

**DF05: 9:10-9:20 a.m. Students' Ideas in Upper-Level Thermal Physics**

*Contributed – David E. Meltzer, Arizona State University, Mary Lou Fulton Teachers College, Mesa, AZ 85212; david.meltzer@asu.edu*

Repeated investigations have confirmed some consistent difficulties among students in upper-level thermal physics courses. These difficulties include confusion regarding the state-function property of entropy, misinterpretations of the meaning of equilibrium in the context of available microstates, misunderstandings of free-expansion processes, and lack of clarity regarding ideal (“Carnot”) efficiency of heat engines. I will discuss these difficulties and related student ideas in the context of development of research-based instructional materials.

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