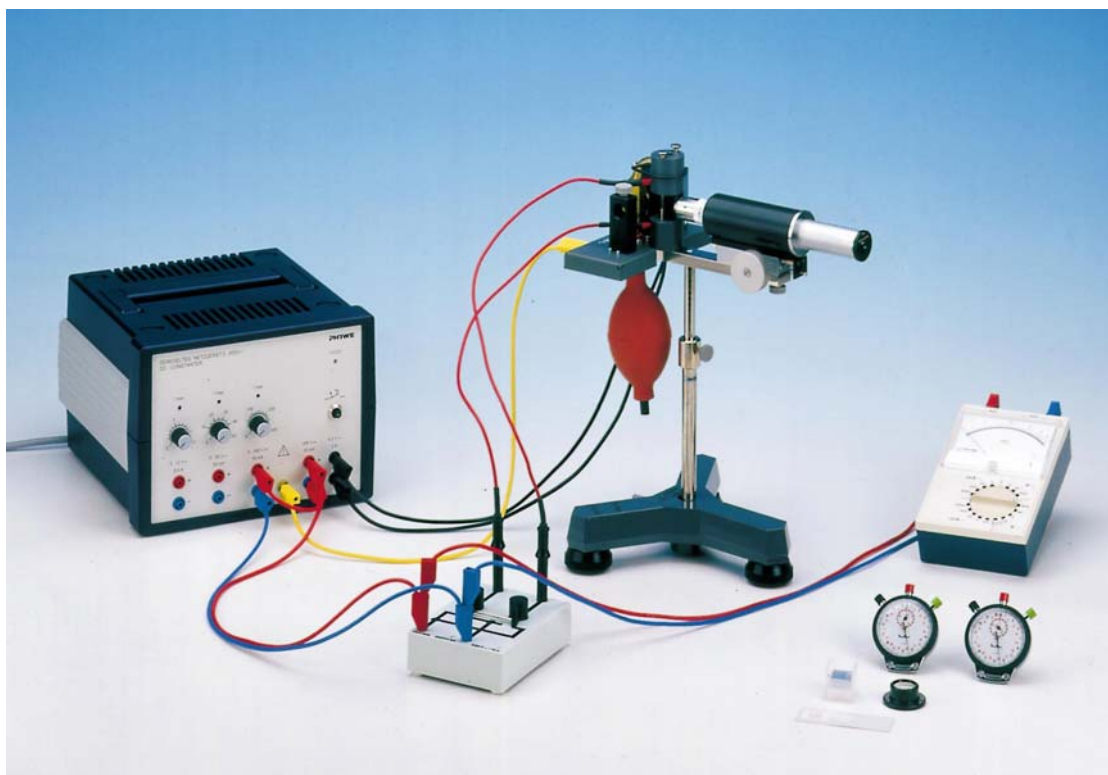


## آزمایش میلیکان



## تئوری

## وسایل

روش کار

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محاسبات

$v_1$	
$v_2$	
$U$	
$Q = n \cdot e$	
$r$	
$d = 2.5 \text{ mm} \pm 0.01 \text{ mm}$	
$\rho_1 = 1.03 \cdot 10^3 \text{ kg m}^{-3}$	
$\eta = 1.82 \cdot 10^{-5} \text{ kg (m} \cdot \text{s)}^{-1}$	
$g = 9.81 \text{ ms}^{-2}$	
$\rho_2 = 1,293 \text{ kg m}^{-3}$	

$\eta$

$r$

$v$

:

$$F = 6 \pi r \eta v \text{ (Stokes' law).} \quad (1)$$

:

$\rho$

$V$

$m$

$$F = m \cdot g = \rho_1 \cdot V \cdot g \quad (2)$$

:

$$F = \rho_2 \cdot V \cdot g \quad (3)$$

:

$$F = Q \cdot E = Q \cdot \frac{U}{d} \quad (4)$$

:

$$v_1 = \frac{1}{6 \pi r \eta} \left( QE + \frac{4}{3} \pi r^3 g (\rho_1 - \rho_2) \right) \quad (5)$$

$$v_2 = \frac{1}{6\pi r \eta} \left( Q \cdot E - \frac{4}{3} \pi r^3 g (\rho_1 - \rho_2) \right) \quad (6)$$

:

$$Q = C_1 \cdot \frac{v_1 + v_2}{U} \sqrt{v_1 - v_2} \quad (7)$$

$$C_1 = \frac{9}{2} \pi d \cdot \sqrt{\frac{\eta^3}{g (\rho_1 - \rho_2)}}$$

$$C_1 = 2.73 \cdot 10^{-11} \text{ kg m (m} \cdot \text{s)}^{-1/2}$$

:

