Announcements

- **Weekly Problem/Review Session:**
  Tuesdays, 4:15 – 5:15 pm
  B112 Angell
- **New Stuff on the Web:**
  -Problem Set Solutions
  -Lecture Slides
  -Updated Syllabus with OH and Problem/Review Session times

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Rounding and Zeros

Rounding

If <5, *round down*
If >5, *round up*
If =5, ***round to nearest EVEN number***

Only round at the END of a calculation!

Zeros

All zeros are significant ***EXCEPT*** those that **only** locate a decimal point

Not certain? Use **Scientific Notation**

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Example: Final Rounded Answer

$1.7 \text{ miles} \times \frac{5280 \text{ feet}}{1 \text{ mile}} \times \frac{12 \text{ inches}}{1 \text{ foot}} \times \frac{2.54 \text{ cm}}{1 \text{ inch}} = \mathbf{273{,}588.48 \text{ cm}}$

-limited to TWO sig figs in result

- ***273,588.48 cm rounds to:***
  270,000 cm
  or
  2.7×10^5 cm (best!)

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The "Munowitz Perspective"

- Overview

  -Matter behaves according to the basic ***physical laws*** of nature, so we can use this knowledge to understand *Chemistry*

  -What ***FORCES*** predominate at the atomic and molecular levels?

  -**Gravitational?**
  -**Electromagnetic?**

  -Gosh, this seems a lot like PHYSICS!

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Force, Work and Energy

- **Force:** depends on **mass** or **charge**
  -UNIT: Newtons (N = kg-m-s^{-2})
- **Work**
  - *the application of **force** over a distance*
- **Energy**
  - *the ability to **do work***

  -UNIT: Joules (J = N-m = kg-m^2-s^{-2})

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Quantifying Matter: Moles

- **An SI Unit (N_0):**
  1 mol = 6.022137 x 10^{23} species

  Avogadro's Number

-mole: Latin ("heap, pile")

Amedeo Avogadro's Hypothesis (1811):
Equal volumes of different gases contain equal numbers of particles

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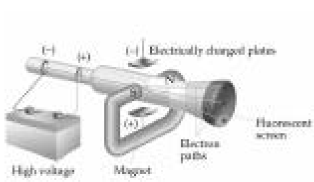
Dalton was *WRONG!*

- Well . . . not *entirely* wrong, but

  Atoms *ARE* divisible



- **1897:**
  J.J. Thomson

Cathode Rays:
charge/mass ratio

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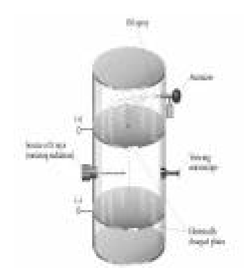
Millikan Oil Drop Experiment

- **1909:**

->measured charge on an electron:
1.6 x 10^{-19} C

-> calc (using Thomson's data) the MASS of an electron:
9.11 x 10^{-28} g



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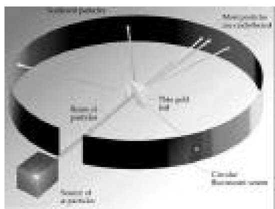
Plum Pudding and Rutherford

"The atom has a structure like plum-pudding" - *J.J. "Boom-Boom" Thomson*

<u>1910:</u> Ernest Rutherford

-shot α-particles at a thin foil of gold

-led to the **Nuclear** model of the atom



The Nuclear Atom

- **Atoms are composed of:**
  - *<u>electrons</u>* (e^-): neg charge, light
  - *<u>protons</u>* (p^+): pos charge, **heavy**
  - *<u>neutrons</u>* (n^0): NO charge, **heavy**

$$\#p^+ = \#e^-$$

n^0 (mass) ≈ p^+ (mass) ≈ 2000 x e^- (mass)

How do Elements Differ?

- <u>Elements classified by $\#p^+$:</u>

  Atomic Number (Z) = $\#p^+$

- <u>What about $\#n^0$?</u>

  $\#n^0$ affects *mass number* only:

  <u>Isotopes!</u>

Isotopes of Hydrogen

^{1}**<u>H</u>**: 1 proton, 0 neutrons, 1 electron

^{2}**<u>H</u>**: 1 proton, *1 neutron,* 1 electron
- <u>Deuterium</u>

^{3}**<u>H</u>**: 1 proton, *2 neutrons*, 1 electron
-<u>Tritium</u>

-Behave the same, chemically

Quantifying Atomic Mass

- New Unit: ***amu*** (atomic mass unit)

  By definition:

  mass of ^{12}C nucleus = 12.000 amu

- For a mole of an element, we use the ***molar mass*** (= g/mol) which is *numerically* identical to the #amu for the element:

  1 mol ^{12}C = 12.000 grams (exactly)

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Why Fractional Molar Masses?

- Need to consider the natural abundances of *isotopes*

  Example: Chlorine

  75.5% ^{35}Cl + 24.5% ^{37}Cl

  (0.755)(34.97) + (0.245)(36.97) = ***35.45 g/mol***

  -This is a *weighted average*; 1 mol of Cl will have a mass of 35.45 grams

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