Instructions: Use whatever format you would like to work on this assignment, but include in the filename *the number of this quiz (i.e., 08) and your last name*.

Photochemical Energy Conversion

1) The article that you read in preparation for this discussion section (available here: https://www.jstor.org/stable/1747192) calculated the detailed-balance limit to the efficiency of solar fuels reactions (Figure 3, plots C), which constitute a less efficient subset of solar energy conversion processes than a photovoltaic, i.e. solar cell (Figure 3, Plot P). Why does the efficiency of a solar device increase, and then decrease, as the bandgap of the light-absorber increases? If the irradiance incident on a solar device increases from that of terrestrial solar illumination (i.e. 1 Sun) to 100 times more intense illumination (i.e. 100 Suns), how do the steady-state concentrations of species change, and what impact does that have on the power-conversion efficiency?

2) The so-called Förster cube is a decent representation of the simplest photochemical processes, but is imperfect. What are some of its major flaws and how could its accuracy be improved?

3) Last week, we discussed Rehm and Weller's article, which assessed the applicability of Marcus theory to bimolecular photochemical reactions between donor and acceptor species dissolved in fluid solution. To obtain their data, Rehm and Weller used pulsed light coupled to measurement of photoluminescence intensity, which exhibited an exponential dependence over time, allowing them to determine pseudo-first-order rate constants as a function of quencher concentration. Given these data, how would you extract values needed to assess whether Marcus theory held for their system?