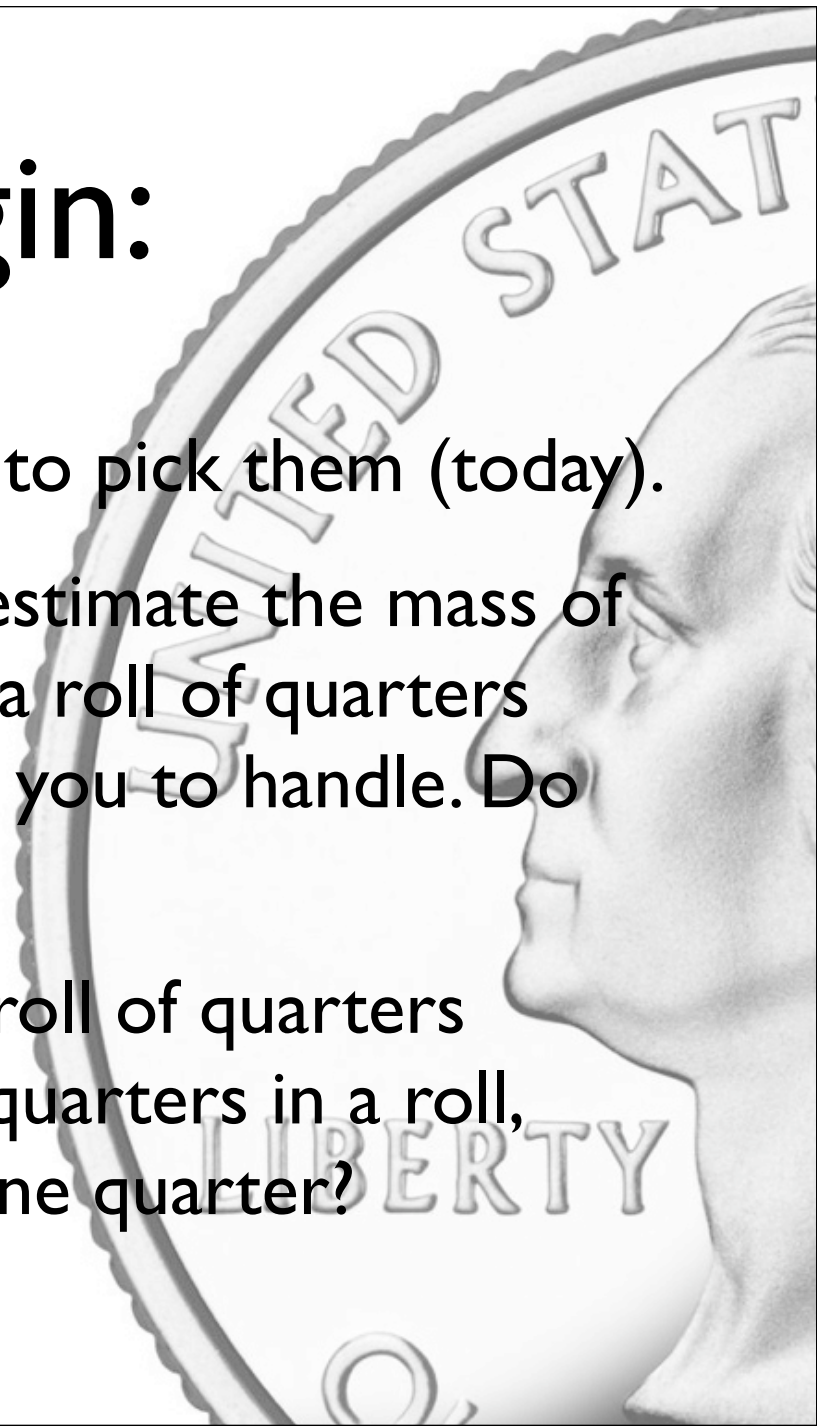


To Begin:

- Sit in groups of 3. You get to pick them (today).
- Your first task will be to estimate the mass of one US quarter. There is a roll of quarters somewhere the room for you to handle. Do not steal it.
- Estimate the mass of the roll of quarters individually. There are 40 quarters in a roll, what is the mass of just one quarter?





