TITLE OF LESSON

Physical Science Unit 1 Lesson 23 – The Mole

Nature of Matter: How do tribes comprehend items at the atomic and molecular level?

TIME ESTIMATE FOR THIS LESSON

One class period

ALIGNMENT WITH STANDARDS

California – Sciences: Chem, Conservation of Matter and Stoichiometry 3; Investigation and Experimentation 1e

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MATERIALS

calculator

Mole Worksheet – Student Page

Mole Worksheet Key – Teacher Page

Editing Skills List – Teacher Page (overhead)

Avogadro the Mole - http://store.acs.org/cgi-bin/acsonline.storefront/EN/catalog/10014, http://www.purcifuls-toys.com/mole.html or http://puppetgallery.com/gallery/mouse.html

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LESSON OBJECTIVES

- To introduce the concept of the *mole*
- To have students learn how to solve mole problems

FOCUS AND MOTIVATE STUDENTS

1) Homework Check - Collect homework.
2) Agenda – Have students copy the agenda you have posted.
3) Dialectical Journal 9 – Have students get into groups and share the one entry each of them thinks was the most important.
4) Peer Edit – Have groups get out the second draft of Lab Report 4. Have students trade lab reports with another student. Post the **Editing Skills List** (Teacher Page) on the front board. Ask groups to edit the other group's lab report in a different color pen or pencil using the skills listed in the **Editing Skills List**. Remind them that although editing is often tedious and time consuming, the payoff is that their final piece will look professional and intelligent. Tell students they have 15 minutes to completely edit their partner's lab report. Whatever they do not finish during that time, they will have to complete on their own time. Tell students they will make the suggested corrections to their lab report tonight, typing or writing neatly in ink their final draft which they will turn in for a formal letter grade tomorrow.
5) Discuss: Counting Quantity – Ask students "How are large quantities of objects counted?" (such as 12 eggs, 500 sheets of paper) *Responses may include:a dozen , a ream.* Ask students why these counting units are used. *Responses may include that it makes it easier to count them.* For example, one doesn't count out the individual number of popcorn kernels one buys at the theater. Popcorn is sold in containers of different sizes, like small, medium, and large.
6) Intro: Mole – Now we are going to look at how scientists count atoms. Introduce students to the concept of the mole by using Avogadro the Mole (He has 6.02×10^{23} hairs on his body, hence the definition of a mole.) Remind students they should be writing this information in their notes because they will be responsible for knowing it and how to use it.

   One mole (mol) = 6.02×10^{23} particles

   Mole –the SI base unit that describes that amount of a substance

   This number is very useful for counting very small particles like atoms. For instance, you wouldn't use moles to count popcorn kernels. One mole of popcorn kernels would be 6.022×10^{23} kernels, which is enough popcorn kernels to not only cover the United States, but to create a pile 310 miles high. (*Holt Science Spectrum*, Chapter 3.4, p 95.)

ACTIVITIES – INDIVIDUAL AND GROUP

1. Calculator Use - Remind students how to use scientific notation on their calculators.

2. Mini Lecture – Remind students that molar mass is the same as atomic mass, except molar mass is in *grams* and atomic mass is in *amu.*
   Molar mass – the mass in grams of 1 mole of a substance

3. Mini Lecture: Conversions – Ask students if they know how to convert from moles to mass or from mass to moles. Tell them that one uses conversion factors. Write the definition for conversion factor on the board and tell students to copy it into their notes as well as the examples that follow.
   Conversion Factor – a ratio equal to one that expresses the same quality in two different ways.

   Remind students that the molar mass of an element allows you to convert between the amount of the element (mole) and its mass (grams).
   If you want to convert from amount (moles) to mass (grams):
   Amount (moles) x $\frac{\text{molar mass of element}}{\text{1 mol of element}}$ = mass (grams)

   If you want to convert from mass (grams) to amount (moles):
   Mass (grams) x $\frac{\text{1 mol of element}}{\text{molar mass of element}}$ = amount (moles)
   The portion in pink in the 2 examples above is the conversion factor.

4. Problem Solving: Individual Work – Hand out the **Mole Worksheet**. Go over example 1 and 2 with the students. Ask students to set up the equations for the conversions for problems 1 & 2 inserting only the units, not the numbers. Have them look at the framework for solving the problem before putting in the numbers so that they understand the importance of the units and that essentially the numbers can be added later. For example 1: How many atoms are in 2.5 moles of titanium?
   (moles) (atoms/mole) = atoms of Ti
   (2.5 moles) (6.022 x 10^{23} atoms/1 mole) = 1.5 x 10^{24} atoms of Ti
   Have volunteers write up their answers on the board leaving room to add the numbers. Once the units are in place, have them add the numbers. Then as a class solve the problem. Check that students understand how to set up conversion equations.

5. Group Work - Have students break into groups, assign roles (see Group Roles below), and work on problems 3-6 of the worksheet. For all problems, ask them to first set up the equation with units followed by adding the numbers. Give students 10 minutes to complete the four problems.

6. Class Agreement – Have one person from each group write their solution on the board for one of the problems and explain how they came to their answer. They must answer any questions or doubts that their classmates have.

7. Group Work – If time permits, allow students to complete the worksheet. If not, they can do so for homework.

8. Binders - Remind students that all work today will be placed in the NOTES section of binder to be used for reference later in course.

9. Homework Review – If a group completes the worksheet before the class period is over, they should be working on the final draft of Lab Report 4. Go over the rest of their homework assignments.

HOMEWORK

1) Finish **Mole Worksheet.**

2) Complete the final draft of Lab Report 4 to be handed in at the beginning of the next class period. The report must include the first draft, the peer revisions, the second draft, the peer edits, and the final version (error free) to get complete credit.
3) Create flash cards of all vocabulary to date. Study these flash cards.

GROUP ROLES

Recorder – Your job will be to record your group's responses. All students are recorders today.

Time Keeper – Your job is to keep make sure the group completes their tasks within the time allotted.

Facilitator – Your job will be to keep your group focused.

Manager – Your job will be to report back to class.

DOCUMENTATION FOR PORTFOLIO

Lab Report 2
Test 1: Matter
Lab Report 3
Class Periodic Table