

**Rating Guide**  
**ESS Cluster-25**

**Item Alignment**  
**Earth and Space Sciences**  
**Earth's Climate Cluster**

Item Number	

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- 1 [1] Allow 1 credit for *both* a correct spatial and temporal change. Acceptable responses include, but are not limited to:
- Spatial change:
- After Theia impacted Earth, the Moon was 14,000 miles away from Earth. Now, the Moon is 239,000 miles away from Earth because it is moving away from Earth.
  - The Moon is 17 times farther away from Earth now compared to the Moon’s position one month after Theia’s collision.
- Temporal change:
- The initial collision of Theia took place over 20 hours and the Moon formed within a month with Theia material scattered throughout Earth’s mantle.
  - 4.5 billion years after post-impact, material from Theia had settled to the bottom of Earth’s mantle.
- 2 [1] Allow 1 credit for 4.
- 3 [1] Allow 1 credit. Acceptable responses include, but are not limited to:
- Zircons found in Moon rocks must have contained 50% Uranium-238 and 50% Lead-206, which indicated that the rocks were approximately 4.5 billion years old, which is the same age as Earth.
  - Zircons in the Moon rocks contained amounts of Uranium-238 and Lead-206 that indicated a decay rate of one half-life, which means the zircons were about 4.5 billion years old. This is about the same age as Earth.
- 4 [1] Allow 1 credit for 3.
- 5 [1] Allow 1 credit for 1.