SCALE-UP Project Play-Day

Richard Wagner, Paul Bunson
April 8, 2011

Activity modified from:
Gaffney JDH, Richards E, Kustus MB, Ding L, Beichner RJ. 2008. Scaling Up
Education Reform. *Journal of College Science Teaching*. May/June: 18-23.

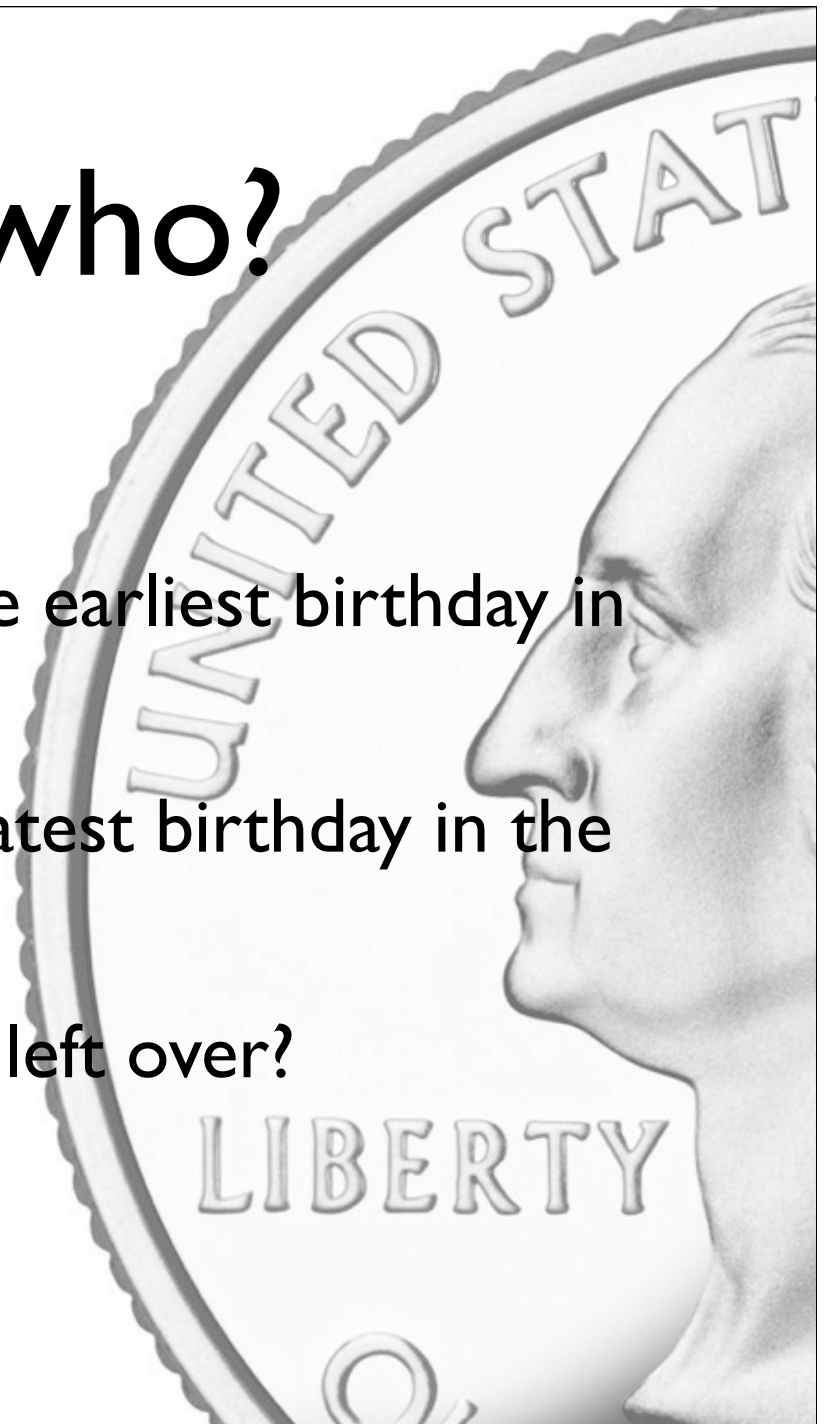
Everyone has a job



- Recorder: Write down all your group's calculations
- Skeptic: Question your group's reasoning. Think of alternative approaches.
- (Mr.) Manager: Keep group on task. Make sure everyone is involved.

