How Can You Explain This? A Fogged Mirror

Imagine that it is a cold, winter day. You take a hot shower and the mirror in the bathroom fogs up.
1. Imagine you had a way to see what was happening at a molecular level when water vapor coming from the shower hits the cold mirror. Draw a scientific model of this and be sure to include:
   - ☐ temperature change
   - ☐ scientific vocabulary
   - ☐ particle motion
   - ☐ “zoomed in” views
   - ☐ kinetic energy
   - ☐ arrows / indicators of motion
   - ☐ phase change
   - ☐ key

   Clearly label all model components. Add a key describing the elements of your model.

2. Referring to parts of your model as evidence, explain how water vapor fogs up a mirror.

   __________________________________________
   __________________________________________
   __________________________________________
   __________________________________________
   __________________________________________
   __________________________________________

Winter 2016 Fogged Mirror Assessment (v3). This work is provided for educational use under Creative Commons Attribution NonCommercial ShareAlike 4.0 International license by the UW Institute for Science & Math Education 2016.
You want to see yourself in the mirror, so you grab a hair dryer, turn it on high, and point the hot air coming from it at the mirror. In about a minute, the fog clears from the mirror so you can see yourself again.

3. Imagine you are able to see what is happening at the molecular level and draw a model of why the fog clears from the mirror. Be sure to show the following:

☐ temperature change
☐ particle motion
☐ kinetic energy
☐ phase change
☐ scientific vocabulary
☐ “zoomed in” views
☐ arrows / indicators of motion
☐ key

Clearly label all model components. Add a key describing the elements of your model.

4. Referring to parts of your model as evidence, explain how fog clears from the mirror.

_________________________________________________________________________________

_________________________________________________________________________________

_________________________________________________________________________________

_________________________________________________________________________________
5. If you were to investigate the “fogged mirror” phenomenon, what is a testable science question you could focus on?

________________________________

________________________________

________________________________

________________________________

6. Circle all of the claims that are true:
   a. The hairdryer physically blows all of the water drops back into the air.
   b. The hot air from the hairdryer increases the kinetic energy of the water particles on the mirror.
   c. The hot air from the hairdryer changes the water drops into a different substance that you can no longer see.
   d. Cold objects like the mirror attract hotter objects like the steam towards them.
   e. The density of the water vapor causes the water drops to form on the mirror.
   f. There is less water in the room after you clear off the mirror using the hairdryer.
7. **Extension:** You want to keep the mirror from fogging up when you take a shower. How would you do that using everyday objects and materials? In the space below, sketch a design that might help you keep the mirror from fogging up.

Based on your understanding of the science involved, explain *how* your design prevents the mirror from fogging up.

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

Winter 2016 Fogged Mirror Assessment (v3). This work is provided for educational use under Creative Commons Attribution NonCommercial ShareAlike 4.0 International license by the UW Institute for Science & Math Education 2016.
Teacher Notes on This Assessment
(do not distribute to students)

1. **Timing.** The assessment takes about one 50-minute class period for students to complete—perhaps a bit less. The two engineering design questions at the end are optional (i.e., they are framed as extra credit), but they are encouraged since engineering design at each grade is part of NGSS.

2. The goal of this assessment is to *surface the range of student’s ideas* related to the phenomena—not to simply gauge whether or not they understand the scientific details. The idea is the make student thinking visible in their responses and to *shape instruction and feedback to support their learning.*

3. **Help students understand what is asked for.** Students can sometimes be thrown during an assessment because they are not familiar with specific terms or perhaps other terminology was used during instruction. Please review the language throughout and refine the terms used in order to minimize student misunderstanding. During the assessment, feel free to help students clarify what is meant by the problems described and the questions that are posed.

4. **Encourage students to express their understanding as well as possible.** Some students have difficulty putting their ideas into words. This can be especially true for English language learners. To the degree possible, students should be encouraged to express their ideas as well as they can. This is why drawings are encouraged throughout. To the degree that you can encourage them to use the language of their choice and still assess their thinking, the better.

Learning Goals

Items in this formative assessment focus on the following learning targets:

- **Standards Bundle:** [MS-PS1-4](#), [MS-PS1-5](#), [MS-PS3-5](#), [CCSS.ELA-LITERACY.RST.6-8.7](#)
  - NGSS Practices
    - Develop and Using a Model (visual representation with text)
    - Construct Explanations
    - Engaging in Argument from Evidence
    - Designing Solutions (Engineering)
  - NGSS Disciplinary Core Ideas
    - Changes in particle motion
    - Temperature and state of a pure substance when thermal energy is added or removed
    - Conservation of mass/energy transfer
  - NGSS Cross-cutting Concepts
    - Cause and Effect