Lesson Title	You say Avocado, I say Avogadro
Length of Lesson	1 hour 15 min
Created By	Chris Ruhs
Subject	Chemistry
Grade Level	10-12th Grade
State Standards	Chemistry I: 8a,b,c
DOK Level	DOK 2
DOK Application	Students demonstrate their knowledge of mole, mass, and particle conversions.
National Standards	9-12: B (Physical Science)
Graduate Research Element	Understanding mole, mass, and particle conversions is essential for understanding concentrations of compounds in the environment, for making solutions, for understanding chemical reactions, and for general wet chemistry in the laboratory.

Student Learning Goal:
MS 9-12th Grade:
Chemistry I: 8 (a) Calculate the formula/molecular mass of compounds. (b) Define the mole as a quantity of matter. (c) Interconvert among mass, mole, and number of particles. *Students will learn and apply concepts of moles and Avogadro's number to interconvert between moles, mass, and particles.*

National Science Education Standards of Content 9-12:
B: Physical Science: Chemical Reactions. *Students must understand that chemical reactions take place between compounds and elements on a whole number ratio basis, however, this is no simple way to count individual particles, so a system of conversion from numbers of particles to easily measured masses is used.*

Materials Needed (supplies, hand-outs, resources):
A box of golf balls and a box of ping pong balls.
List of conversion problems.

Lesson Performance Task/Assessment:
Formative:
1. Discussion on Avogadro's number, the mole, mass, and molecular weights using ping pong balls and golf balls.
2. Work through a few problems together. Allow for questions.

Summative:
1. Game allowing students work in teams and compete to gain confidence with converting grams to moles, and moles to particles.

a. Students work in teams; two students from each team work together in a head to head match.
b. Points are awarded for speed and accuracy.
c. Other students work through the problems on the board while waiting their turns.

Lesson Relevance to Performance Task and Students:
A conceptual, conversational approach to this topic will allow students to understand the basis for how mole conversions work mathematically, to question the value of this knowledge, to realize how real-world scientists use this knowledge, and to mete out any misunderstandings the students may hold. Working through a few problems will allow everyone to see the concepts play out through examples. Finally, the game will allow students to gain practice and confidence with performing the conversions.

Anticipatory Set/Capture Interest:
Golf balls and ping pong balls were cause students to wonder what's going on.

Guided Practice:
Conversation and example problems will serve as guided practice.

Independent Practice:
Students will work in teams to demonstrate correct understandings of mole, mass, and particle conversions without the teacher's help.

Remediation and/or Enrichment:
Remediation:
Individual IEP, focus on one simpler examples, avoid leading discussion or taking too many turns in the game.

Enrichment: segue into discussion on how knowledge of mole, mass, and particle conversions could be used in a laboratory experiment and in real life, into concentrations (molarity), and into ideal gas laws.

Check(s) for Understanding:
Why do we need to use the mole?

Do chemical reactions work on a mass basis or on a whole number ratio basis?

What is the mathematical process for converting from moles to mass

Closure:

A student-lead, teacher-guided summary discussion will bring closure to the lesson plan.

Possible Alternate Subject Integrations:
Biology: concentrations
Physics: ideal gas laws

Teacher Notes: