Pre-Lab 2

Michael Brodskiy
Professor: M. Onabajo

September 25, 2024

1. Using the equation:

$$i = I_s\left(e^{v/(nV_T)} - 1\right)$$

and the given measurements, we may write:

$$10^{-3} = I_s\left(e^{.62/(n.025)} - 1\right)$$
$$10^{-2} = I_s\left(e^{.69/(n.025)} - 1\right)$$

Since the exponential is greater than 1, we may simplify to:

$$\frac{10^{-3}}{e^{24.8/n}} = I_s$$
$$\frac{10^{-2}}{e^{27.6/n}} = I_s$$

$$I_s = .001e^{-\frac{24.8}{n}}$$
$$I_s = .01e^{-\frac{27.6}{n}}$$

We can combine the two equations to solve for n and I_s:

$$.001e^{-\frac{24.8}{n}} = .01e^{-\frac{27.6}{n}}$$
$$e^{-\frac{24.8}{n}} = 10e^{-\frac{27.6}{n}}$$
$$e^{\frac{27.6-24.8}{n}} = 10$$
$$\frac{27.6-24.8}{n} = \ln(10)$$
$$n = \frac{2.8}{\ln(10)}$$

$$\boxed{n = 1.216}$$

We then plug this into the earlier equations to find I_s:

$$I_s = .001e^{-24.8/1.216}$$
$$\boxed{I_s = 1.3889 \cdot 10^{-12}[\mathrm{A}]}$$

We can verify by using the second equation for I_s:

$$I_s = .01e^{-27.6/1.216}$$
$$\boxed{I_s = 1.3889 \cdot 10^{-12}[\mathrm{A}]}$$

It is difficult to measure the current in a reverse bias mode, however, because the diode may reach breakdown voltage by increasing the reverse voltage.

2. Read through, no questions ✓

3.