$$r = C_2 \cdot \sqrt{v_1 - v_2} \quad (8)$$

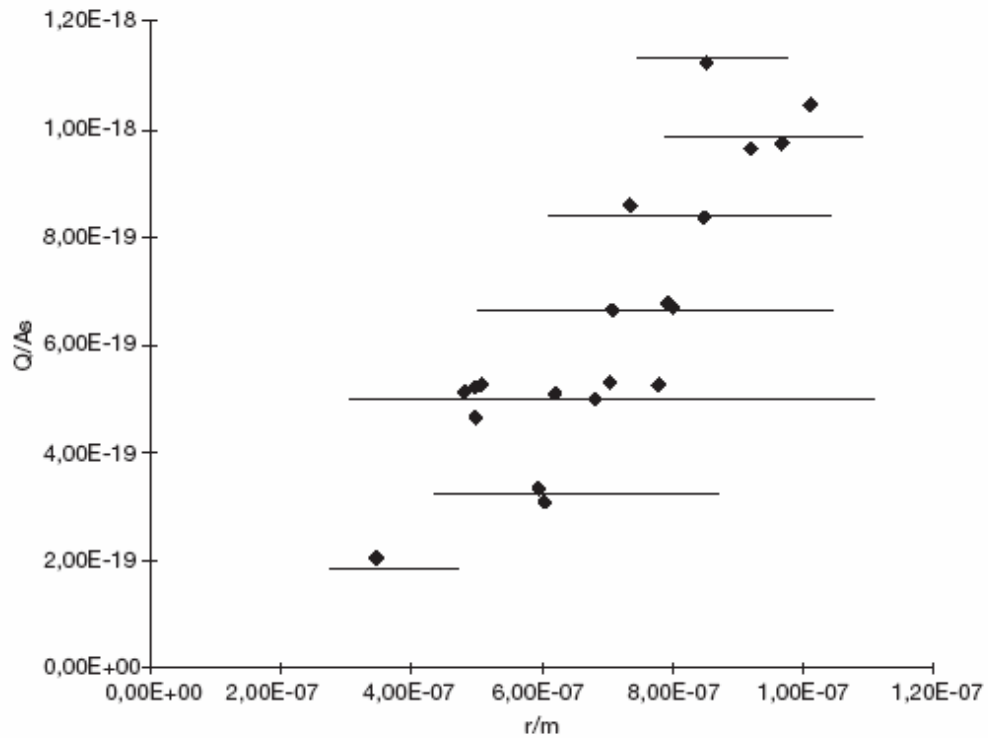
$$C_2 = \frac{3}{2} \cdot \sqrt{\frac{\eta}{g (\rho_1 - \rho_2)}}$$

$$C_2 = 6.37 \cdot 10^{-5} \text{ (m} \cdot \text{s)}^{1/2}$$

$$Q = n \cdot e$$

:

$$e = 1.68 \cdot 10^{-19} \text{ As}$$



$\frac{U}{V}$	$\frac{t_1}{s}$	$\frac{s_1}{div.}$	$\frac{t_2}{s}$	$\frac{s_2}{div.}$	$\frac{s_1}{mm}$	$\frac{s_2}{mm}$	$\frac{v_1}{m/s}$	$\frac{v_2}{m/s}$	$\frac{(v_1 - v_2)}{(m/s)}$	$\frac{r}{m}$	$\frac{Q}{As}$	$n$	$\frac{e}{As}$
300	9.6	150	13.5	150	4.45	4.45	4.64E-04	3.30E-04	1.34E-04	7.37E-07	8.54E-19	5	1.71E-19
300	7.0	90	11.2	120	2.67	3.56	3.81E-04	3.18E-04	6.36E-05	5.08E-07	5.19E-19	3	1.73E-19
300	5.8	90	7.1	60	2.67	1.78	4.60E-04	2.51E-04	2.10E-04	9.22E-07	9.57E-19	6	1.60E-19
300	7.4	90	8.8	60	2.67	1.78	3.61E-04	2.02E-04	1.59E-04	8.02E-07	6.59E-19	4	1.65E-19
300	6.9	90	8.2	90	2.67	2.67	3.87E-04	3.26E-04	6.13E-05	4.99E-07	5.19E-19	3	1.73E-19
300	5.6	90	8.0	60	2.67	1.78	4.77E-04	2.23E-04	2.54E-04	1.02E-06	1.04E-18	6	1.73E-19
400	6.9	90	9.8	90	2.67	2.67	3.87E-04	2.72E-04	1.15E-04	6.82E-07	4.92E-19	3	1.64E-19
400	6.4	90	8.3	90	2.67	2.67	4.17E-04	3.22E-04	9.55E-05	6.23E-07	5.04E-19	3	1.68E-19
400	5.0	90	5.0	60	2.67	1.78	5.34E-04	3.56E-04	1.78E-04	8.50E-07	8.28E-19	5	1.66E-19
400	7.0	120	7.9	120	3.56	3.56	5.09E-04	4.51E-04	5.79E-05	4.85E-07	5.09E-19	3	1.70E-19
400	6.0	60	8.5	60	1.78	1.78	2.97E-04	2.09E-04	8.73E-05	5.95E-07	3.30E-19	2	1.65E-19
400	5.5	90	7.4	90	2.67	2.67	4.85E-04	3.61E-04	1.25E-04	7.11E-07	6.59E-19	4	1.65E-19
400	4.7	60	7.8	60	1.78	1.78	3.79E-04	2.28E-04	1.51E-04	7.82E-07	5.19E-19	3	1.73E-19
400	5.2	120	10.6	180	3.56	5.34	6.85E-04	5.04E-04	1.81E-04	8.57E-07	1.11E-18	7	1.59E-19
400	6.5	60	9.7	60	1.78	1.78	2.74E-04	1.84E-04	9.03E-05	6.05E-07	3.03E-19	2	1.52E-19
500	6.4	120	7.2	120	3.56	3.56	5.56E-04	4.94E-04	6.18E-05	5.01E-07	4.61E-19	3	1.54E-19
500	5.5	90	9.8	120	2.67	3.56	4.85E-04	3.63E-04	1.22E-04	7.04E-07	5.23E-19	3	1.74E-19
500	5.2	60	5.7	60	1.78	1.78	3.42E-04	3.12E-04	3.00E-05	3.49E-07	2.00E-19	1	2.00E-19
500	6.4	120	8.9	120	3.56	3.56	5.56E-04	4.00E-04	1.56E-04	7.96E-07	6.67E-19	4	1.67E-19
500	5.2	120	5.9	90	3.56	2.67	6.85E-04	4.53E-04	2.32E-04	9.70E-07	9.67E-19	6	1.61E-19