

The Mole

5E Lesson

The 5E model is a scientifically proven method to improve student engagement and learning in your classroom

- ✓ Engagement
- ✓ Exploration
- ✓ Explanation
- ✓ Elaborate
- ✓ Evaluate



Complete Teacher Instructions

The Mole 5E Lesson

Grades 7-10	The Mole	Ongoing Lesson
Lesson Objective: Students will learn about: • The mole • Avogadro's number • Amedeo Avogadro • Molar mass		
Possible Student Misconceptions: • May not recognize it as a counting unit • May think of it as a molecular property		
Materials: • 1 device (smartphone, Chromebook, laptop, tablet, or computer) per 3 students • A means of projecting a PowerPoint presentation • Internet access • General classroom objects		
Teacher Notes: ➢ All videos can be accessed directly from the PowerPoint. To retrieve them, click on the video icon while in slideshow mode and it will automatically open for you. If it doesn't, right-click on the image and click Edit Hyperlink or something similar. ➢ I've created a video walkthrough if needed. It can be accessed here - https://youtu.be/oCIKIP9SaDQ ➢ I don't believe in long lessons. If you feel your students are losing their focus, stop the PowerPoint and give them a 5-minute break. If you'd like to see more of my video collection here - http://www.teachwithferny.com are tons of brain-break videos to choose from all grouped by category.		

The Mole – 5E Lesson

Engagement Phase Your students will watch the video 'Avogadro's Number Song' and complete the following. 1. Watch the video and answer the questions.		Duration: 10 min
The video can be found here - https://www.youtube.com/watch?v=R76zj9Y6zxi		Teacher Role: Facilitate learning and keep students focused
Teacher Notes: - The video is about three minutes long - You may need to show the video more than once or pause when an answer is given to one of the questions.		Goal: Students use their newly obtained knowledge to propose solutions and extend their learning to new situations
Exploration Phase Exploration – Lab Station Activity • In groups of 2-3, have your students complete <i>Exploration – Lab Station Activity</i>. Once they're done, they will submit their passport to you.		Duration: 30 min
Teacher Notes: • The complete instructions for my Lab Station activity can be found in the <i>START HERE – Instructions</i> file.		Teacher Role: Distribute and collect evaluation
Explanation Phase PowerPoint Lessons • The lesson is found in the folder – <i>Explanation – The Mole Lesson Lab and Activities</i>. • This lesson is designed to be completed over one day • There are multiple embedded videos and plenty of opportunity to engage, interact and check for your students' understanding throughout the lesson • There are, additionally, four worksheets for students to practice calculations • The lesson covers the following topics:		Goal: Students are given the opportunity to demonstrate their understanding and evaluate their own progress

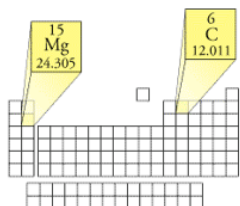
➢ The mole ➢ Avogadro's number ➢ Molar mass ➢ Finding n ➢ Finding the number of atoms	Goals ☐ Students develop understanding of the content ☐ Observations and experiences are discussed and critiqued ☐ Students develop vocabulary ☐ Students are able to connect the content presented to previous experiences
Teacher Notes: • All videos can be accessed directly from the PowerPoint. To retrieve them, click on the video icon while in slideshow mode and it will automatically open for you. If they don't open, right-click the image and select Edit Hyperlink or something similar. • I've created a video walkthrough if needed. It can be accessed here - https://youtu.be/oCIKIP9SaDQ • I have also enclosed a .PDF version of both the teacher and student versions.	Duration: 1 hour Teacher Role – Facilitate learning and keep students focused
Elaborate Phase Elaborate – Reading Your students will complete – <i>Elaborate – Amedeo Avogadro – Famous Scientist Reading</i> . This reading will require your students to move beyond what was covered directly in the lesson and allow them to further develop their understanding.	Goal ☐ Students use their newly obtained knowledge to propose solutions and extend their learning to new situations
Evaluate Phase Quiz Have your students complete - <i>Evaluate – The Mole Quiz</i>	Duration: 30 min Teacher Role – Distribute and collect evaluation
Teacher Notes: ➢ It's sometimes best to have the students peer evaluate ➢ Placing students in small groups and having them exchange papers to mark will accomplish two things	Goal ☐ Students are given the opportunity to demonstrate their understanding and evaluate their own progress
1) Provide immediate feedback on the questions they just completed 2) Significantly reduce your marking time ➢ Peer evaluation is not needed, only suggested when appropriate	

