Physical Science - Middle School

Properties of Matter

Scenario Guide
Activation Date:
Intensity Level: Low

Author(s)	Avatar(s) & Environment	Suggested Learner Audience
Simulations for Secondary Science Teachers Conference Shanna Hays Tori McPetrie Dr. Robert Moody Dr. Andrea Ridley **Mursion** Jessica Gasparolo	**Host Avatar(s)** Nina/Michael **Simulation Avatars** Savannah, Dev, Ava, Jasmine, Ethan **Environment [ML3z]** Middle School-8th Grade Classroom	• Teachers • Non-credentialed Teachers • Pre-service Teachers
Delivery Mode(s) Available for Scheduling 1:1, Facilitated Group		
This scenario was created in partnership with AACTE and the convening, Enhancing Science Education through Virtual Reality: A Conference to Design Simulations that Enhance the Clinical Preparation of Secondary Science Teachers, is funded by the National Science Foundation (NSF) 20-572 Discovery Research PreK-12, award #2040747.		

Learner-Facing Vignette:

You are a middle school science teacher, and you are continuing a unit on the three properties of matter with your students. For today's lesson, you will lead a class discussion beginning with the prompt question "Which is the densest: ice, water or steam?" During the class discussion, ask the students to reference the pre-loaded worksheet on their tablets, which details the molecular structures of the three properties of matter. Encourage the students to expand and build on their hypotheses as a group in order to come to a class consensus.

Outcome:

Your goal in this scenario is to use higher-order thinking questions to lead student discussion about the basics of molecular structure and density.

Strategies/Best practices to consider:

- Use higher-order thinking questions to engage the entire class critically on the topic
- Ask students to provide explanations for their assumptions
- Encourage students to engage in investigative planning

Information about Intensity Range:

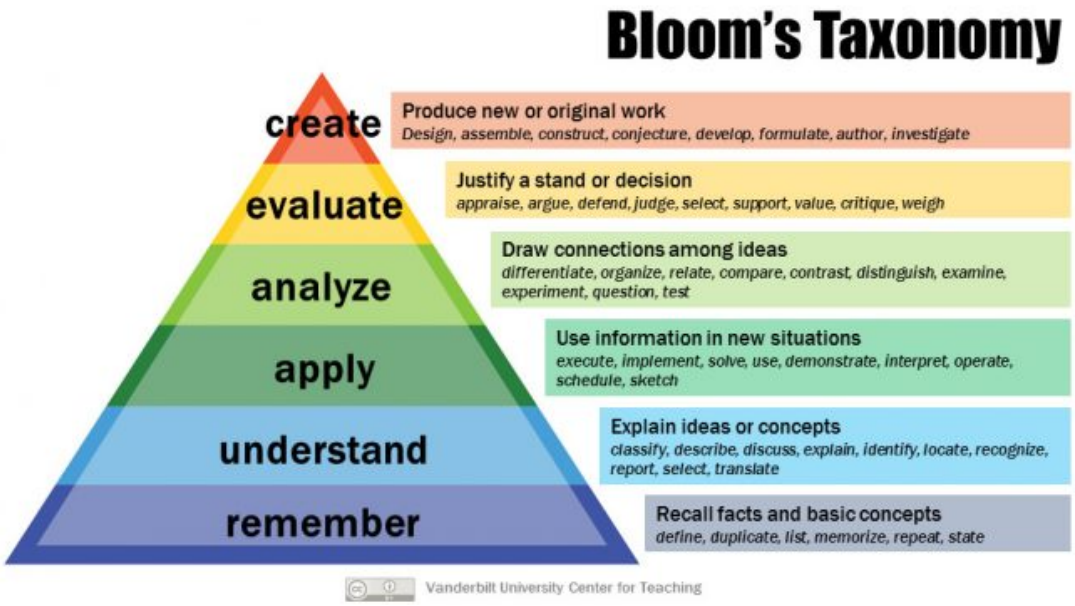
- Low intensity sessions are meant to build confidence for the learner. This setting is recommended for first time learners.

