

October 2, 2015

Physics 131

Prof. E. F. Redish

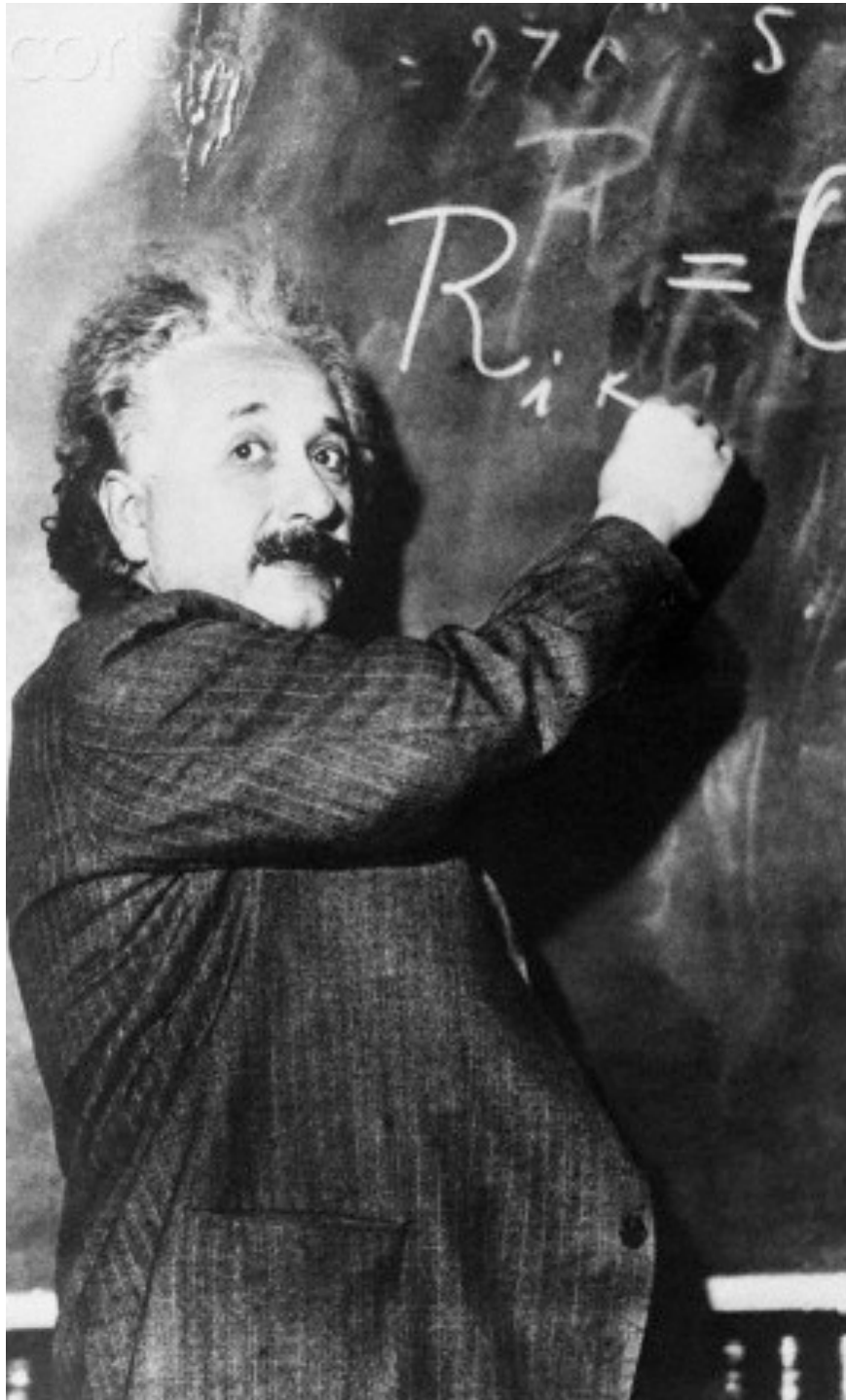
■ Theme Music: Tom Petty

Free Fallin'

