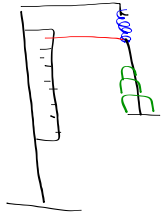


Practice Lab - SolutionsHypothesis

- If we know spring constant, we could determine the mass of fruit (candy)
- Hooke's Law: $F_{\text{spring}} = k \cdot x$

SketchTable 1: Determination of A Spring Constant

Trial	Mass		Distance		F_g (N)	k (N/m)
	g	kg	cm	m		
1	10	0.01	0.7	0.007	0.098	14
2	20	0.02	1.4	0.014	0.196	14
3	30	0.03	2.1	0.021	0.294	14
4	40	0.04	2.8	0.028	0.392	14
5	50	0.05	3.6	0.036	0.49	13.6

Hooke's Law

$$F = kx$$

spring

$$F_{\text{spring}} = F_g = m \cdot g$$

$$F_g = (0.01)(9.8)$$

$$F_g = 0.098 \text{ N}$$

$$k = \frac{F_{\text{spring}}}{x}$$

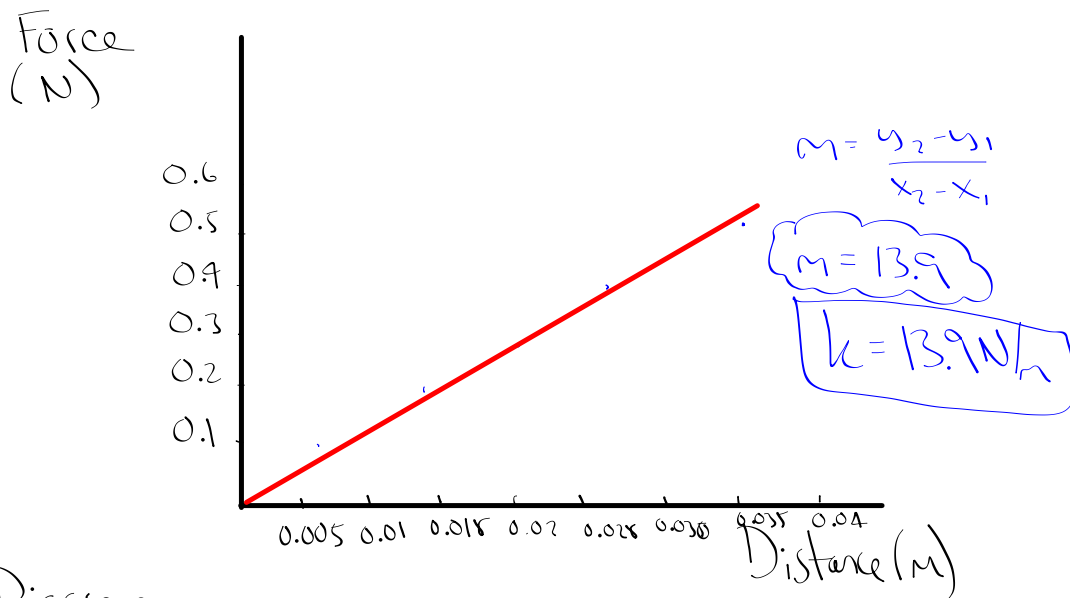
$$k = \frac{0.098 \text{ N}}{0.007 \text{ m}}$$

$$k = 14 \text{ N/m}$$

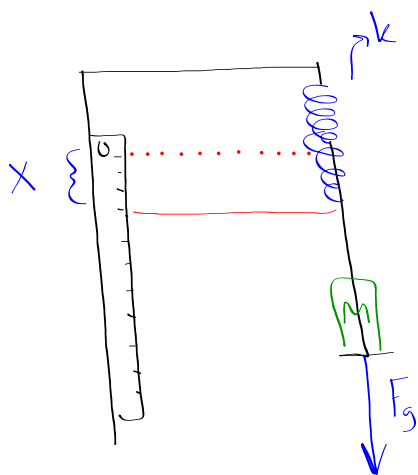
$$k_{\text{avg}} = \frac{13.6 + 14 + 14 + 14 + 14}{5}$$

$$k_{\text{avg}} = 13.92 \text{ N/m}$$

Graph : Determination of Spring Constant, k



Diagram



k = Spring constant (N/m)

X = Spring stretch distance (m)

M = Mass (kg)

F_g = Force of gravity (N)

Results Determine Mass of Candies

Candy	k (N/m)	x (m)	F _{spring} (N)	m (kg)
York	13.9	0.005	0.0695	0.007
Reese	13.9	0.003	0.0417	0.004
Freddo	13.9	0.008	0.1112	0.011

$$F_{\text{spring}} = k \cdot x$$

$$= (13.9 \text{ N/m})(0.005 \text{ m})$$

$$F_{\text{spring}} = 0.0695 \text{ N}$$

$$F_{\text{spring}} = mg$$

$$m = \frac{F_{\text{spring}}}{g} = \frac{0.0695 \text{ N}}{9.8 \text{ m/s}^2}$$

$$m = 0.007 \text{ kg} = 7 \text{ g}$$

Discussion

- Can use % error to determine precision
 - ↳ Compare to a scale measurement → Mass
 - Compare avg k to slope k
 - Sensitive? Not the best
 - ↳ Small masses
 - Ruler → only to 0.5 mm
 - Spring → didn't know theoretical k
 - Damaged? bent?
- $$\% \text{ error} = \frac{\text{actual} - \text{theoretical}}{\text{theoretical}} \times 100\%$$
- Accuracy → Compare to balance or known values
 - Hypothesis was proven correct overall, but probably not best device
 - Error:
 - Ruler degree of measurement → 0.5 mm
 - Spring quality (bent/damaged?)
 - Mass holder (moving) → Improper reading
 - Wire → Bent?
 - Thickness
 - Ruler moved (Point of reference)
 - If elastics used (extra mass)

Conclusion

In this experiment Hooke's law was used to find a spring constant with an approximate value of 13.9 N/m. This was then used to determine the masses of several pieces of candy.