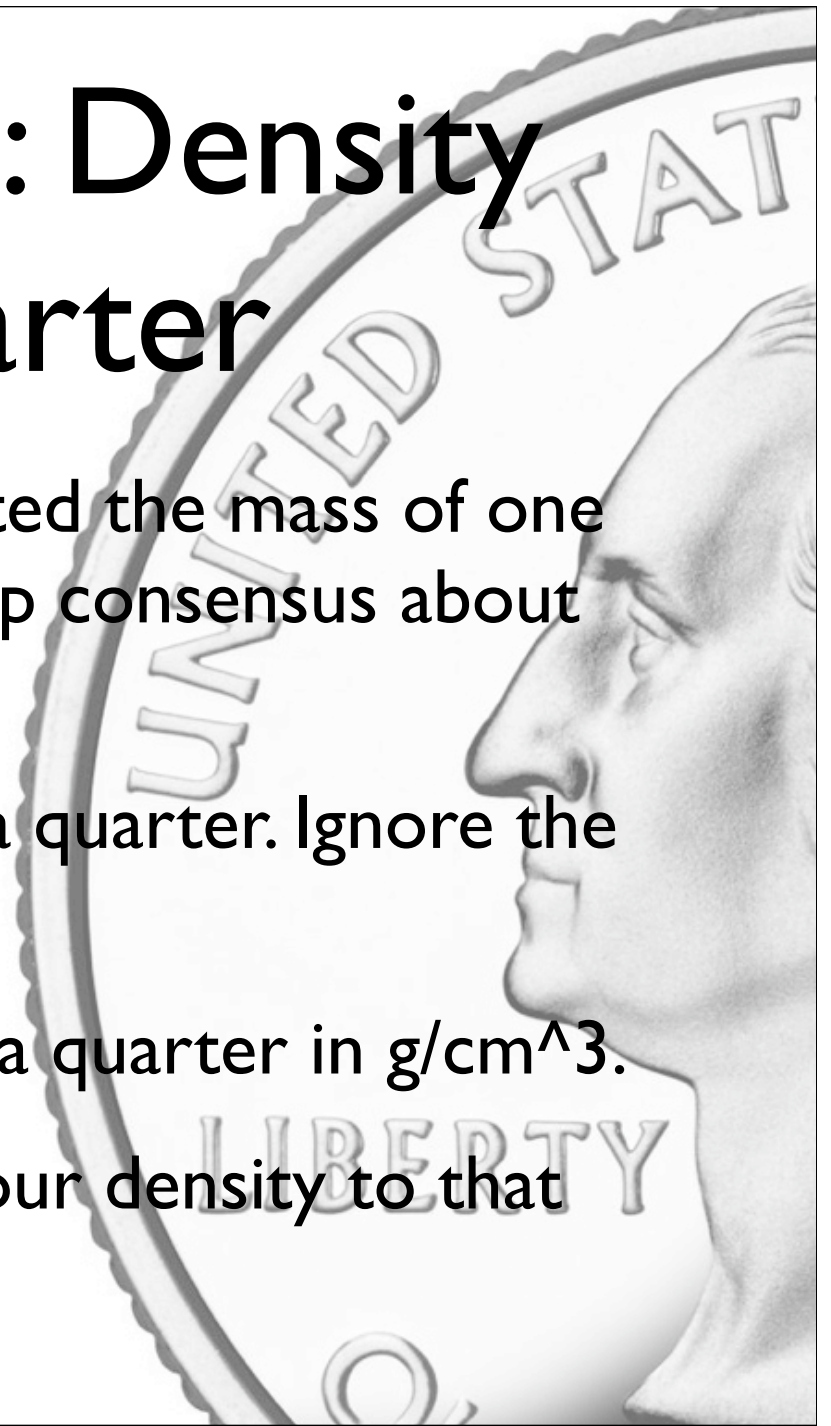
Who is who?

- Recorder: Who has the earliest birthday in the year?
- Skeptic: Who has the latest birthday in the year?
- (Mr.) Manager: Who is left over?



