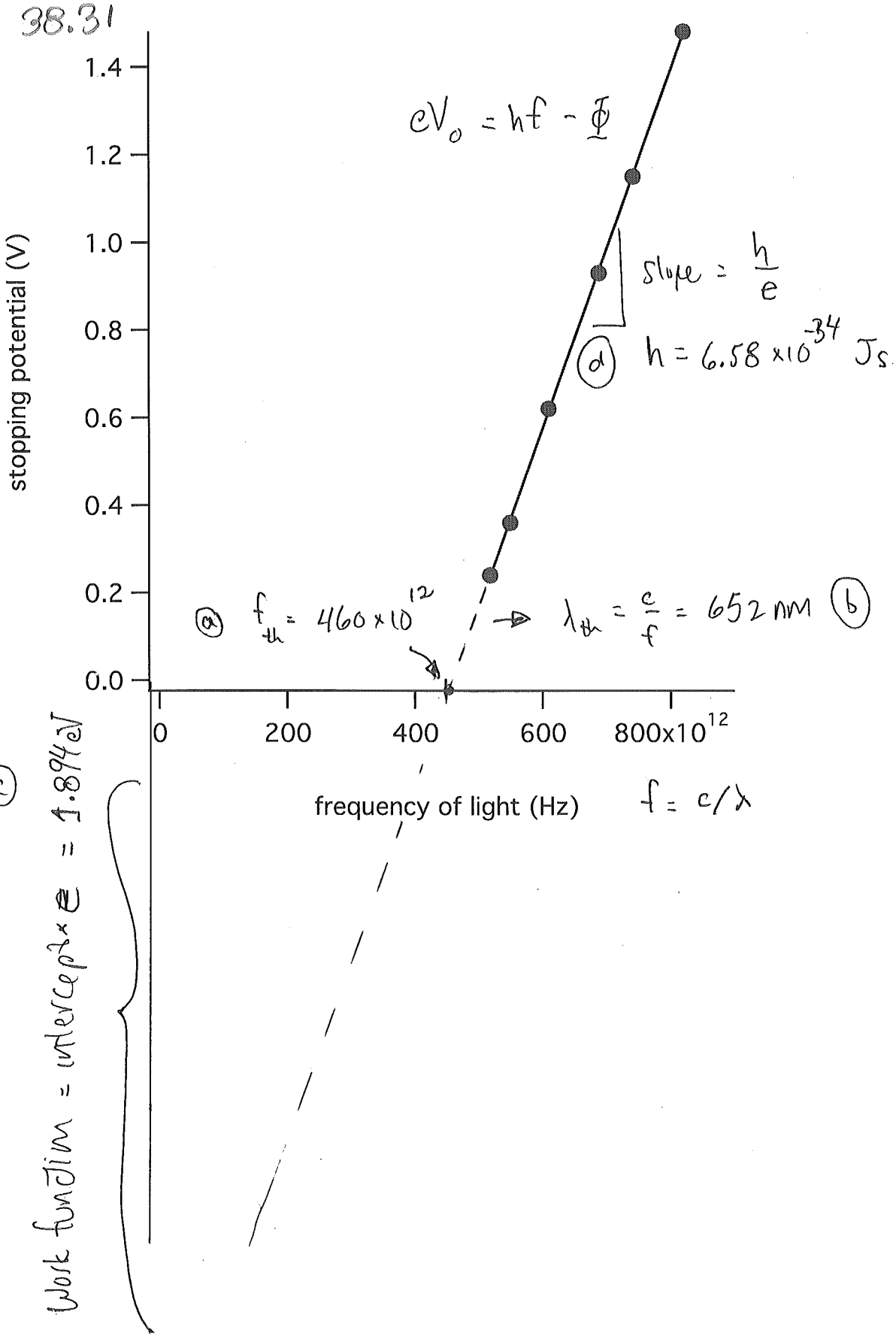
38.31



$eV_0 = hf - \Phi$

slope $= \frac{h}{e}$

(d) $h = 6.58 \times 10^{-34}$ Js

(a) $f_{th} = 460 \times 10^{12}$ → $\lambda_{th} = \frac{c}{f} = 652$ nm (b)

(c) Work function = intercept $\times e = 1.894$ eV

$f = c/\lambda$

38.39. a) If $E_\gamma = 10^6$ eV, $\lambda_\gamma = \frac{c}{f} = \frac{hc}{E} = \frac{4\times10^{-15}\cdot 3\times10^{8}}{10^6} = 1.2\times10^{-12}$ m

$\lambda_f = 500\times10^{-9}$ m $\quad \Delta\lambda \simeq \frac{500\times10^{-9}\text{ m}}{10^{26}} = 5\times10^{-33}$ m

b) $\Delta\lambda = \frac{h}{mc}(1-\cos\phi)$

$\simeq \frac{h}{mc}\frac{\phi^2}{2} = 1.213\times10^{-12}\text{ m}\cdot\phi^2$

$\phi = 6.4\times10^{-11}$ rad $= 3.67\times10^{-9}$ degrees

c) If it scatters 10^{26} time in 10^6 years then time to scatter

$t_s = \frac{10^6\text{ y}}{10^{26}}\cdot\frac{365\text{ d}}{\text{y}}\cdot\frac{24\text{ h}}{\text{d}}\cdot\frac{3600\text{ s}}{\text{h}} = 3.1\times10^{-13}$ s.

And $ct_s = 9.46\times10^{-5}$ m $= 94.6\ \mu$m. $\simeq 0.1$ mm.