Chemistry is for Everyone: Accommodations and Modifications for Success in Chemistry

Ariel Serkin
Norfolk County Agricultural High School
Walpole, MA
STEMteachersMassBay
ariel.serkin@gmail.com
aserkin
The pressure of a sample of helium in a 2.00 L container is 0.988 atm. What is the new pressure if the sample is placed in a 5.00 L container?

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</table>
\[ P_i V_i = P_f V_f \]
\[ (0.988 \text{ atm})(2.00 \text{ L}) = (P_f)(5.00\text{L}) \]

\[(6)(2) = (x)(4)\]
What we have heard...

- Students can’t do chemistry if they can’t do the math
- Everyone can’t do chemistry
- Some kids don’t have the “horsepower”, are not that smart, are useless academically
Reality

- Chemistry is about more than algorithmic learning
- Some students excel algorithmically but have no conceptual understanding
- NGSS emphasizes proportional thinking & conceptual understanding
- All students are capable of high level thinking with scaffolding and accommodations
  - Make thinking visible
  - Formative assessments
  - Rigorous course
My Students

- Sophomore Chemistry Class
- Primarily College Prep 2
- 50% 504s and IEPs
- failed the MA Bio MCAS
- agricultural high school - would rather climb trees, rebuild engines, groom dogs, and ride horses than be in academics
Goals for the webinar

1. Strategies for the classroom - practical approaches to implement
2. Philosophical approaches - changes in pedagogy to help all learners
3. Modifications - deeper changes for students who require
Accommodation Chart

- Keep track of all your students and their accommodations
- Easy resource
  - you
  - paraprofessional/co-teacher
  - IEP/meetings
Special Education Reference Chart

Use this chart to help organize the accommodations/ modifications used in your classes. Please note the accommodations listed here may not appear on a 504 plan or an IEP. They are common accommodations (examples) that have been used in past practice. **Please see each IEP/504 to view each student’s specific plan and modify this chart to reflect the students within your classroom.**

<table>
<thead>
<tr>
<th>Student</th>
<th>Extended time</th>
<th>Separate test setting</th>
<th>Processor</th>
<th>Reference sheet</th>
<th>Word processor</th>
<th>Graphic Organizer</th>
<th>Preferential Seating</th>
<th>Break down large assignments</th>
<th>Repetition of Directions</th>
<th>Assignment modification</th>
<th>Break down directions</th>
<th>Check ins for Understanding</th>
<th>Other</th>
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I. Molar Mass

A. Definition –
1. Based on their __________ ___________ on the periodic table
2. By convention, we round atomic masses to ____ sig figs
3. Molar masses can be used as a conversion factor

B. Units
1. Molar mass has units of grams per mole (or _______________)

C. Example
1. 1 mol of C = __________ grams
2. How many grams of iron are there in 8.00 moles of iron?

D. Practice Problems
1. What is the molar mass of nitrogen?
Notes

- put a slide up and don’t talk when students copy
- give students time to reflect
- post notes on Google Classroom or class website
Vocabulary

Mass
- Amount of stuff
- 5 g + 4 g = 2 g
- Graphical
- Equations
- Diagram

Volume
- Space that something takes up
- Verbal
- Math
- Diagram
- Graphical
- Volume
- 5 cm x 2 cm x 1 cm

Density
- The amount of stuff in a given amount of space
- Volume
- Mass = \( \frac{9}{3} \) cm

Pressure
- Amount of collisions of particles against the surface(s) of a container
- \( P \alpha \frac{n}{V} \)
- P
- \( \frac{1}{V} \)
- \( \frac{1}{L} \)
- High P
- Low P
## Demonstration Notes

<table>
<thead>
<tr>
<th>Date of Demonstration</th>
<th>Description of what happened</th>
<th>What did we learn</th>
<th>Particle Diagrams</th>
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</thead>
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<tr>
<td>Variable 1</td>
<td>Variable 2</td>
<td>Description</td>
<td>Relationship</td>
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Grouping Strategies

01 Heterogeneous Grouping
- ideally they support each other
- often students perceived as weak
- don’t do work or thought incapable

02 Homogeneous Grouping
- allow students to work at their own rate
- support each other
- might feel targeted or thought less capable

03 Randomized Grouping
- make it clear it’s randomized
- no one is specifically targeted
- adjustments made
Grouping Roles

equal work for all students
ensure all students participate
rotate roles so not the same students do the same things each time

example: POGIL Roles
Whiteboarding

large student whiteboards (3’ x 5’)
designed to prompt student thinking and understanding
include diagrams and graphs
prompt student and teacher discussion and dialogue
smaller whiteboards used for individual work
“magic whiteboards”
5. **PNP**

If there are more particles, they will hit the sides more, causing more pressure.

6. **PTPV**

If the temperature goes up, particles will go faster causing them to hit the sides more, causing more pressure.

If the volume goes down, with the same force, they will hit the sides more, causing more pressure.

The pressure will stay the same because the particles move faster, but don’t hit the sides more because the number of particles stays the same.

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**Particle Diagram**:

- At point P, the volume is 250 mL.
- At point V, the volume is 375 mL.
- At point T, the temperature is 300 K.
- At point C, the pressure is 70 kPa.

**Written Description**:

The volume increased and the pressure decreased. The temperature number of particles stays the same.