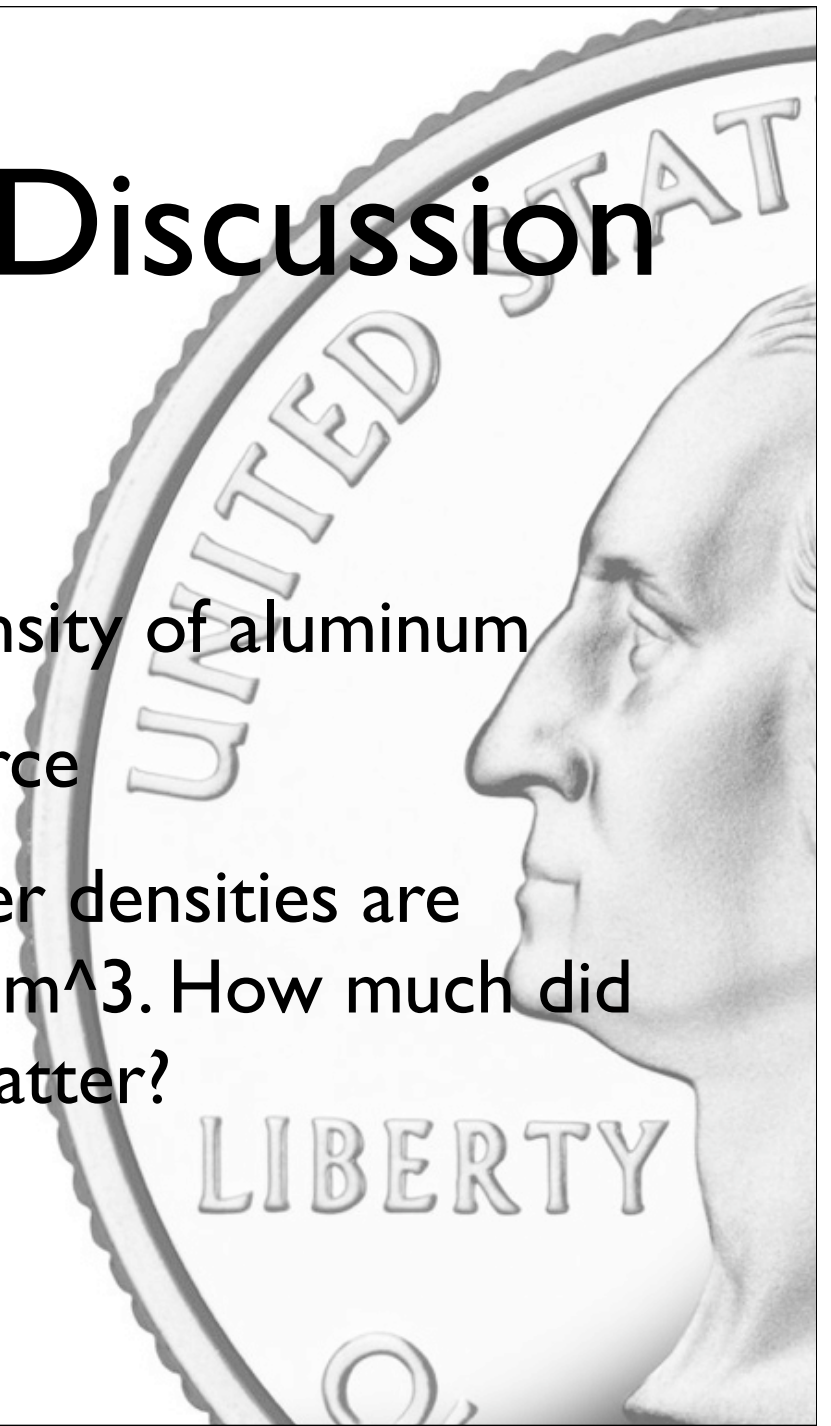
Activity One: Density of a Quarter

- You have already estimated the mass of one quarter. Come to a group consensus about the mass.
- Estimate the volume of a quarter. Ignore the carvings (if you want).
- Calculate the density of a quarter in g/cm^3 .
- When done, compare your density to that of other groups.



