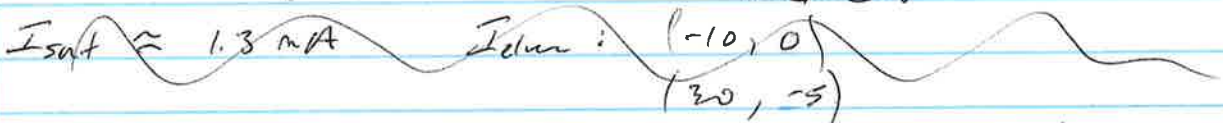


2011 Day 1 Question 5A (Diagnoses)

a. e^- saturation: $\phi \approx 50 \text{ V}$
 i^+ saturation: $\phi \approx -10 \text{ V}$

b. $\phi_f \approx 10 \text{ V}$
 $\phi_{pl} \approx 50 \text{ V}$, estimated at knee of e^- saturation

c. $kT_e = e \left(\frac{dI_{sat}}{dV} \right)^{-1}$ (40, -10)



Maybe better to go other way: $V_{sp} - V_f = (3.3 + 0.5 \log 40) \frac{kT_e}{e}$
 $40 \text{ eV} = (3.3 + \approx 0.5 \cdot 3.5) kT_e$

$\rightarrow T_e \approx 8 \text{ eV}$

d. $I_{is} = 0.6 e n_e \int \frac{kT_e}{m_i} A_p$

$\frac{1}{A_p} \left(\frac{1.3 \text{ mA}}{0.6 e n_e} \right) \int \frac{kT_e}{m_i} = n_e$

$n_e = \frac{1}{A_p} \frac{(2 \text{ mA})}{e} \sqrt{\frac{m_p 40}{8 \text{ eV}}}$

$\frac{2\pi}{2\pi} 2\pi \left(\frac{d}{2}\right) h + \pi \left(\frac{d}{2}\right)^2$
 For A_p use simple surface area?

sheath expansion effects - electron ^{saturation} current is not very flat.
 not much, ion saturation current is fairly constant (not very sloped).