Answer keys to "Temperature and Formation of Solar System"

1. **[Approximately 600 K]** A range of answers is acceptable.
2. **[Approximately 400 K]**
3. **[Mars, Earth, Venus, and Mercury]** You will need to recognize that the graph uses the Kelvin scale for temperature.
4. **[Jupiter, Saturn, Uranus, and Neptune]**
5. **[Greater than approximately 3.0 AU]** Beyond about 3.0 AU, the temperature in the solar nebula was below the freezing point of water and would allow condensation of gases.
6. **[Less than approximately 2.7 AU]** For a rocky planet to have formed requires that the solar nebula was too hot for hydrogen and helium to condense, which happens at temperatures greater than the boiling point of water.
7. **[No]** This region of the solar nebula would have been too hot for gases to condense.

   Some students may recall that the majority of the extrasolar planets that have been discovered so far are described as “large/hot Jupiters” and yet typically orbit at much less than 2.2 AU. This may suggest a more complex formation process in the case of those systems, or an evolution may occur over time in the history of those solar systems.

Answer keys to "Earth’s Changing Surface"

1. **[Oceanic plate is moving right, continental plate is moving left.]**
2. **[D]** Material cools as it rises so the mantle at D is hotter.
3. **[Position A, right; Position B, down; Position C, left; Position D, up.]**
4. **[Student 1 is correct]** Student 2 thinks it would be possible for momentum to keep this motion going over all these years—which isn’t possible.
5. **[It will disappear when it moves under the continental plate.]** The oceanic plate

is being moved to the right by the motion of the mantel material. And because the oceanic plate is more dense than the continental plate, the oceanic plate is being forced beneath the continental plate. Eventually, these motions will cause the island on the oceanic plate to be under the continental plate.

6. **[It will disappear when it moves under the continental plate.]** The oceanic plate is being moved to the right by the motion of the mantel material. And because the oceanic plate is more dense than the continental plate, the oceanic plate is being forced beneath the continental plate. Eventually, these motions will cause the impact crater on the oceanic plate to be under the continental plate, just like with the island in Question 5.
7. **[Over time this crater will be covered or altered due to volcanic activity such as a lava flow.]**
8. **[It is cool and inactive (not molten and active).]** The abundance of craters indicates that the Moon's surface is stable over long periods of time and thus, must not have a molten interior.
9. **[Evidence of plate tectonics such as active volcanism, or a lack of old craters]** Plate tectonics is driven by a molten interior.