesis.	Give an example of a redox reaction	What does the derivative represent with respect to the graph of the original function?	Calculate the kinetic energy of a car?	Summarize concepts in 2-3 sentences, or summarize problem solving steps in previously worked examples
Apply Uses previously learned material to solve problems in new situations	What would happen if a point mutation turned an amino acid codon into a stop codon?	Calculate the amount of product obtained from a chemical reaction	Find the equation of the tangent line to the graph of $f(x) = x^2$, at the point (1,f(1))	Use kinetic energy to find the stopping distance of a car.	See if you can use what you've learned to solve problems you haven't done before.
Analyze Break an idea into its component parts for logical analysis	Why does it matter that DNA is antiparallel?	Determine which reagent is the limiting reagent in a stoichiometry problem	What does each term in the difference-quotient definition of the derivative represent graphically?	Identify all types of energy in a system and apply conservation of energy to solve for unknown	Practice producing (writing, saying) information not just looking it over in your notes.
Evaluate Judge something based on some criteria	Develop an argument against splicing insecticidal genes into the corn genome.	Determine the identity of your laboratory unknown sample based on your laboratory tests and observations	Why is the derivative also said to represent "instantaneous rate of change" and how does this definition compare with the "slope of a tangent line" definition?	Identify sources of error in a particular experiment	Be prepared to make a value judgment based on certain criteria such as usefulness and effectiveness.

Adapted from *Levels of Learning: From Simple to Complex* by Sanger Learning & Career Center (www.lifelearning.utexas.edu)