Auxiliary Concept: Heat Transfer

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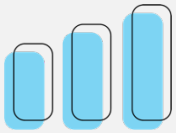
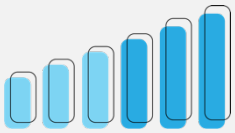
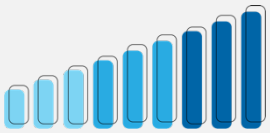
Engineering Literacy Dimension: Engineering Knowledge
Domain: Engineering Sciences
Overview: *Heat Transfer* is the scientific knowledge that builds upon the principles of thermodynamics and fluid dynamics to describe how heat moves from one body to another. For heat to transfer, a temperature difference or gradient is needed. Heat will move from a higher temperature to a lower one (hot to cold). This concept is important to Engineering Literacy, as it is the knowledge that informs how engineering professionals understand, design, create, and analyze material selections, machinery efficiency, reaction kinetics, heat exchangers, and cooling towers.

Performance Goal for High School Learners
I can, when appropriate, draw upon the knowledge of Heat Transfer content, such as (a) *conductive, convective, and radiation heating* and (b) *heat transfer coefficients*, to analyze how heat moves from one system (solid, liquid or gas) to another in order to solve problems in a manner that is analytical, predictive, repeatable, and practical.

	 Basic	 Proficient	 Advanced
CONDUCTIVE, CONVECTIVE, & RADIATION HEATING	I can describe the various ways heat transfer moves across systems.	I can calculate the Fourier Law and energy balances to formulate and solve steady and unsteady problems involving conduction. Use the Newton Law of cooling, correlations, and energy balances to formulate and solve heat transfer problems involving forced and natural convection. Use radiation exchange concepts to formulate and solve problems involving radiant heat transfer between multiple surfaces	I can use all three modes of heat transfer to design and to evaluate performance of thermal systems.
HEAT TRANSFER COEFFICIENTS	I can identify and define typical overall heat transfer coefficients of various modes and phases.	I can calculate the overall heat transfer coefficient, q, by Overall Heat Transfer Coefficient equation and number of transfer units (NTU) method, U.	I can use heat transfer coefficients to assess and improve the efficiency (performance) of a heat exchanger.