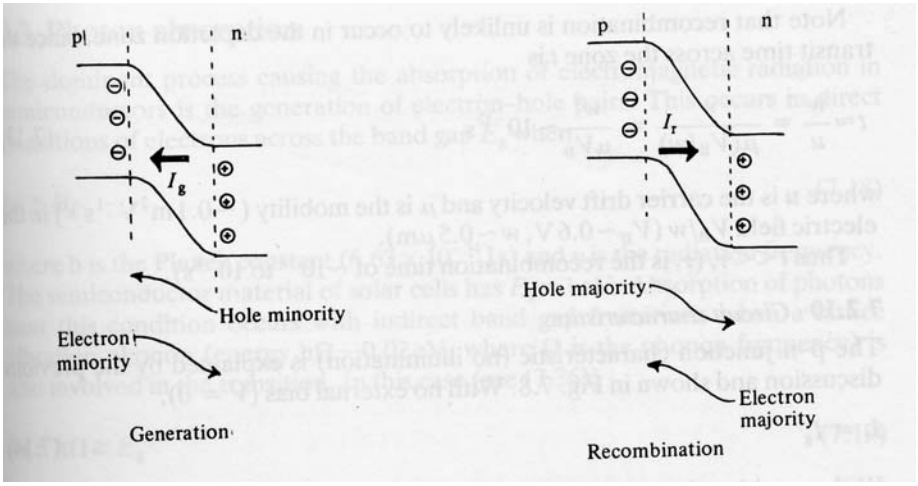
SOLUTION TFY4300 FY2201 08.12.2004
Part 2.

Problem 2.
Describe how the solarcell (or photovoltaic cell) becomes an electrical current source driven by a flux of solar radiation. Both pn junction, biasing and solar absorption should be included in the description.

Pn material connected introduce a flow of charge across the boader. A voltage V_B is established, $V_B = E_g - \varphi_n - \varphi_p$



By forward biasing of a pn junction a current can be generated in across the junction.

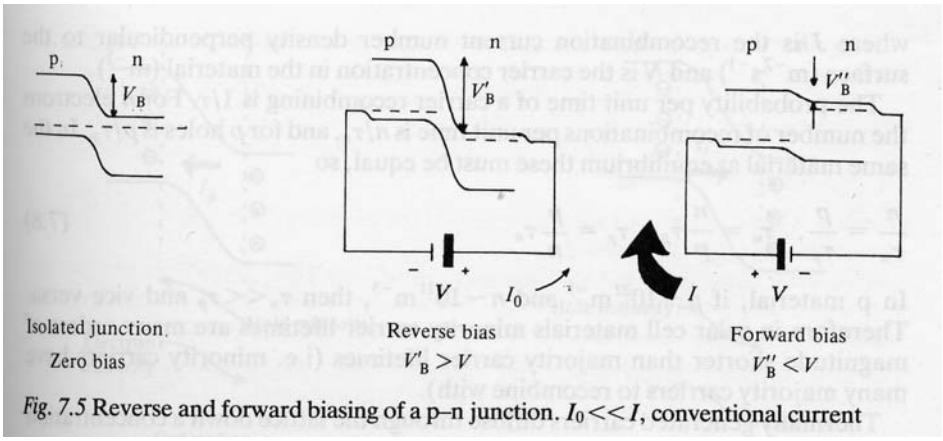
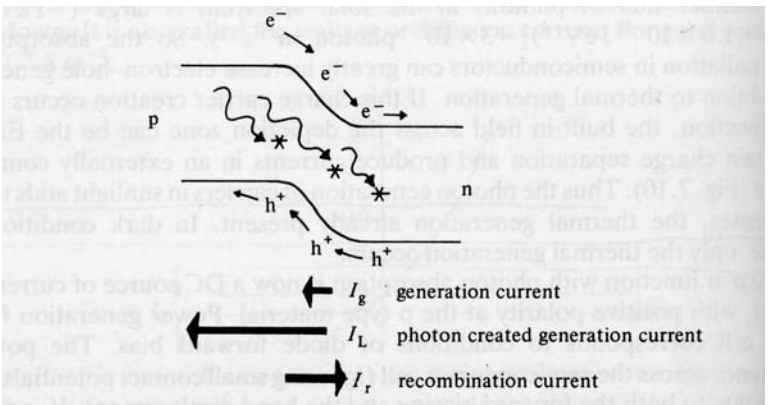


