

Chapter 8



Kevin Cram: Classification of Matter

Kevin Cram has taught Chemistry in CPS for six years. He earned a B.A. in Chemistry from Michigan State University, a M.S. in Chemistry from Purdue University and a M.A in Teaching from Dominican University through the Chicago Teaching Fellows alternative certification program. During the 2010-2011 school year Cram was awarded a grant supported by CPS and Apple® for a classroom set of iPads. In 2012 Cram collaborated with several CPS educators to plan and develop the CPS iPad Academy professional development conference. Cram was apart of the 2012-2013 cohort of Teach Plus teaching policy fellows from Chicago focusing on teacher evaluation and professional development. Beginning the spring semester of 2013, Cram has been a DePaul faculty member in the Department of STEM Studies teaching STEM 420 - Chemistry for Teachers.

Classification of Matter

Grade Level: 8th-12th grade

Content Area Topic: Chemistry

Disciplinary Core Idea:

- PS1.A - Substances are made from different types of atoms, which combine with one another in various ways. Atoms form molecules that range in size from two to thousands of atoms. (MS-PS1-1)

Science and Engineering Practice:

- Develop a model to predict and/or describe phenomena (MS-PS1-1), (MS-PS1-4)
- Develop a model to describe unobservable mechanisms (MS-PS1-5)

Learning Objective(s):

Students will be able to....

- Analyze models and correctly apply the terms atom, molecule and particle to models
- Synthesize a model of a pure substance or mixture containing atoms, molecules or particles

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Suggested Time Allotment: 1 class period; 45 min

Prior Lessons:

- Students should be familiar with why we use visual models for non-visual objects in chemistry
- Students should be familiar with the vocabulary of states of matter (solid, liquid, gas)
- Students should be familiar with modeling states of matter
- Homework the night before create a “before and after” T-chart and in the “before” column define the terms atom, molecule and particle in your own words.

Subsequent Lesson:

- Students will use atom, molecule and particle vocabulary to interpret common mixtures and pure substances (i.e. Coffee, Salt Water, Pizza, Cookies)
- Students will differentiate Pure Substances into categories of Elements and Compounds
- Students will differentiate Mixtures into categories of Heterogeneous and Homogeneous

Materials & Resources Needed:

- “Classification of Matter” POGIL Model 1 worksheet - <http://www.beavercreek.k12.oh.us/cms/lib5/OH01000456/Centricity/Domain/211/Classification%20of%20matter%20pogil.pdf> (This link contains the entire “Classification of Matter POGIL” worksheet with answer key. I will only use Model 1 (pg. 1) in this lesson)
- Kool-Aid Modeling PDF - https://docs.google.com/file/d/0B_fWtw_iYNfJeWw0NkdlUm50ZUU/edit
- Example Student “Before and After” notes - https://docs.google.com/file/d/0B_fWtw_iYNfJZnE1Y1Y0WkN0Vm8/edit
- Computer and projector (optional document camera)
- White board/poster paper

Lesson Activities & Sequence:

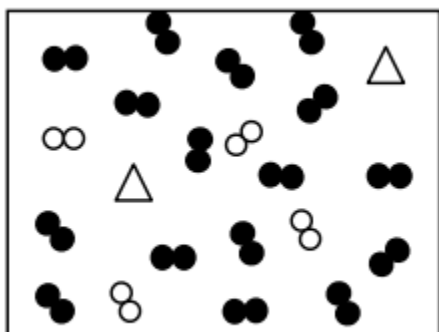
- “Chem Catalyst” - Display “Kool-Aid Modeling” PDF and ask students “What do you know about this matter?” Make sure to probe students into what goes into Kool-Aid (Water, Sugar, Kool-Aid Powder). This is a whole class discussion; teacher notes student ideas on white board/poster paper) (3 min)
- Prompt students to take out their “before” definition homework and check for completion. *Have students that did not complete HW make a “before” and “after” chart in their notes. Ask students to define the terms atom, molecule and particle in your own words. For students that need support provide the blank note taking template (2 min)
- Group students in pairs and pass out Model 1 to pairs of students. Have student choose roles of “discussion speaker”, “model annotator” (2 min)
- Introduce POGIL Model 1 and have student read “Why?” prompt. (1 min)
- In students pairs, ask students to analyze the model and come up with a definition for the word “atom” and write it in the “after” column of their notes (3-5 min)
- Whole class discussion on student definitions of the word “atom” (2 min)
- Repeat steps 5 & 6 with the terms molecule and particle (6-10 min)
- Display the definition of Pure Substance and Mixture (Kool-Aid Modeling PDF) and prompt students to add vocab to notes. (2 min)
- Prompt students to identify the Pure Substances in Model 1 and discuss as whole class (2 min)
- Prompt students to identify the Mixtures in Model 1 and discuss as whole class (2 min)
- Exit Slip: Show the Kool-Aid image again and ask students to create a model similar to the models in Model 1 and label whether Kool-Aid is a mixture or a pure substance. Prompt students to use

discussion from “Chem Catalyst” to guide their modeling (10 - 15 min)

- If time permits, share student models using document camera and discuss as a class or begin developing concept map of vocabulary words

Assessment:

- From the exit slip, the teacher will be able to evaluate the student’s ability to create a model and correctly apply the term “pure substance” or “mixture” to their model.
- Alternatively, you may display another model of matter and have students determine whether the matter is a pure substance or a mixture. An example model is below:



*This sample of matter would be classified as a mixture of elements

Proficient Models: Display 3 types of particles (water, sugar and kool-aid powder) and correctly labels Kool-Aid as a Mixture

Developing Models: Display at least 2 types of particles (water, sugar and kool-aid powder) and/or correctly labels Kool-Aid as a Mixture

Unsatisfactory Models: Does not clearly display different types of particles and labels Kool-Aid as a Pure Substance

Feedback

Teachers As Learners:

The group of learners appreciated the pace of this lesson. Students were allowed to write down and share their initial ideas about the vocabulary words atom, molecule and particle with their neighbor.

They appreciated addressing a single vocabulary word at a time when evaluating the nine model's. Finally they reflected on how their initial ideas about the vocabulary words may have changed after completing the modeling lesson and also expanded their understanding of these words to the vocabulary words of pure substance and mixture.

Elements of Pretty Good Practice:

The lesson incorporates whole class and small group collaboration. The teacher becomes a facilitator that allows students to share their initial conceptions and work together to modify or confirm those initial conceptions using the POGIL model. For more on POGIL pedagogy visit -

<https://pogil.org/resources/implementation/hspi-implementation-guide/stage-1-shifting-to-a-student-centered-classroom>.

Modifications and Adaptations:

- Differentiate groups of students into heterogeneous groups by academic ability
- Have larger groups (4 students) with more defined roles (i.e. Speaker, Annotator, Timer, Summarizer)

Questions Arisen:

- How can students use technology to annotate and share explanations of the models in the POGIL?
- How can students use technology to generate their Kool-Aid model exit slip and share with exit slip with the teacher and/or class?

Peer Feedback:

Number the 9 models (i.e. #1, #2) with marker before copying to help students talk about which box they are working on

Related Resources/Ideas:

<https://pogil.org/>