February 11, 2013 Physics 132 Prof. E. F. Redish

- **Theme Music:** Desi Arnaz

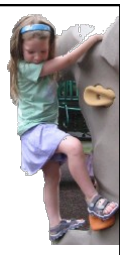
  Perhaps

- **Cartoon:** Pat Brady

  Rose is Rose

2/11/13 Physics 132 **1**

Foothold ideas: Entropy



- Entropy – an extensive measure of how well energy is spread in a system.
- Entropy measures
  - The number of microstates in a given macrostate $S = k_B \ln(W)$
  - The amount that the energy of a system is spread among the various degrees of freedom
- Change in entropy upon heat flow $\Delta S = \frac{Q}{T}$

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Foothold ideas: Transforming energy

- Internal energy: thermal plus chemical ΔU
- Enthalpy: internal plus amount needed to make space at constant p $\Delta H = \Delta U + p\Delta V$
- Gibbs free energy: enthalpy minus amount associated with raising entropy of the rest of the universe due to energy dumped $\Delta G = \Delta H - T\Delta S$
- A process will go spontaneously if $\Delta G < 0$.

Reading question

When the partition in the box is lifted the molecules can diffuse to the other side; however, they are not doing work because they are only diffusing due to random motion. Why then when you only put a hole in the partition and have the molecules travel to the other side and hit a turbine is that considered doing work? Is it simply because the molecules hit the fan and thus lose energy and give it to the turbine?