Pb # 7

a: radius of the drop of oil = 0.000276 cm

ρ: density of oil = 956.1 Kg/m^3

$\bar{t}$ = average time of fall (field $\vec{E}$ off) = 11.894 sec

$\bar{\ell}$: rise (field on) and fall (field off) distance = 10.21 mm

d: plate separation = 16.00 mm

V: potential difference between the plates = 5085 V

The mass of the drop $m = \rho V = \rho \frac{4}{3}\pi a^3 = 8.42\times10^{-14}$ Kg

From textbook $q = \frac{mg}{E}\left(\frac{v+v'}{v}\right) = \underbrace{\frac{mgd}{V}}_{= 25.96\times10^{-19}\,C}\left(\frac{v+v'}{v}\right)$

v: speed of the drop when field off.

v': speed " " " " on.

$v = \frac{\bar{\ell}}{\bar{t}} = 8.58\times10^{-4}$ m/s

$v_1' = \frac{10.21\times10^{-3}}{80.708} = 1.27\times10^{-4}$ m/s $\Rightarrow q_1 = 25.96\times10^{-19}(1.148)$
$= 29.8\times10^{-19}$ C

$v_2' = \frac{10.21\times10^{-3}}{22.386} = 4.56\times10^{-4}$ m/s $\Rightarrow q_2 = 39.76\times10^{-19}$ C

$v_3' = \frac{10.21\times10^{-3}}{140.566} = 0.726\times10^{-4}$ m/s $\Rightarrow q_3 = 28.16\times10^{-19}$ C

$v_4' = \frac{10.21\times10^{-3}}{79.6} = 1.28\times10^{-4}$ m/s $\Rightarrow q_4 = 29.76\times10^{-19}$ C

$v_5' = 2.94\times10^{-4}$ m/s $\Rightarrow q_5 = 34.77\times10^{-19}$ C

$v_6' = 3.49\times10^{-4}$ m/s $\Rightarrow q_6 = 36.42\times10^{-19}$ C