10/5 Lecture outline

• Engine efficiency $\eta \equiv |W|/|Q_H|$. Refrigerator performance: $\omega = |Q_C|/|W|$.

• Work through these examples:

1. Stirling engine (2 isotherms, 2 isochorics). Find $\eta = 1 - T_C/T_H$.
2. Carnot engine (2 isotherms, 2 adiabats). Find $\eta = 1 - T_C/T_H$.
3. Otto engine (2 adiabats, 2 isochors).
4. Diesel engine: (2 adiabats, 1 isochor, 1 isobar).

• 2nd law. Clauius: *no device can be made that operates in a cycle and whose* **SOLE** *effect is to transfer heat from cooler to hotter body* – i.e. $\omega < \infty$. Kelvin: *no engine can be made which, working in a cycle, produces no effect other than extracting heat from reservoir and producing the equal amount of mechanical work* – i.e. $\eta < 1$.

• Want to maximize η. **Question: How? Answer: Reversible.** Carnot's statement. Illustrate why.

• Use Carnot engine to define temperature θ: $\eta = 1 - \Theta_C/\Theta_H$. Lots of C-engines in series, defines Θ temperature scale. Agrees with previous definition, $\Theta = T$ (!).