Each phase is clearly described

A Complete Lesson

Molar Mass

- The molar mass of anything is the mass of 1 mole of that thing in grams
 - Coins, chickens, computers, students, etc.
- 1 mole ^{12}C atoms = 6.022×10^{23} atoms = 12.01 g
- 1 mole ^{24}Mg atoms = 6.022×10^{23} atoms = 24.305 g



12 Mg 24.305	6 C 12.011
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For any element
The atomic mass (amu) =
molar mass (grams/mol)

← Make sure your students are on track

Student copies with blanks
Videos embedded right into
your slideshow

The Number of Atoms

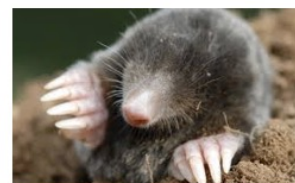
- How do you find the number of atoms?
 $n = m/M$
- What does n represent?
—
- What is a mole?
—

The Mole...

- We need a relationship between the mass of a sample of an element/compound and the number of atoms/molecules in that sample
- For this, we use the MOLE



1 mole (mol) = 6.02×10^{23} particles = Avogadro's Number



Interactive and Engaging Activities

Amedeo Avogadro

Scientific Reading Comprehension Article and Extension Activity

Amedeo Avogadro
Born August 9, 1776, Turin, Italy
Died July 9, 1856, Turin, Italy



Who is Amedeo Avogadro?
Count Lorenzo Romano Amedeo Carlo Avogadro di Quaregna and Cerreto was a nobleman, a lawyer, and a scientist born on August 9, 1776, in the city of Turin, Italy. He developed a hypothesis in 1811 that gained recognition after his death and became known as Avogadro's Law. Its development led eventually to the designation of a mathematical constant in chemistry called Avogadro's Number. This constant is fundamental in the study of chemistry to this day.

Avogadro's Life
Avogadro began his career as an ecclesiastical (church) lawyer, having obtained a doctorate in canon law in 1796. During his time as a lawyer, however, he developed a keen interest in science, specifically math and physics. In 1800, he began taking private lessons in math, physics, and chemistry under the tutelage of a mathematical physicist named

Vincenzo Kessel. Avogadro's first scientific paper was on the electrical behavior of salt solutions. Volta first demonstrated the electric battery. Academy of Sciences.

In 1806, his love of science was not and he high school in Turin. In 1809, he left the high school at the Royal College of Turin. It was here that, while ignored during his scientific history. He had been following scientists in particular John Dalton and Dalton proposed, in 1808, that all matter is made of atoms. In 1811, Avogadro published a paper in the volumes of all gases at constant temperature and pressure. He realized, for the first time, that elements could exist as multi-atom molecules rather than individual atoms and that oxygen was one of these elements, existing naturally as O₂ when (diatomic) molecule. In this 1811 paper, he correctly presented the formulas for water, carbon dioxide, and hydrogen chloride, and he correctly decided, among other things, that water is H₂O and carbon dioxide is CO₂. Unfortunately, for the next 50 years, his work was largely ignored. It was not until 1860, at the Karlsruhe Conference, that his ideas were finally recognized. Including that the distinction between atoms and molecules was actually thought to be a matter of degree.



CARBON



Improve your students' **Literacy** and **Analysis Skills**, use as an **Emergency Substitute Plan**, or create **Applicability** in your classroom

The Mole (Avogadro's Number)— Lab Station Activity

$$6.02 \times 10^{23}$$

AVOGADRO'S NUMBER





7 Lab Station Activities to get your kids out of their seats and engaged in their learning

Get away from tired practices and unengaged students



Provide a Scientifically-Proven means of instruction



Incorporate Technology and Increase Collaboration