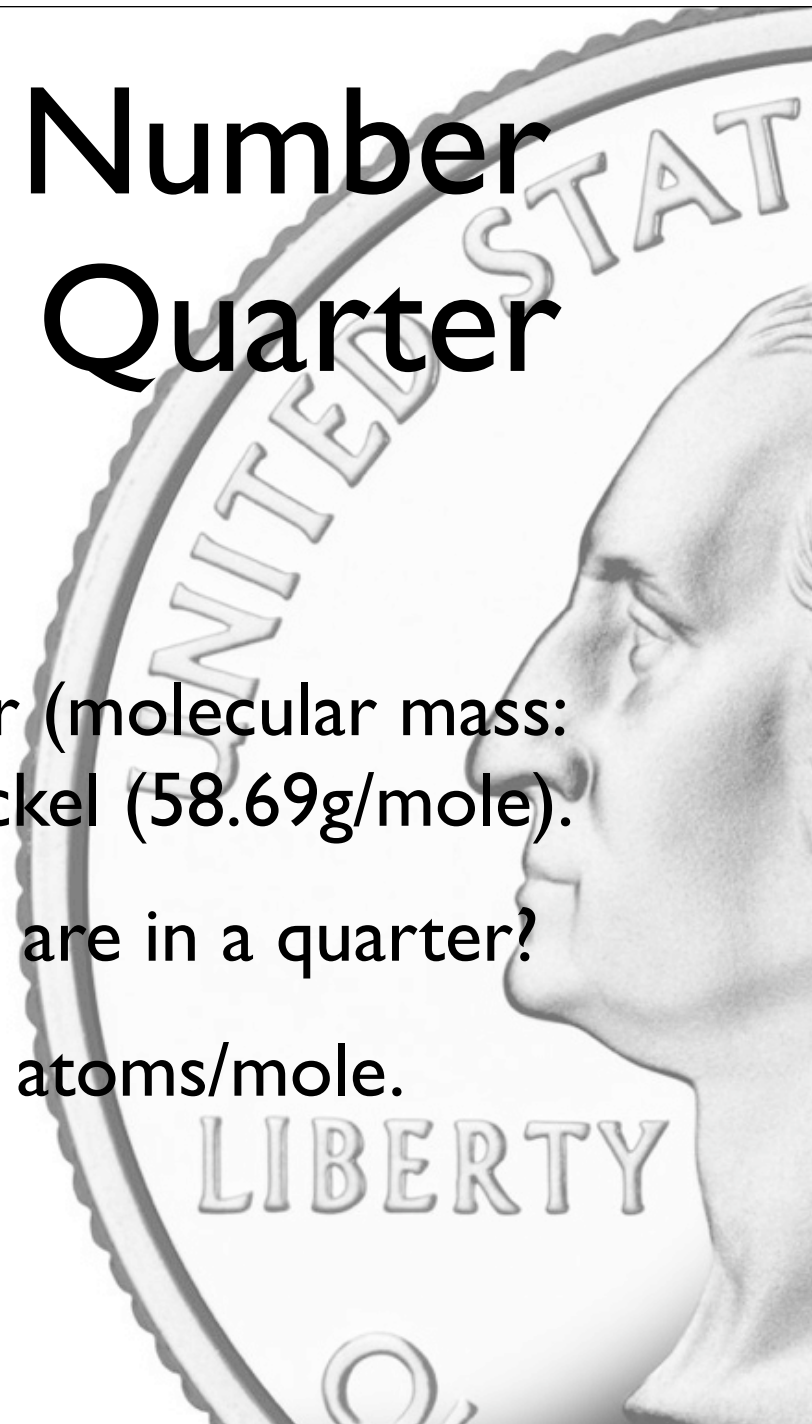
Activity One: Discussion

- Look online for the density of aluminum
- Justify the internet source
- Actual nickel and copper densities are 8.91 g/cm^3 and 8.94 g/cm^3 . How much did the carved out parts matter?



Activity Two: Number of atoms in a Quarter

- A quarter is 92% copper (molecular mass: 63.55g/mole) and 8% nickel (58.69g/mole).
- About how many atoms are in a quarter?
- Hint: there are 6×10^{23} atoms/mole.





When dice appear, roll dice to pick a group to present how they did the calculation.

