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| Selected & Constructed Response Items C2.1c |
| Compare qualitatively the energy changes associated with melting various types of solids in terms of the types of forces between the particles in the solid. |
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Selected/Constructed Response Items for Thermochemistry & Solutions

**C2.1c:** Compare qualitatively the energy changes associated with melting various types of solids in terms of the types of forces between the particles in the solid.

1. Sodium chloride has a melting point of 801ºC, the melting point of water is 0ºC. This is because:
   1. sodium chloride is a polar compound and water is a non-polar compound, so the attraction between solid sodium chloride particles is greater than that between water particles.
   2. sodium chloride is a non-polar compound and water is a polar compound, so the attraction between solid sodium chloride particles is greater than water particles.
   3. both sodium chloride and water form a three dimensional network of bonds in their solid form, but the bonds that hold the particles of sodium chloride together are weaker than those that hold the particles of water together.
   4. both sodium chloride and water form a three dimensional network of bonds in their solid form, but the bonds that hold the particles of sodium chloride together are stronger than those that hold the particles of water together.
2. The melting point of methane (CH4) is –182ºC, the melting point of water is 0ºC. This is because:
   1. methane is a non-polar compound, so there is comparatively weak attraction between the particles that make up its solid, and water is a polar compound so there is a much stronger attraction between the particles that make up its solid.
   2. methane is a polar compound, so there is comparatively weak attraction between the particles that make up its solid, and water is a non-polar compound so there is a much stronger attraction between the particles that make up its solid.
   3. methane is an ionic compound, so there is comparatively weak attraction between the particles that make up its solid, and water is a polar compound so there is a much stronger attraction between the particles that make up its solid.
   4. methane is an ionic compound, so there is comparatively weak attraction between the particles that make up its solid, and water is a non-polar compound so there is a much stronger attraction between the particles that make up its solid.
3. The melting point of methane (CH4) is –182ºC, that of decane (C10H22) is –30ºC, this is because:
   1. methane is non-polar so the attraction between the particles of solid methane is small, and decane is polar so the attraction between solid particles of decane is greater.
   2. methane is polar so the attraction between particles of solid methane is small, and decane is non–polar so the attraction between solid particles of decane is greater.
   3. both methane and decane are non polar, but decane is made of much larger molecules, so the attraction between each particle of decane is greater than that between particles of methane.
   4. both methane and decane are polar, but decane is made of much larger molecules, so the attraction between each particle of decane is greater than that between particles of methane.
4. The halogens, in order that they appear on the periodic table are fluorine, chlorine, bromine and iodine. Predict the relative trend in their melting point, and explain this trend.
5. One of the characteristics that distinguish the metals from the non-metals is that metals have a high melting point and non-metals do not. Explain this difference in terms of the attraction between the particles that make them up.

Teacher companion Notes for Selected/Constructed Response Items  
 for Thermochemistry & Solutions  
**High School Chemistry:**

**C2.1c:**

**Question 1:**

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

**Correct answer: d**, one of the classic examples that differentiate melting points based on inter-particle attraction.

Distracter a, misidentification of the bonding character of sodium chloride and molecular character of water.

Distracter b, misidentification of the bonding character of sodium chloride, and the effect of this characterization.

Distracter c, improper interpretation of the effect of the bonding character of the two compounds.

**Question 2:**

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

**Correct answer: a**, another classic example that differentiate melting points based on inter-particle attraction.

Distracter b, misidentification of the bonding character of both compounds.

Distracter c, misidentification of the bonding character of methane.

Distracter d, misidentification of the bonding character of methane and water.

**Question 3:**

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

**Correct answer: c**, like polarities, but greater opportunity for coordination of weak bonding on the larger molecule results in greater inter-particle attraction.

Distracter a, misidentification of bonding character of decane.

Distracter b, misidentification of the bonding character of methane.

Distracter d, misidentification of the bonding character of methane and decane.

**Question 4:**

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

**Correct answer:** should include dispersion forces and the influence of molecular size on the inter-particle attraction.

**Question 5:**

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

**Correct answer:** should include the electron sea model of metallic bonding and the covalent nature of non-metal bonding, correlated with the resulting inter-particle attractions.