Newton by William Blake (1805)

Announcements

- Some MP Problems indicate unit vectors as $\hat{x}$ $\hat{y}$ instead of $\hat{i}$ $\hat{j}$
- Bring your **Student Workbook** to tutorial
- When you have a question, it is hard to see you if you just raise your hand
  - Motion is easier to see. *Wave* your hand at Lulu

Last Time

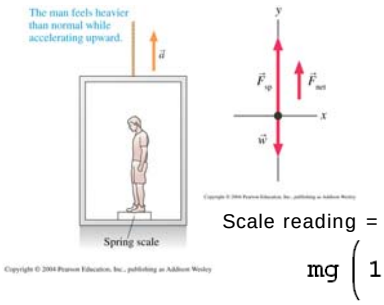
- Finished Chapter 4
  - Newton's 1st Law
  - Inertial Reference Frames
  - Free Body Diagrams
- Chapter 5 – One Dimensional Dynamics
  - Equilibrium
  - Applying Newton's Laws
  - Mass and Weight (almost finished)

Today

- Finish Chapter 5
- A brief diversion: The General Theory of Relativity
- Chapter 6 – 2 Dimensional Dynamics
  - Cartesian Components are independent of each other
  - Projectiles Redux

Redux: "Bringing Back"

Figure 5.8



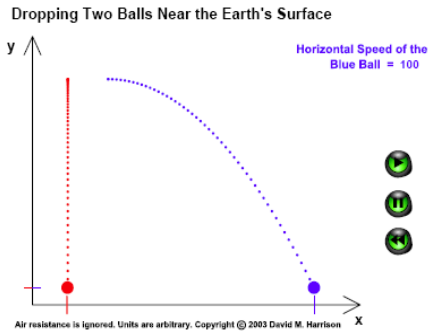
Scale reading = apparent weight:

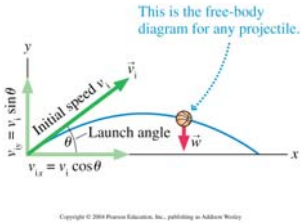
$$mg\left(1 + \frac{a_y}{g}\right)$$

Jules Verne, "From the Earth to the Moon" (1866)

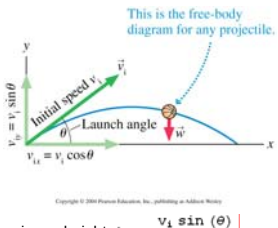
Einstein's Equivalence Principle (1907)

- "We shall therefore assume complete physical equivalence between the gravitational field and the corresponding acceleration of the reference system." (**Jahrbuch der Radioaktivitat un Elektronik 4** (1908) pg. 443.)
- "For an observer in free fall off the roof of his house, there exists for him during his fall no gravity."
- "The happiest thought of my life."





- Projectile:
  $x_f = v_i \cos(\theta)\, t$
  $y_f = v_i \sin(\theta)\, t - \frac{1}{2} g\, t^2$
- Generic Parabola:
  $(y - y_0) = c\,(x - x_0)^2$



Time to maximum height: $t_1 = \dfrac{v_i \sin(\theta)}{g}$

Time from maximum height to the ground: $t_2 = t_1$