Atomic Structure

- Ball/Spring Model
- Packing Fraction
- Maximum Packing Fraction ~75%
- Use 60% for this Tangible

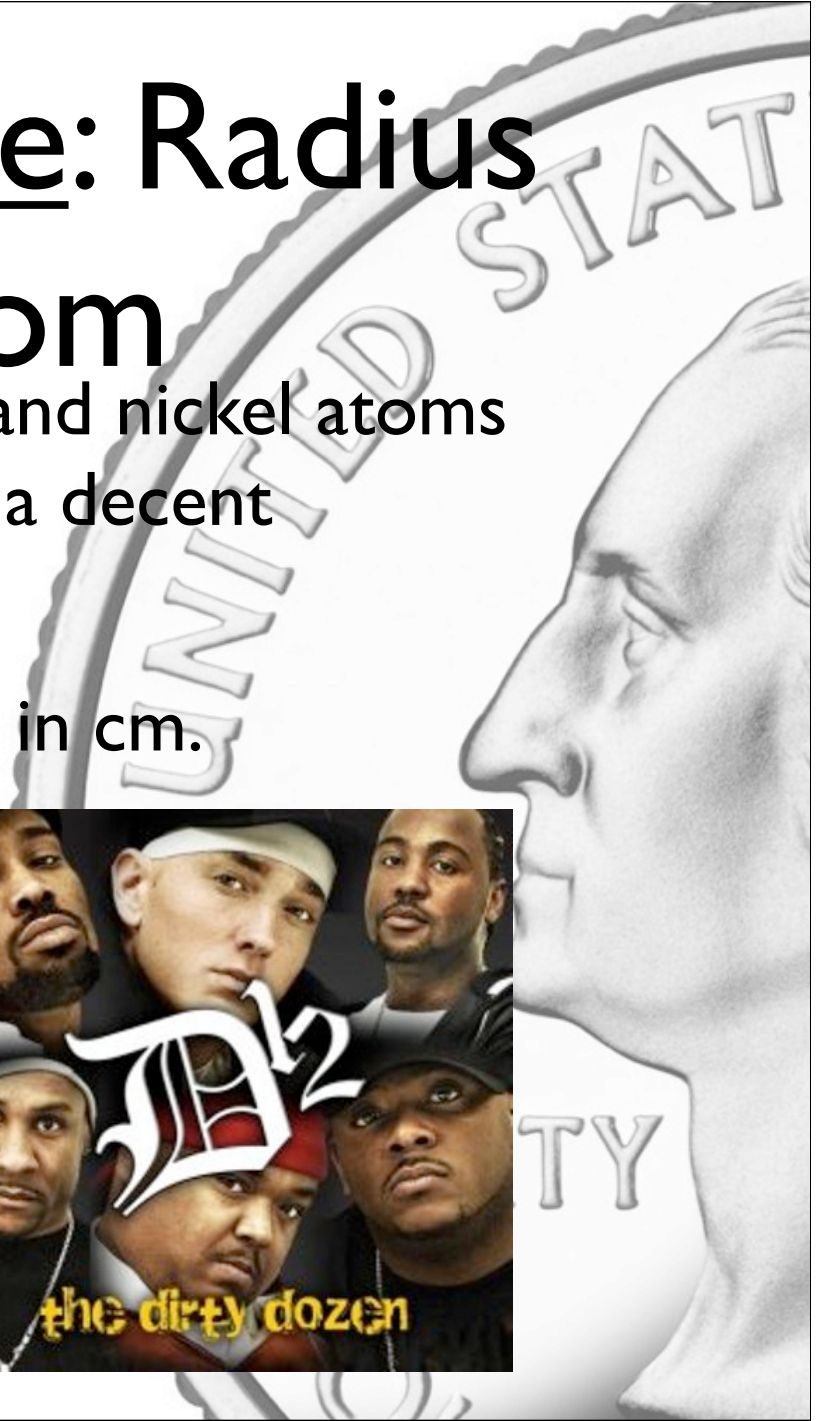
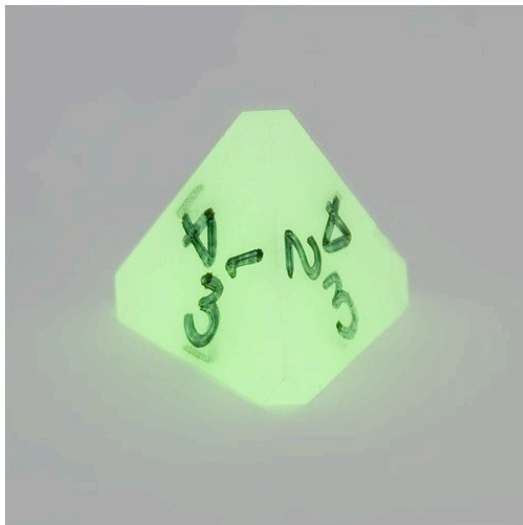
FIGURE 6

The ball-and-spring model used in the name-block activity.



