A. (2 pts) A p-n junction solar cell has $V_{oc} = 0.5$ V and $J_{sc} = 20$ mA/cm^2. A second cell, of the same area, has $V_{oc} = 0.6$ V and $J_{sc} = 16$ mA/cm^2. Assuming that both cells obey the ideal diode equation, find the values of V_{oc} and J_{sc} when the two are connected in (a) parallel and (b) series. Assume room temperature operation.

B. (2 pts) A graphene sheet is placed on top of a 300 nm SiO_2 layer which is on top of a 0.4 mm Si wafer (p-type, with $N_A = 10^{15}$ cm^{-3}). Assume that the work function of the graphene equals that of the Si. A voltage of 100 V is applied across the structure, first with one polarity and then the other. In the depletion case, assume that the Si is of high quality and that no inversion channel forms. Hence a depletion layer forms whose width, W, is given by the usual expression,

$$W = \left(\frac{2K_S \epsilon_o \phi_s}{qN_A} \right)^{1/2}$$

where ϕ_s is the potential across the semiconductor. What are the magnitudes of the electric field obtained at the graphene/oxide interface for each polarity?

q	1.6×10^{-19} C	electron charge
ϵ_o	8.85×10^{-14} F/cm	permittivity of free space
K_S	11.8 (Si)	relative dielectric constant
K_o	3.9 (SiO_2)	relative dielectric constant
k_B	8.617×10^{-5} eV/K	Boltzman's constant
h	6.63×10^{-34} J s	Planck constant
m_o	9.11×10^{-31} kg	electron mass
k_BT/q	0.0259 V at 300 K	thermal voltage
c	3×10^8 m/s	speed of light