

# MEASURING g VIA A PENDULUM

03/06/2020

length of pendulum L / m	ten periods / s	ten periods / s	ten periods / s	ten periods / s	period T / s	x = T^2	y = 4*pi^2 * L
0.1	6.25	6.25	6.45	6.32	0.63	0.40	3.95
0.15	7.86	7.84	7.85	7.85	0.79	0.62	5.92
0.2	8.87	8.94	8.91	8.91	0.89	0.79	7.90
0.25	10.07	10.16	10.11	10.11	1.01	1.02	9.87
0.3	11.17	10.97	10.93	11.02	1.10	1.22	11.84
0.35	11.7	11.82	11.79	11.77	1.18	1.39	13.82
0.4	12.67	12.69	12.69	12.68	1.27	1.61	15.79
0.45	13.35	13.35	13.40	13.33	1.35	1.83	17.77
0.5	14.38	14.33	14.35	14.35	1.44	2.06	19.74
0.55	14.94	14.86	14.91	14.90	1.49	2.22	21.71
0.6	15.65	15.81	15.76	15.74	1.57	2.48	23.69
0.65	16	15.96	16	15.99	1.60	2.56	25.66
0.7	16.9	16.92	16.92	16.91	1.69	2.86	27.63
0.75	17.26	17.47	17.35	17.36	1.74	3.01	29.61
0.8	17.95	17.97	18.11	18.01	1.80	3.24	31.58
0.85	18.67	18.71	18.65	18.68	1.87	3.49	33.56
0.9	19.19	19.23	19.17	19.20	1.92	3.69	35.53
0.95	19.89	19.85	19.82	19.85	1.99	3.94	37.50
1	20.24	20.22	20.24	20.24	2.02	4.10	39.48
0.72	17.11	17.14	17.17	17.14	1.71	2.94	28.42

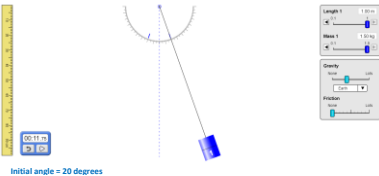
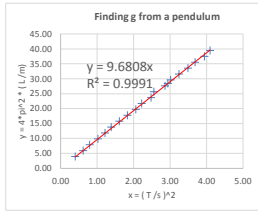
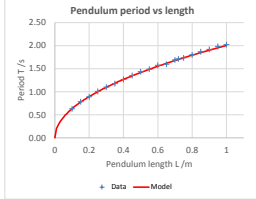
$$m\ddot{\theta} = -mg \sin \theta \approx -mg \theta \quad \text{NEWTON II}$$

$$\therefore \ddot{\theta} = -\frac{g}{L} \theta$$

$$\text{SHM: } \ddot{\theta} = -\left(\frac{2\pi}{T}\right)^2 \theta = -\omega^2 \theta$$

$$\theta(t) = \theta_0 \cos\left(\frac{2\pi t}{T}\right) = \theta_0 \cos \omega t$$

$$\therefore T = 2\pi \sqrt{\frac{L}{g}} \quad T^2 = 4\pi^2 \frac{L}{g} \quad g T^2 = 4\pi^2 L \quad \text{i.e. } y = gx$$



Initial angle = 20 degrees

Using  $g = 9.81 \text{ N/kg}$

MODEL curve

L / m	T / s
0.000	0.000
0.010	0.201
0.020	0.284
0.030	0.347
0.040	0.401
0.050	0.449
0.060	0.491
0.070	0.531
0.080	0.567
0.090	0.602
0.100	0.634
0.110	0.665
0.120	0.695
0.130	0.723
0.140	0.750
0.150	0.777
0.160	0.802
0.170	0.827
0.180	0.851
0.190	0.874
0.200	0.897
0.210	0.919
0.220	0.941
0.230	0.962
0.240	0.983
0.250	1.003
0.260	1.023
0.270	1.042
0.280	1.062
0.290	1.080
0.300	1.099
0.310	1.117
0.320	1.135
0.330	1.152
0.340	1.170
0.350	1.187
0.360	1.204
0.370	1.220
0.380	1.237
0.390	1.253
0.400	1.269
0.410	1.285
0.420	1.300
0.430	1.315
0.440	1.331
0.450	1.346
0.460	1.361
0.470	1.375
0.480	1.390
0.490	1.404
0.500	1.419
0.510	1.433
0.520	1.447
0.530	1.460
0.540	1.474
0.550	1.488
0.560	1.501
0.570	1.515
0.580	1.528
0.590	1.541
0.600	1.554
0.610	1.567
0.620	1.580
0.630	1.592
0.640	1.605
0.650	1.617
0.660	1.630
0.670	1.642
0.680	1.654
0.690	1.666
0.700	1.678
0.710	1.690
0.720	1.702
0.730	1.714
0.740	1.726
0.750	1.737
0.760	1.749
0.770	1.760
0.780	1.772
0.790	1.783
0.800	1.794
0.810	1.805
0.820	1.817
0.830	1.828
0.840	1.838
0.850	1.850
0.860	1.860
0.870	1.871
0.880	1.882
0.890	1.893
0.900	1.903
0.910	1.914
0.920	1.924
0.930	1.935
0.940	1.945
0.950	1.955
0.960	1.966
0.970	1.976
0.980	1.986
0.990	1.996
1.000	2.006