Supplemental Materials:

Students Prior Knowledge:
The three properties of matter. Outside of this the students may have limited to no prior knowledge.

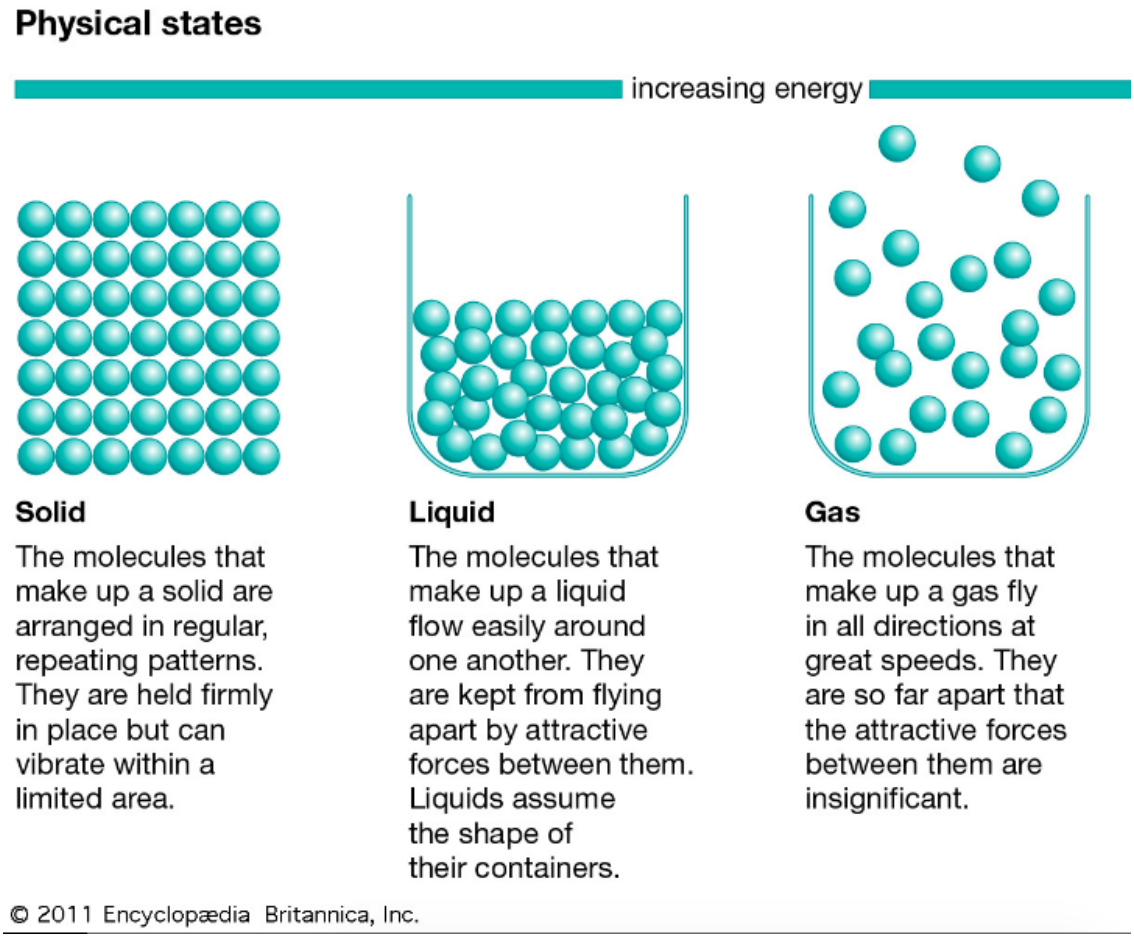
This scenario is gearing toward practicing the following of the Next Generation Science Standards 8 Practices of Science & Engineering:[1]

Asking Questions & Defining Problems
A practice of science is to ask and refine questions that lead to descriptions and explanations of how the natural and designed world works and which can be empirically tested.
Obtaining, Evaluating, and Communicating Information
Scientists and engineers must be able to communicate clearly and persuasively the ideas and methods they generate. Critiquing and communicating ideas individually and in groups is a critical professional activity.



