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| Selected & Constructed Response Items C4.4a |
| Explain why at room temperature different compounds can exist in different phases. |
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| **7/16/2008** |

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| These materials were developed under a grant awarded to Wayne RESA by the Michigan Department of Education. |

Selected/Constructed Response Items for Introduction to Bonding

**C4.4a:** Explain why at room temperature different compounds can exist in different phases.

1. When a small amount is placed in a container
   1. a solid will fill the container and take the shape of the container, where as a liquid will not fill the container and take the shape of the container.
   2. a solid will not full the container and will take the shape of the container, where as a liquid will not fill the container and will take the shape of the container.
   3. a solid will not fill the container or take on the container’s shape, where as a liquid will fill the container and will take on the container’s shape.
   4. a solid will not fill the container or take on the container’s shape, where as a liquid will not fill the container and will take on the container’s shape.
2. A solid is different from a liquid in that
   1. the particles of a solid are in contact with each other and can move past each other, and those of a liquid are not in contact with each other and can move past each.
   2. the particles of a solid are in contact with each other and cannot move past each other, and those of a liquid are in contact with each other and can move past each other.
   3. the particles of a solid not in contact with each other and cannot move past each other, and those of a liquid are in contact with each other and can move past each other.
   4. the particles of a solid are in contact with each other and cannot move past each other, and those of a liquid are not in contact with each other and can move past each other.
3. At room temperature and pressure, carbon dioxide (atomic mass: 46.005amu/CO2) is a gas, where as water (atomic mass: 18.015amu/H2O) is a liquid. The reason that the more massive carbon dioxide is a gas while water is a liquid is
   1. carbon dioxide is a polar compound, so there is a stronger attraction between its molecules than exists between the non-polar molecules of water.
   2. carbon dioxide is a non- polar compound, so there is a stronger attraction between its molecules than exists between the polar molecules of water.
   3. carbon dioxide is a non-polar compound, so there is less attraction between its molecules than exists between the polar molecules of water.
   4. carbon dioxide is a non-polar compound, so there is less attraction between its molecules than exists between the non-polar molecules of water.
4. Why are almost all ionic compounds solids at room temperature?
5. Methane, CH4 is a gas at room temperature and pressure. On the other hand dichloromethane CH2Cl2 is a liquid under the same conditions. Diagram the molecular geometry of each of these compounds, and use it to explain why these two compounds behave differently.

Teacher Companion Notes to Selected Constructed Response Items

for Introduction to Bonding

**High School Chemistry**

**C4.4a:**

**Question 1:**

**Difficulty:** Low, all students should be able to answer this question correctly.

**Correct answer: d**, a direct observation of the demonstration of phase changes.

Distracter a, incorrect description of the solid.

Distracter b, incorrect description of the solid.

Distracter c, incorrect description of a liquid.

**Question 1:**

**Difficulty:** Average, a well prepared student should be able to answer this question.

**Correct answer: b**, behavioral characteristics of solid and liquid particles, inferred from macroscopic observation.

Distracter a, incorrect description of solid and liquid particle behavior.

Distracter c, incorrect description of solid particle behavior.

Distracter d, incorrect description of liquid particle behavior.

**Question 3:**

**Difficulty:** High, this question may challenge the above average student.

**Correct answer: c**, Lower intermolecular attraction results in volatility.

Distracter a, incorrect description of carbon dioxide and water.

Distracter b, incorrect interpretation of the effects of polarity.

Distracter d, incorrect description of water’s polarity.

**Question 4:**

**Difficulty:** Average, a well prepared student should be able to answer this question.

**Correct answer:** should include a description of the structure of an ionic crystal lattice, and describe how the attraction between unlike charged ions results in the particles being held together and unable to move past each other.

**Question 5:**

**Difficulty:** High, this question may challenge the above average student.

**Correct answer:** should recognize both molecules as tetrahedral, but with methane being non-polar and dichloromethane polar. The greater attraction between the polar molecules of dichloromethane creates a condition where the molecules stay in contact with each other, but still are able to move past each other.