■ Cartoon: Bob Thaves

Frank & Ernest





The Equation of the Day

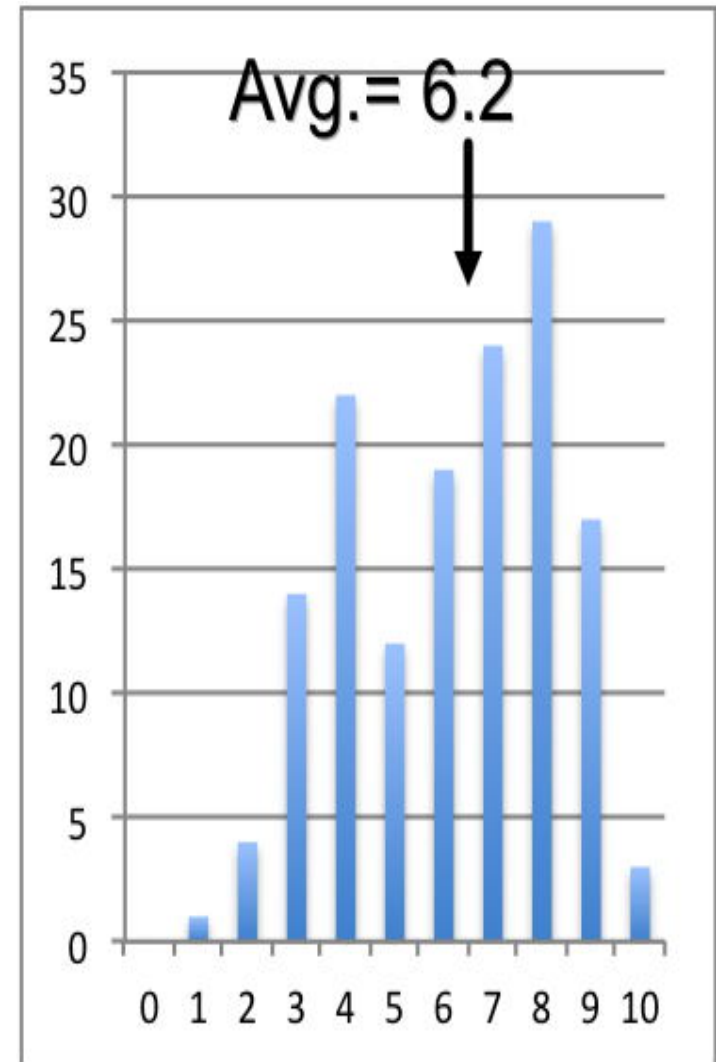
Weight and
mass

$$\vec{F}_A^{grav} = \vec{W}_A = m_A \vec{g}$$

Quiz 4

	#1
1=4>2=3	51%
1>2=3>4	13%
1>2=3>4=0	3%
1>4>2=3	12%
1=2=3=4	6%

	2.1		2.2		2.3
mv/F	66%	mv/f	47%	mv²/2f	7%
F/mv	6%	-mv/f	5%	mv²/f	22%
mΔv/F	10%	mΔv/f	9%	fv/m	6%
m/Fv	2%	f/mv	3%	mv/f	8%
				f/mv²	1%



Foothold Principles

Newton's Laws



- Newton 0:
 - An object responds to the forces it feels when it feels them.

- Newton 1:
 - An object that feels a net force of 0 keeps moving with the same velocity (which may = 0).

- Newton 2:
 - An object that is acted upon by other objects changes its velocity according to the rule

$$\vec{a}_A = \frac{\vec{F}_A^{net}}{m_A}$$

- Newton 3:
 - When two objects interact the forces they exert on each other are equal and opposite.

$$\vec{F}_{A \rightarrow B}^{type} = -\vec{F}_{B \rightarrow A}^{type}$$

Kinds of Forces

■ Forces are what objects do to each other when they interact.

■ Types of Force

– Normal: N **]** $T = k\Delta L$
– Tension: T

– Friction: f $f \leq \mu N$

– Weight: W $\vec{W} = m\vec{g}$

– Electric: F^E

Foothold Ideas: Gravity



- Every object (near the surface of the earth) feels a downward pull proportional to its mass:

$$\vec{W}_{E \rightarrow m} = m\vec{g}$$

What object causes W ?

where \vec{g} is referred to as *the gravitational field*.

- This is a Force even though nothing touching the object is responsible for it.
- The gravitational field has the same magnitude for all objects irrespective of their motion and at all points.
- The gravitational field always points down.
- It is measured to be $g \approx 9.8 \text{ N/kg}$

Why N/kg instead of m/s^2 ?

Response to Gravity: Free Fall

- After an object has been released,
 - if it is dense enough so the forces from the air can be ignored
 - if nothing else is touching itthe only force acting on it is gravity.
- The force of gravity is proportional to the mass.

$$\vec{a} = \vec{F}^{net} / m = \vec{W}_{E \rightarrow m} / m = m\vec{g} / m = \vec{g}$$