[1] NSTA, and using information from Appendix F of the Next Generation Science Standards © 2011, 2012, 2013 Achieve, Inc. "Science and Engineering Practices." *National Science Teaching Association*, 2014, https://ngss.nsta.org/practicesfull.aspx. Accessed 10 8 2021.

Student Handout:
Use the handout to inform your discussion.



Background (Internal, not Learner-Facing)

Review Time	Delivery Mode(s)
MursionBank: 15 minutes billed as Trainee directly to client	1:1, Facilitated Group

Scenario Specific Content

Intensity Level:

- **Low:** In a low intensity, the students exhibit mostly on task behavior with a few instances of off task behavior. Most students are engaged and off-task behavior is likely a result of over-participation or excitement over the subject matter. Off-task behavior can be redirected at the first attempt by the Learner.

Host Specific Inquiries:

- N/A

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What is this scenario intended to address?

In this simulation, the learner will elicit student thinking related to the content. Specifically, they will pose questions that provoke students to share their thinking about the content in order to evaluate their understanding, guide instructional decisions, and surface ideas that will benefit other students.

Simulation Specialist Goal:

The goal of the Simulation Specialist is to follow the teacher's lead and, if elicited, create an open dialogue about the content between students.

Avatar's Perspective:

Initially, the students will only have a surface level understanding of the content; the Learner will have to elicit the differing interpretations of the content through higher-order questions and further checks for context.

Please reference the following table for possible responses to the Learner's prompt question; or you may come up with your own responses. If you use your own responses, be prepared to expand on the response and offer reasoning.

Potential Perspectives	**Hypothesis Responses to the Learner's Prompt Question:** Which property of matter do you think is the most dense?	**Reasoning** (Only if Prompted)
Perspective 1 Misconception	*I thought the density was all going to be the same.*	• *Because it's all really water - and water is water.* • *I don't think it matters what it looks like.*
Perspective 2 Partially Correct	*I think the density will all be different.*	• *We went on vacation to Minnesota to the lake, and just parts of the lake were frozen - I could tell because fish were swimming under the surface. So it was just the top part that was frozen.* • *Which means that part is less dense. So when the water freezes the molecules disperse. Since they're not a group anymore they take up less space. Same with steam.* This is right in that the frozen part is less dense, but he's wrong in that the frozen molecules actually take up more space/expand.
Perspective 3 Correct	*The ice will be lightest and float.*	• *When I have a glass of water with ice, the ice always floats.* • *So ice must weigh less - otherwise it would sink.*
Perspective 4 Misconception	*I think the ice will be the densest.*	• *Since it's the most solid I think the molecules would be closer together.* • *And it's cold so they would want to crowd together.*
Perspective 5 Correct but Guessing Without Support	*Obviously the steam has the least density because it's all out in the air.*	• *You can't even touch it duh.* • *I don't know why it's like that - it just is.*

