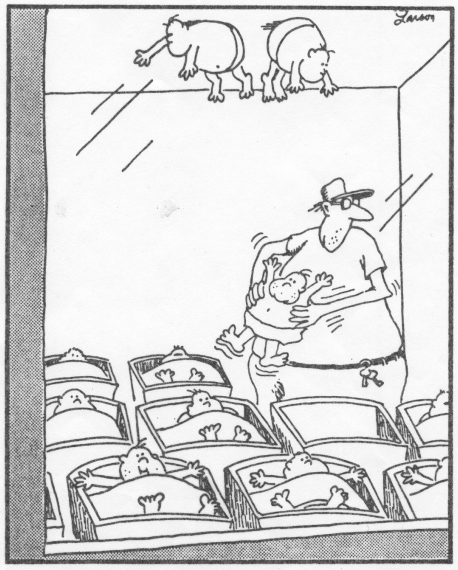
October 5, 2016 Physics 131 Prof. E. F. Redish

- **Theme Music:**
  Joni Mitchell
  Electricity
- **Cartoon:**
  Gary Larson
  The Far Side

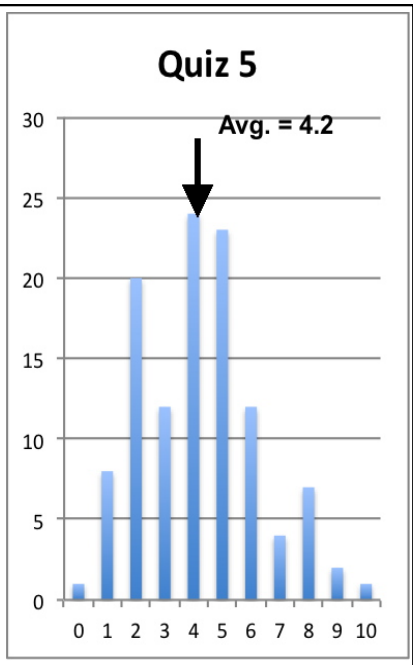


Late at night, and without permission, Reuben would often enter the nursery and conduct experiments in static electricity.

10/5/16

Quiz 5

	1		*2.1*		*3*
A	8%	M/LT	41%	A	14%
B	36%	MT/L	5%	B	23%
C	5%	ML/T	13%	C	45%
D	0%			D	18%
E	41%			E	0%
F	10%				



10/5/16 Physics 131 **3**

The Game of Dimensions

Equations in physics (science) are NOT the same as equations in math!

- Many of the symbols we are NOT NUMBERS but are created from measurements.
- How this is done is called the DIMENSIONALITY of the quantity.
- We have three different kinds of measurements that we use:
  - A measurement with a ruler (a length)
  - A measurement with a clock (a time)
  - A measurement with a scale (a mass)

When we ask a symbol: "What measurements are you made of and how?" we will indicate it by using double square brackets:

$[\![\Delta x]\!] =$ 

A displacement is found using a rul
(making a Length measurement – L

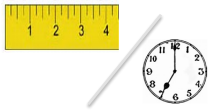
$[\![\Delta t]\!] =$ 

A time interval is found using a clo
(making a time measurement – T)

$[\![m]\!] =$ 

A mass is found using a scale
(making a mass measurement – M

When we combine measurements we express is by showing how those measurements are combined

$[\![v]\!] =$ 

A velocity is found by dividing a l
measurement by a time measureme

$[\![a]\!] = ($  $)$ 

$=$  $($  $)$

An acceleration is found by dividi
velocity measurement by a time measurement

Measurements, being a number with a unit, combine like algebrai symbols when combined.

When we have correct equations
for symbols that we know
it can tell us what measurements
were combined to create that symbol.

$F = ma$ so $[\![F]\!] = [\![ma]\!]$

so

$[\![F]\!] = [\![m]\!][\![a]\!] =$ 

Since we don't want to be always
drawing little scales, rulers, and clocks,
we write them as "M", "L", and "T"
but be careful not to confuse them with
algebraic symbols
that have values!

(Also, from laziness, we only write
single instead of double brackets.)

So read these as follows:

$[v] = \mathrm{L/T}$

To get a velocity, divide a ruler measurement by a clock measurement

$[F] = \mathrm{ML/T^2}$

To get a force, multiply a scale measurement by a ruler measurement and divide by two clock measurements

Keep separate your statement of what measurement tools you are using (dimensional analysis) from your actual values!

- These are not numbers!