Fig. 7.5 Reverse and forward biasing of a p–n junction. $I_0 << I$, conventional current

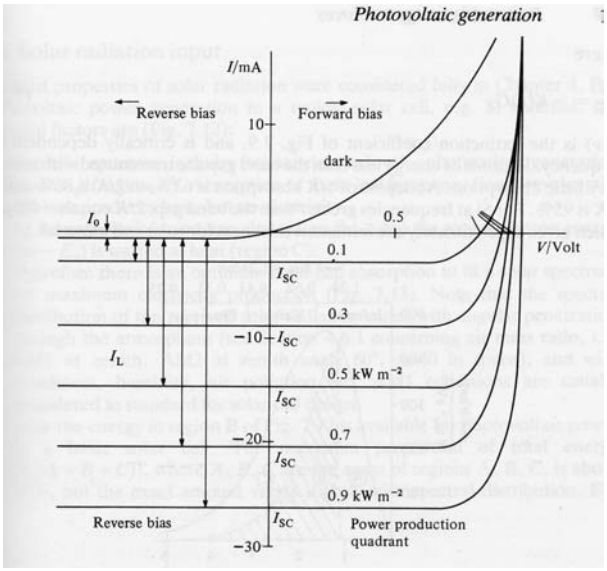
With a reverse bias a saturation current is established.

For a solar cell, absorption of photons at the junction introduce additional electron/hole pairs, thus a



photoninduced current is created.

In the forward biased direction a power can be gained from the external circuit.



By including the solar cell into a storage battery, which can be loaded as the solar cell is illuminated. A current source as been established. Higher voltage can be obtained by connecting several solar cells into a serial circuit.

b)

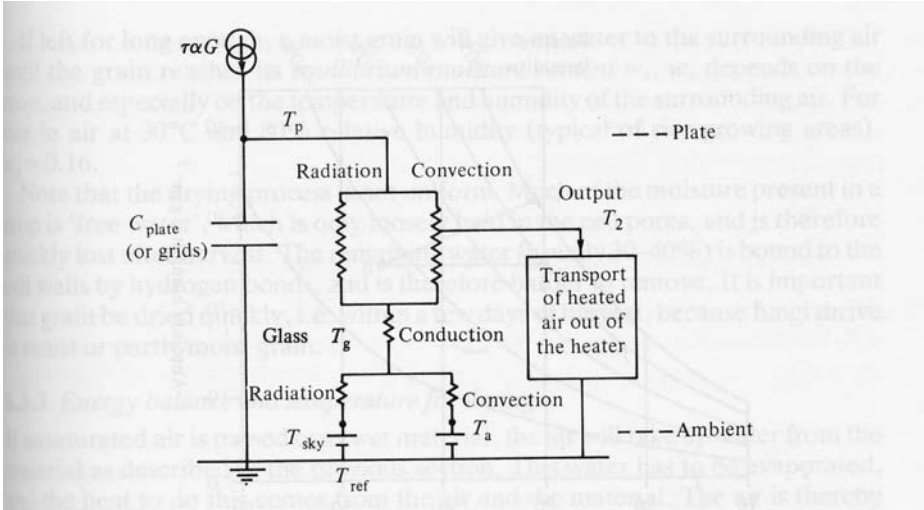


Fig. 6.2 Heat circuit for the air heater of Fig. 6.1 (a). Note how air circulation within the heater makes the exit temperature T_2 less than the plate temperature T_p. Symbols of Chapter 5