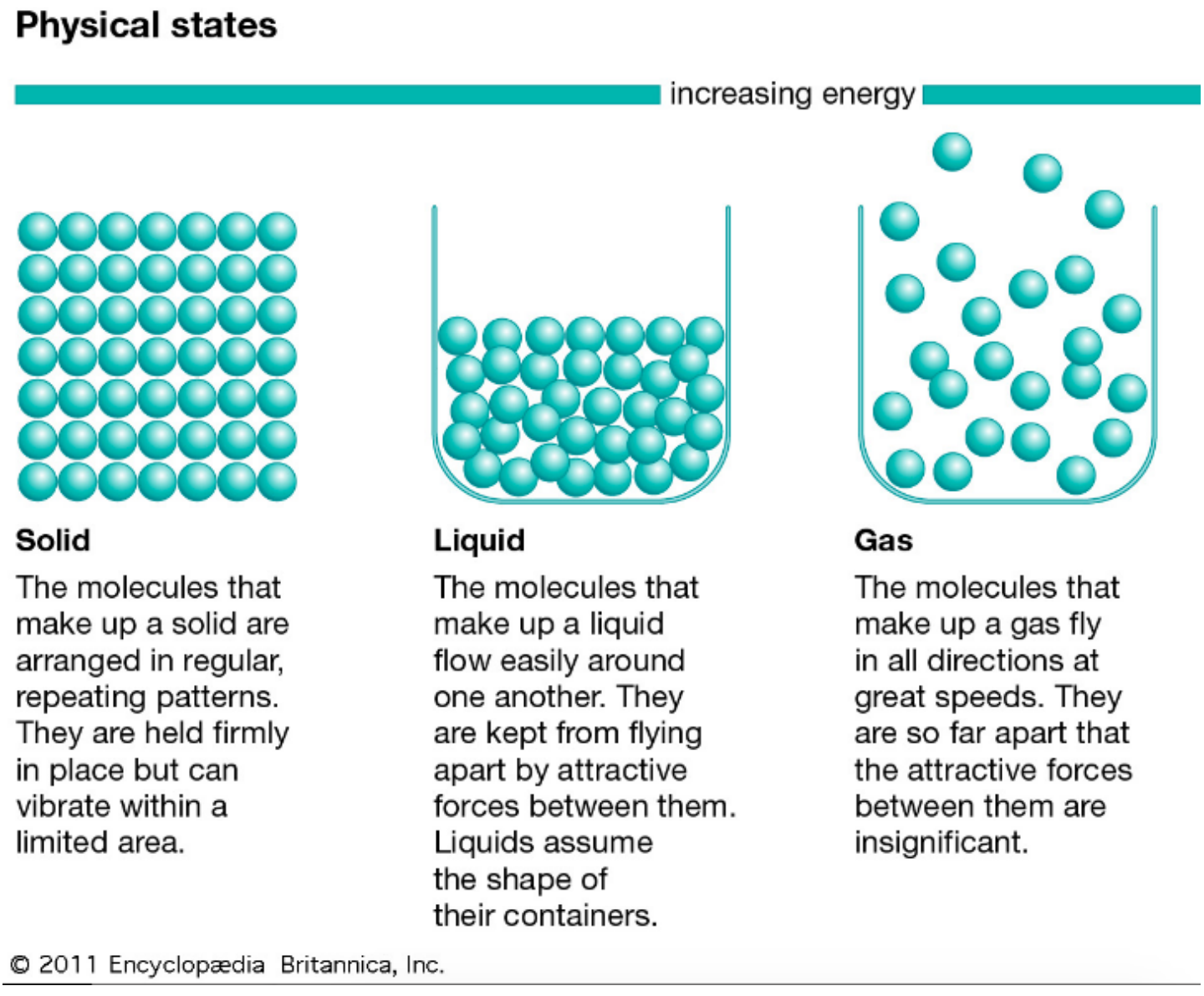
Pushback Techniques:

- If asked close-ended questions - answer with “yes” or “no” only
- If questions are unrelated to text or surface level, do not volunteer additional responses
- If Learner never switches students, a student may ask “Why am I the only one getting asked anything?”