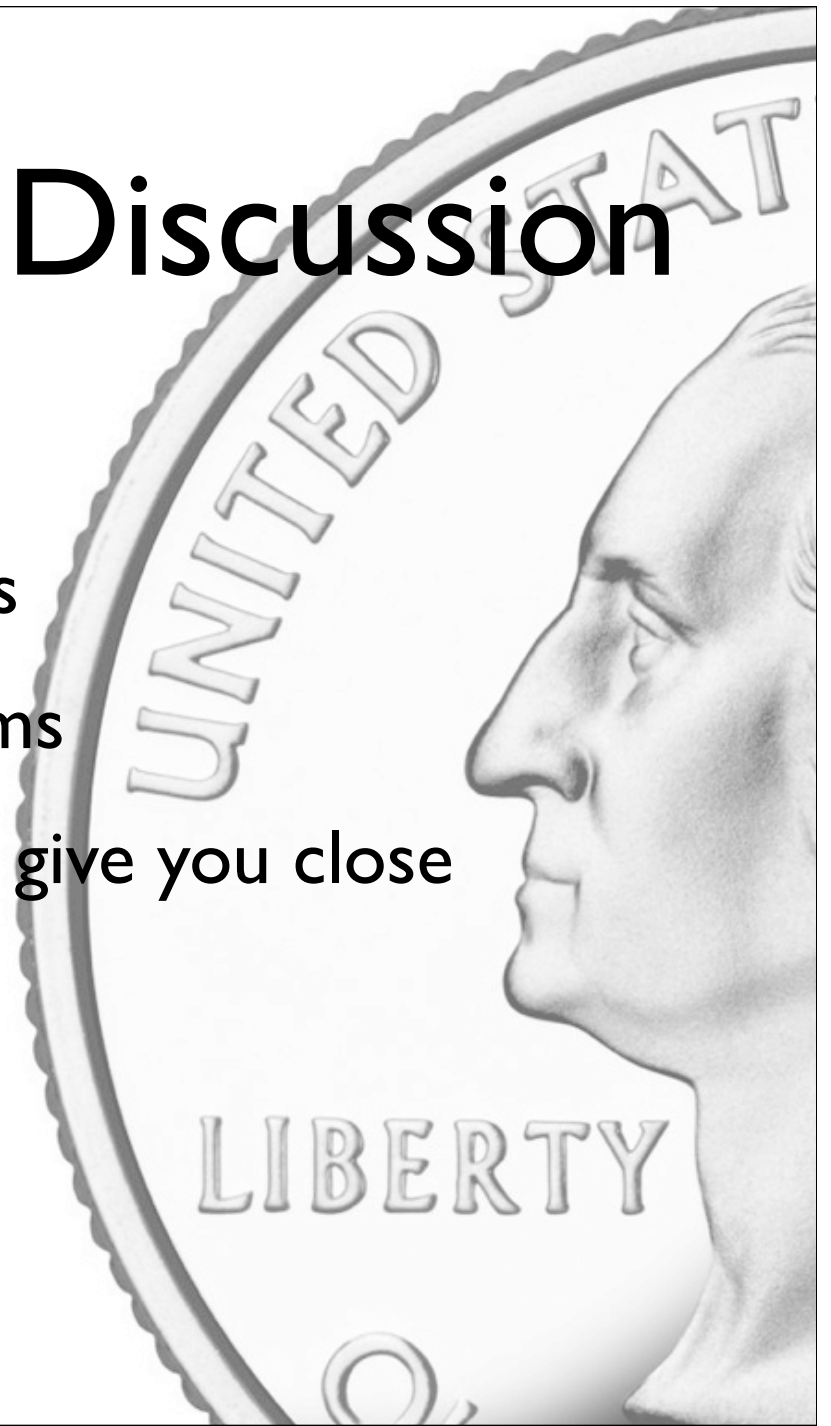
Activity Three: Radius of I atom

- Assume that the copper and nickel atoms are the same size. (Is this a decent assumption?)
- Find the radius of I atom in cm.



