Features Analysis Chart—Properties of Matter

Teacher Name: _____ **Circle One: PRE POST**

Describe the assessment item: Question 4 on the pre-post assessment for the Properties of Matter unit: Use words and pictures to show what happens to the molecules that make up ice and liquid water when an ice cube melts. What changes take place?

Photos courtesy of BSCS

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Molecules in Frozen Water

Molecules in Liquid Water

Describe the ideal response:

Ideal illustrations: *For both illustrations, students should use dots to represent the water molecules. They may use a three-part molecular representation (H_2O) instead, but that isn't essential. For the molecules in frozen water, students should indicate in some way that they are moving, such as using wavy lines or arrows to show the particles generally staying in place but vibrating. For the molecules in liquid water, students should show them still relatively close together but moving around more freely and sliding past one another.*

Ideal written response: Molecules in frozen water vibrate tightly in place and can't move around very much. When ice cubes melt, the molecules heat up and change to liquid water. The liquid molecules aren't as close together as the frozen molecules, so they can move around more and slide past each other.

Features of a Complete, Accurate Response	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**
1. Water is made up of tiny particles called *molecules*.																												
2. The molecules that make up ice and liquid water are the same. Only the motion and arrangement of the molecules change, not the molecules themselves.																												
3. Heat must be added to turn ice into liquid water.																												
4. As a solid (ice), water molecules are close together and can't move around, so they vibrate in place.																												
5. As a liquid, water molecules can move around more freely and slide past one another.																												

Features Consistent with Student Misconceptions/Problems	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**
1. Water is shown as drops or in a blue color but not as molecules or particles.																												
2. Solid water molecules (ice) look really different from liquid water molecules (e.g., they're larger, smaller, in a different configuration).																												
3. Students show liquid water molecules moving around, but solid water molecules aren't moving at all.																												
4. Students describe other changes in particles but don't mention movement (e.g., particles are spread out and take up more space; they're in a box or bag).																												
5. Students don't mention heating or cooling as it relates to the melting or freezing processes.																												
6. Atoms and molecules are visible.																												
7. In solids, the molecules are stuck together.																												
8. Molecules in a solid do not move.																												