MASSACHUSETTS INSTITUTE OF TECHNOLOGY
Department of Physics

Physics 8.01X Fall Term 2001

WORK DONE BY FRICTION

The air table in this demo was set up to measure v_0 before the air cart hit a taped strip, and we also measured the distance d traveled by the cart before it stopped. We showed in class that because

$$\Delta W = \Delta K.E.$$

$$-\mu_k mgd = -mv_0^2/2$$

so that

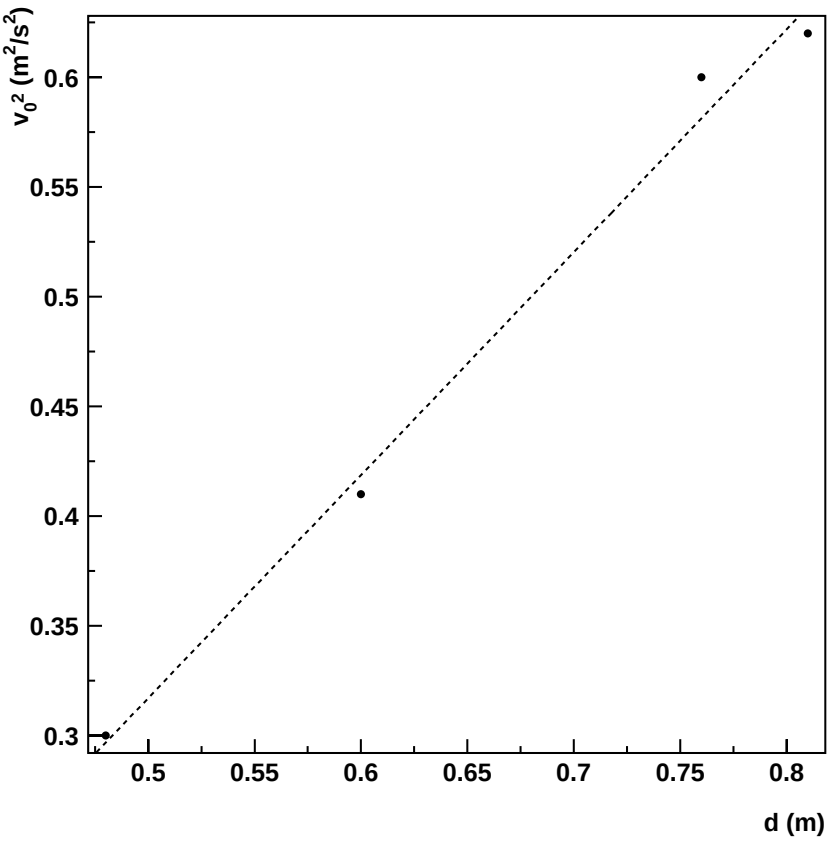
$$v_0^2 = 2\mu_k gd.$$

So if we plot v_0^2 vs. d, we should get a straight line with a slope $2\mu_k g$.

Here is the data (thanks to Yayi). The timer measured the time t in seconds for the 10 cm cart to cross it, so $v_0 = \frac{0.1}{t}$ m/s.

t s	v_0 m/s	v_0^2 m^2/s^2	d m
0.156	0.64	0.41	0.60
0.182	0.55	0.30	0.48
0.129	0.78	0.60	0.76
0.127	0.79	0.62	0.81

The following plot shows v_0^2 vs d.



The slope, calculated using a computer program, is 1.02 m/s^2. So the coefficient of friction is μ_k=slope/$2g$ = 0.05.