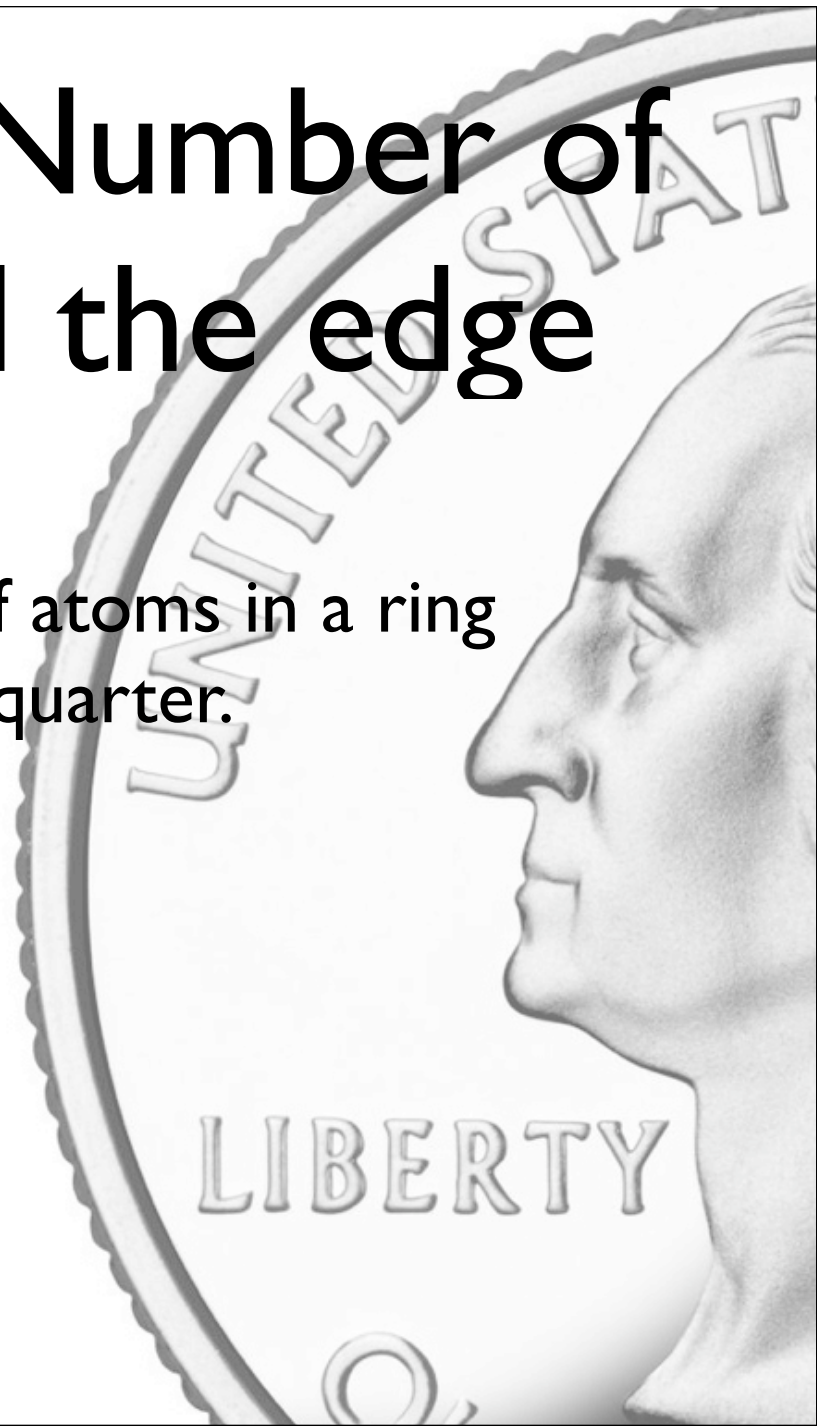
Activity Three: Discussion

- Actual sizes:
 - Nickel: 1.24 angstroms
 - Copper: 1.28 angstroms
- The 60% was chosen to give you close answers, hopefully.



Activity Four: Number of atoms around the edge

- Calculate the number of atoms in a ring around the edge of the quarter.
- The answer is a lot.



Why do this?

- Estimation Practice (“a useful skill for engineers and scientists”).
- Practice with pre-class reading.
- Hands on examples of science.
- Internet Sources

