November 18, 2011 Physics 131 Prof. E. F. Redish

- **Theme Music: Moby**

  James Bond Theme

- **Cartoon: S. Harris**

11/18/11 Physics 131 **1**

Outline

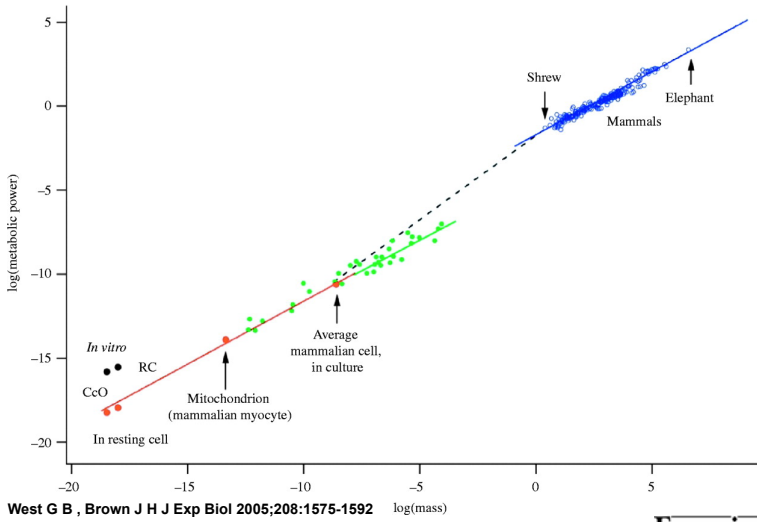
- Makeup exam
- Reading question: log plots
- Reading question: bound states
- Bound states
- Long range attraction between neutrals

11/18/11 Physics 131 **2**

Reading question

- Why is it important for us to see the line as straight rather than curved? Why can't we make the same conclusions about a graph if it is in x and y rather than log x and log y?

Extension of Kleiber's 3/4-power law for the metabolic rate of mammals to over 27 orders of magnitude from individuals (blue circles) to uncoupled mammalian cells, mitochondria and terminal oxidase molecules, CcO of the respiratory complex, RC (red circles).



West G B , Brown J H J Exp Biol 2005;208:1575-1592

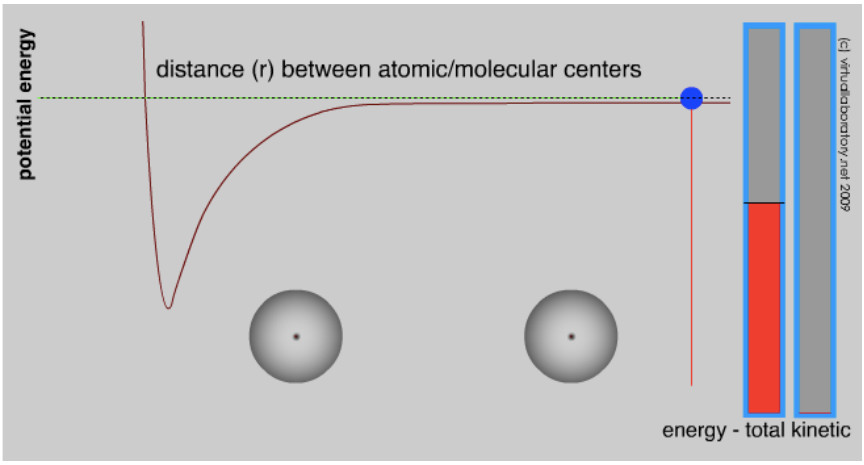
Reading question

- You said the minimum r is the bond length. Does this mean real atoms behave the same way as the simulation? Cause I was able to get them to stick together, yet, they were still bouncing. Is it possible for atoms to stick together and not bounce? Cause in chemistry we were just told that the bond length is this number, which is the distance between the 2 atoms. If atoms actually behave the way they do in the simulation, how was it decided that the minimum r length is the value they want, why not an average?

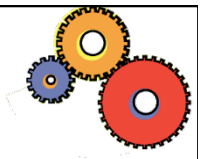
Foothold ideas: Bound states

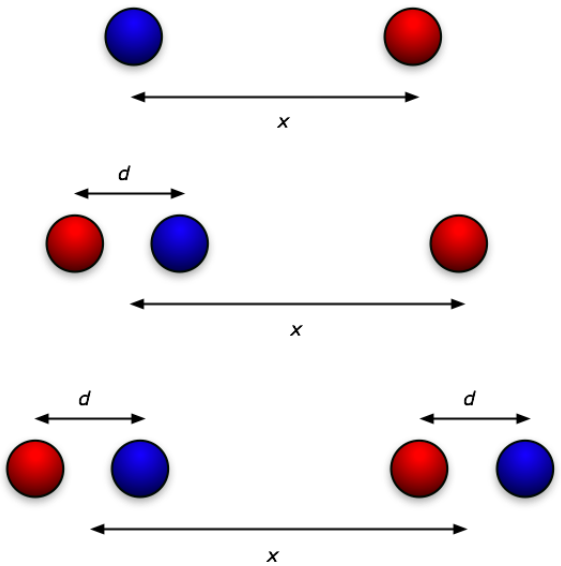
- When two objects attract, they may form a *bound state* – that is, they may stick together.
- If you have to do positive work to pull them apart in order to get to a separated state with KE = 0, then the original state was in a state with negative energy.

Molecular forces



What are the implications?

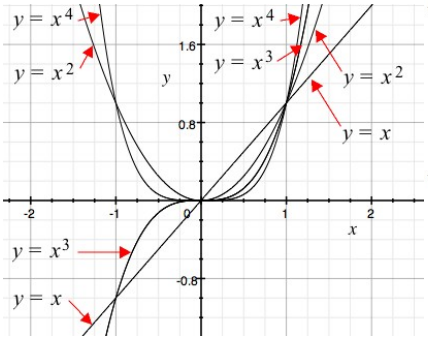




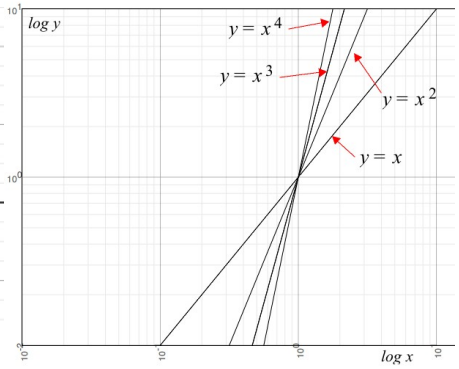
Log-log plots (positive powers)

$y = x$ $y = x^2$
$y = x^3$ $y = x^4$

Linear plot



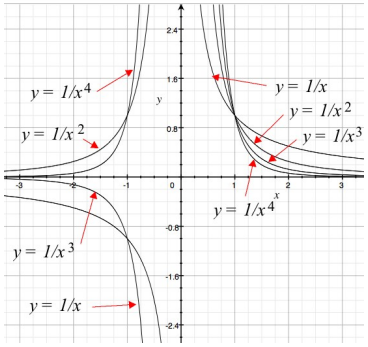
Log-log plot



Log-log plots (negative powers)

$y = 1/x$ $y = 1/x^2$
$y = 1/x^3$ $y = 1/x^4$

Linear plot



Log-log plot