Solutions 5:

1. **3rd Generation Photovoltaics**
   Definition is on the slides. OPV and a-Si cells are in the single band gap devices.

2. **Efficiency calculations**

a) The Carnot efficiency is:

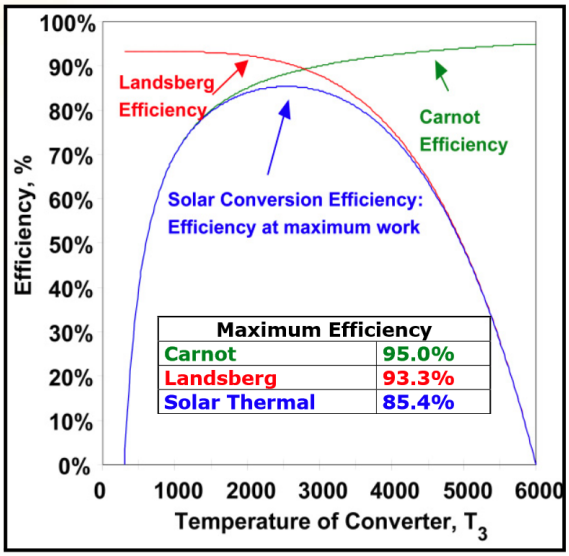
$$\eta_C = 1 - \frac{T_A}{T_S}$$

where T_A is the temperature of the absorber and T_S the temperature of the sun.

The Landsberg efficiency is:

$$\eta_L = 1 - \frac{4}{3}\frac{T_A}{T_S} + \frac{1}{3}\frac{T_A^4}{T_S^4}$$

Taking both into account one gets the following plot:



The Shockley Queisser Limit describes the efficiency of a single band gap cell with the following assumptions:

Assumptions in this "detailed balance" approach:

i)The mobility μ is infinite ⇒collection of carriers no matter where they are generated

ii)Complete absorption of all photons above the band gap

iii)That EG >> kT

b)

The solution here is a combination of a Carnot process and a black body radiation:

$$\eta = \left(1 - \frac{T_A^4}{T_S^4}\right)\left(1 - \frac{T_A}{T_S}\right)$$

3. **Tandem Solar Cells**
   Solutions can be found on the slides.