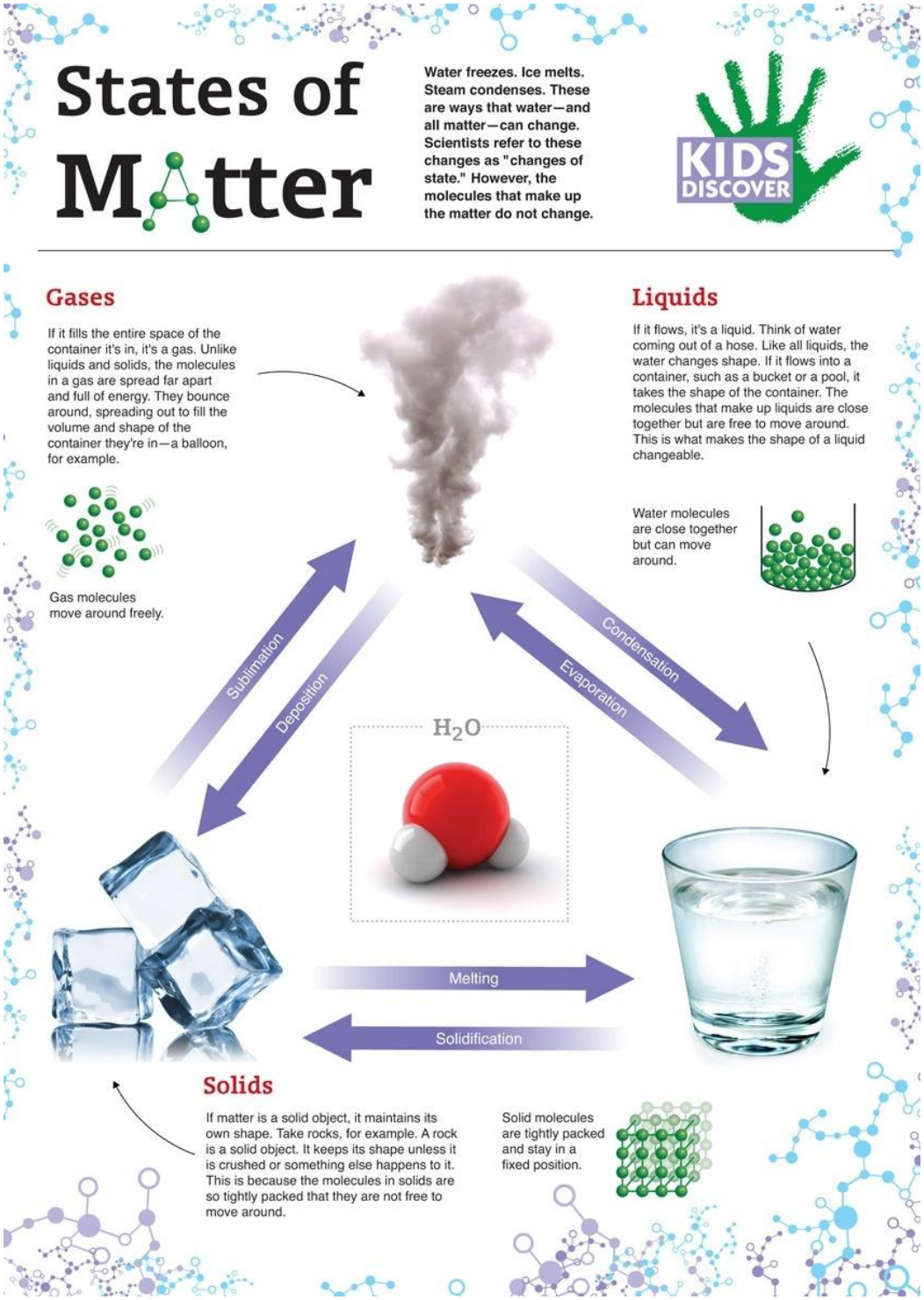
Sim Specific Information: Pushback Techniques:

- If asked close-ended questions - answer with “yes” or “no” only
- If questions are unrelated to text or surface level, do not volunteer additional responses
- If Learner never switches students, a student may ask “Why am I the only one getting asked anything?”

Sims should be familiar with the Three Properties of Matter in advance of today’s lesson:



Additional Properties of Matter Reference Sheet:



The Learner may introduce the following terms, so a general understanding will be helpful but not necessary since the Learner is introducing these concepts anyway:

- Mass: the amount of matter or substance that makes up an object. It is measured in units called kilograms, which can be abbreviated kg. It's important to remember that mass is different from weight. Mass always stays the same, while weight changes with changes in gravity.
- Volume: a measure of the amount of space occupied by that object, and is not to be confused with mass. The volume of a mountain is much larger than the volume of a rock, for instance.
- Density: a word we use to describe how much space an object or substance takes up (its volume) in relation to the amount of matter in that object or substance (its mass). Another way to put it is that density is the amount of mass per unit of volume. If an object is heavy and compact, it has a high density.