The final pressure is 70 kPa.
Science Talk

● Why talk science?
  ○ generate conversation
  ○ illuminate student thinking and misconceptions
  ○ encourages collaboration

● problems?
  ○ stressful for students

● solution
  ○ talk moves
Science Talk Moves

- Gives structure for conversation
- Allows students to not be “put on the spot”
- Helps students clarify their thinking
- Respectful and productive conversation
**Discussion Starters**

### Whiteboard Meeting Questioning & Discussion Guides

<table>
<thead>
<tr>
<th>Confirm, Agree and Review</th>
<th>Clarify and Seek Understanding</th>
<th>Disagree or Express Confusion</th>
</tr>
</thead>
<tbody>
<tr>
<td>I agree with ___ because ___</td>
<td>Can you give an example?</td>
<td>I am not sure about ___ because ___</td>
</tr>
<tr>
<td>I have evidence to support what ___ said</td>
<td>(Paraphrase what you heard) Are you saying ___?</td>
<td>I disagree with ___ because ___</td>
</tr>
<tr>
<td>I agreed with what ___ shows because ___</td>
<td>Why did you say ___?</td>
<td>I can see that ___; however, I can't see ___</td>
</tr>
<tr>
<td>Another thing I noticed is ___</td>
<td>Can you explain your evidence in a different way?</td>
<td>But on the other hand ___</td>
</tr>
<tr>
<td>I want to go back to the evidence from ___</td>
<td>What is your evidence for ___?</td>
<td>What you said doesn't match my evidence because ___</td>
</tr>
<tr>
<td>I'd like to add on to what ___ said</td>
<td>What did you mean by that?</td>
<td>What you said doesn't go with what ___ said because ___</td>
</tr>
<tr>
<td>Going back to what ___ said about ___</td>
<td>Can you say more about that?</td>
<td>I don't understand ___</td>
</tr>
<tr>
<td>There is more evidence of what you just said for example ___</td>
<td>What (text or data) makes you think that?</td>
<td>I am confused about ___</td>
</tr>
<tr>
<td>What you said matches what ___ said because ___</td>
<td>How do you know?</td>
<td>I'm not sure I understand what you are saying. Can you say it in another way?</td>
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<tr>
<td>(Paraphrase what you heard) Does that sound right?</td>
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<tr>
<th>Analyze and Interpret</th>
<th>Compare, Explain and Extend</th>
<th>Reflect and Build Consensus</th>
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<tr>
<td>What would happen if ___?</td>
<td>I would like to build on what ___ said</td>
<td>What conclusion can we make based on all of our evidence?</td>
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<tr>
<td>How would the results change if ___?</td>
<td>I'm thinking about ___ and I'm wondering ___</td>
<td>How did we reach that conclusion?</td>
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<tr>
<td>How does this compare to ___?</td>
<td>This makes me think ___</td>
<td>How can we account for any evidence that doesn't support this conclusion?</td>
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<tr>
<td>Why does it work this way?</td>
<td>I want to know more about ___</td>
<td>Can we explain our evidence in terms of our model?</td>
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<tr>
<td>Does it always work that way?</td>
<td>Now I am wondering ___</td>
<td>How does our evidence support our model?</td>
</tr>
<tr>
<td>Can you give an example when it could work another way?</td>
<td>Something else we studied that goes along with that is ___</td>
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Whiteboard Uses

- labs/demonstrations
- homework
- speed dating
- mistake game
- exam review
- presenting in pairs/presenting in class
assign problems
choose problems
have students
choose problems for each other
Assessment tips

- provide lines not just blank spaces for open response questions
- have separate spaces for problems with multiple components
- e.g.
  - a. Classify the following as pure substance or mixtures.
  - b. explain your classification
- give extra time
Johnstone’s Triangle

Particulate Level Understanding
Chemistry learning is difficult for students because it occurs on all three levels – macroscopic, symbolic, and submicroscopic (Gabel, 2000 & Sirhan, 2007)

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Particle Diagrams
The volume increased when it was put into a larger container so there were fewer collisions making the pressure smaller. The temperature and number of particles stay the same.

d. Explain in writing what is the difference between the two particle diagrams. (2.4)

As the pressure increased the volume decreased. The temperature and number of particles didn't change.
Advantages

- Clarify conceptual understanding
- Identify points of strength and weakness
- Help reteaching
Standards Based Grading

- What are your specific learning objectives?
  - Broad enough that they you only need a few for every unit, specific enough that they are measurable
- Tie assignments and assessments to specific learning objectives
- Separate problem solving skills from concepts
- Allow reassessments

Sources: Lauren Stewart, Erica Posthuma Adams
specific feedback
● outlines strengths and areas that need improvement
● helps communication with student, parent/guardian, special education liaison

reassessment
● students are involved in grading process
● learn at different rates
● skills build, so allow them to achieve proficiency

understanding
● gain conceptual understanding
● gain confidence to ensure future understanding
Modifications

Philosophy

Strategies
Modifications

accommodations: changes how a student learns

modifications: changes what a student learns

Strom, E “The Difference Between Accommodations and Modifications”
Learning goals

What specifically do you want your students to know?
What is the most important aspect?
Can it be modified so the concept is still learned?
Common problems

Avogadro’s number
understanding how to use scientific notation
use of a calculator
multi step problems
Solutions

- use simple numbers
- avoid scientific notation
- break problems down into steps
- alternate assessments
Questions?
To complete a brief survey about this webinar, and to generate your certificate of attendance, visit: http://bit.ly/AACT-PD


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