TABLE 1

Primary (P) and secondary (S) Science and Engineering Practices for the rocket task.

Rocket Task	1. Ask questions/ define problems	2. Develop and/ or use models	3. Plan and/ or carry out investigations	4. Analyze and/or interpret data	5. Use math/ computational thinking	6. Construct explanations/ design solutions	7. Engage in argument from evidence	8. Obtain/ evaluate/ communicate information
Identify the problem								
Share and develop plan			P					
Create and test			P				P	
Communicate and give feedback				P		S		S
Improve and retest						S		S

TABLE 2

Mapped DCIs, CCCs, and SEPs for the rocket task.

Disciplinary Core Ideas (DCIs)	Crosscutting Concepts (CCCs)	Science and Engineering Practices (SEPs)
PS1.B. Chemical Reactions: Chemical processes, their rates, and whether or not energy is stored or released can be understood in terms of the collisions of molecules and the rearrangements of atoms into new molecules, with consequent changes in the sum of all bond energies in the set of molecules that are matched by changes in kinetic energy. (HS-PS1-4),(HS-PS1-5) ETS1.C. Optimizing the Design Solution: Criteria may need to be broken down into simpler ones that can be approached systematically, and decisions about the priority of certain criteria over others (trade-offs) may be needed. (secondary to HS-PS1-6)	Cause and Effect: Change in reactants affects products in a chemical reaction (e.g., rocket propellants, launches). Scale, Proportion, and Quantity: Balanced chemical equations corresponded with teachers' choices for concentrations of reactants. Structure and Function: Acid/base reactions produce specific products based on chemical structures.	Plan and Carry Out Investigations (P): Different acid-base combinations can be used to propel the toy rocket, some better than others. Analyze and/or Interpret Data (P): Different acid-base combinations lead to different performance results that may or may not meet design criteria. Engaging in Argumentation Using Evidence (P): Choices for improving propellant mixtures are based upon quantitative performance results.

TABLE 3

Intersections between DCIs, SEPs, and CCCs for the rocket task.

Performance Expectation(s)	DCI/SEP Connections	SEP/CCC Connections	DCI/CCC Connections
HS-PS1-5. Apply scientific principles and evidence to provide an explanation about the effects of changing temperature or concentrations of the reacting particles on the rate at which a reaction occurs. HS-PS1-6. Refine the design of a chemical system by specifying a change in conditions that would produce increased amounts of products at equilibrium.	Students work collaboratively to plan and investigate (e.g., reinforce/apply) their knowledge of acid-base chemistry through creating a method of propulsion for a toy rocket.	Students collect evidence and make arguments about how to improve their propulsion systems (e.g., when combining chemicals to propel their rockets; cause and effect).	Students manipulate concentrations of chemical reactants when developing their propulsion systems (e.g., scale, proportion, quantity tied into acid-base chemistry). Students apply their knowledge of acid-base chemistry when choosing their propellants (structure and function; cause and effect).

Note. CCC= Crosscutting Concepts; DCI = Disciplinary Core Ideas; SEP = Science and Engineering Practices.