Problem #2 (5 points)
In a Millikan experiment, the distance of rise and fall of an oil droplet is 1.0 cm and the average time of fall (field off) is 13.9 sec. The observed rise time is 39.2 sec. The oil density is 858 kg/m^3, and the viscosity of air 1.83 x 10^{-5} kg/m s. If the mass of the drop is 6.73 x 10^{-11} g, calculate the number of electrons on the oil drop assuming a plate separation of 1.98 cm and a potential difference between the plates of 5000 V.

$$q = \frac{mg}{E}\left(\frac{v+v'}{v}\right) = \frac{\rho g d}{V}\left(\frac{v+v'}{v}\right)$$

$$v' = \frac{x}{t'} = \frac{0.01}{39.2} = 2.55 \times 10^{-4}\ m$$

$$v = \frac{x}{t} = \frac{0.01}{13.9} = 7.2 \times 10^{-4}\ m$$

$$q = \frac{6.73\times10^{-14} \times 9.8 \times 1.98\times10^{-2}}{5000}\left(\frac{7.2+2.55}{7.2}\right)$$

$$= 3.54 \times 10^{-18}\ C = ne$$

$$\Rightarrow n = \frac{q}{e} = \frac{3.54 \times 10^{-18}}{1.6 \times 10^{-19}} \approx \boxed{22}$$