**Earth and Space Sciences**
**Rating Guide**
**Modeling of Earth's Interior Sample Cluster**

1 [1] Allow 1 credit for 2.

2 [1] Allow 1 credit for identifying **Change in Density** as the characteristic for evidence 1, **States of Matter** for evidence 2, *and* appropriate explanations. Acceptable explanations include, but are not limited to:

Explanation 1:

— The velocity of seismic waves change as the waves travel from a less dense layer to a more dense layer.

— The transition from one Earth layer to another is associated with an increase in density, and this is where a sudden change in velocity occurs.

Explanation 2:

— Shear waves cannot travel through a liquid, but can travel through a solid. The presence of sheer waves indicates the state of matter of that layer.

— The outer core is a liquid and shear waves do not travel through a liquid. The state of matter of an Earth layer affects the presence of the type of seismic wave.

3 [1] Allow 1 credit for 4.

4 [1] Allow 1 credit for *both* tectonic plate interactions. Acceptable responses include, but are not limited to:

Tectonic interaction *A*:

— continental convergence

— convergence of two tectonic plates

— subduction of one plate under another plate

Tectonic interaction *B*:

— rifting/divergence along ridge

— sea-floor spreading (at mid-ocean ridge)

— rising magma above a hot spot (creating an island arc)

5 [1] Allow 1 credit for *2.*

6 [1] Allow 1 credit. Acceptable responses include, but are not limited to:

— Convection currents cause rising magma to reach the surface, solidify into rock with a certain magnetic polarity, and move away from the ridge, forming a mirror image pattern on either side of the ridge.

— Convection currents cause magma to rise to the surface and form basalt, pushing the older basalt with a different magnetic polarity away from either side of the ridge.

— Convection currents cycle materials at the ridge, pushing rocks further from both sides of the ridge. The pattern of the magnetic field on each side of the ridge is a mirror image of the other.

**Item Alignment**
**ESS - Modeling of Earth's Interior Cluster**

| Item Number | Performance Expectation |
|---|---|
| 1 | HS-ESS2-3 |
| 2 | HS-ESS2-3 |
| 3 | HS-ESS2-3 |
| 4 | HS-ESS2-3 |
| 5 | HS-ESS2-3 |
| 6 | HS-ESS2-3 |

**Earth and Space Sciences**
**Rating Guide**
**Plate Tectonics Sample Cluster**

1 [1] Allow 1 credit. Acceptable responses include, but are not limited to:

— Over 300 million years, the continents separated by diverging tectonic plates.

— Diverging plates separated the continents, creating two separate mountain chains located thousands of kilometers apart/~5000 - 7000 km apart.

2 [1] Allow 1 credit for containing/presence of uranium and a correct explanation. Acceptable explanations include, but are not limited to:

— Half of the uranium found in some of the zircon crystals will decay into a stable material after 4.5 billion years.

— Uranium is a radioactive substance that has a constant rate of decay, which allows it to be used for dating rock samples.

— Uranium is a radioactive substance that decays at a predictable rate, so the amount of uranium that remains can be used to determine the age of the rock.

— The exponential decay of uranium in the rock allows for the radiometric dating of the rocks in the Appalachian Mountains.

3 [1] Allow 1 credit for 2.

4 [1] Allow 1 credit for 1.

5 [1] Allow 1 credit for 2.

6 [1] Allow 1 credit for *both* correct responses. Acceptable responses include, but are not limited to:

Predicted hydrosphere change:

— Less water flowed into Earth's mantle.

— Less water flowed into the mantle, while more water stayed on the surface.

Predicted sea level change:

— sea level increased

— Sea level must have increased because there was less water on the surface.

**Item Alignment**
**ESS - Plate Tectonics Cluster**

| Item Number | Performance Expectation |
|---|---|
| 1 | HS-ESS2-1 |
| 2 | HS-ESS1-6 |
| 3 | HS-ESS1-5 |
| 4 | HS-ESS2-3 |
| 5 | HS-ESS1-5 |
| 6 | HS-ESS2-2 |

**Earth and Space Sciences**
**Rating Guide**
**The Effect of the Moon on Earth Sample Cluster**

1 [1] Allow 1 credit for an acceptable response. Acceptable responses include, but are not limited to:

— Every six hours the observer experiences a different tide height from low to high or high to low because of Earth's regular rotation every 24 hours.

— In a 24-hour period, the person experiences two high tides and two low tides.

2 [1] Allow 1 credit for 1.

3 [1] Allow 1 credit for 2.

4 [1] Allow 1 credit for October 6 *or* October 7 and a correct piece of evidence. Acceptable responses include, but are not limited to:

— The first quarter Moon phase from August 31 to September 29 takes 29 days to complete one cycle. Therefore, the time period required for any cycle of phases would be the same amount of time.

— It takes about 29 to 30 days for a full cycle of one full Moon to the next full Moon. 29.5 days from September 7 would be October 6 or October 7.

5 [1] Allow 1 credit for 2.

6 [1] Allow 1 credit for 3.

**Item Alignment**
**ESS - The Effect of the Moon on Earth Cluster**

| Item Number | Performance Expectation |
|---|---|
| 1 | HS-ESS1-7 |
| 2 | HS-ESS1-7 |
| 3 | HS-ESS3-1 |
| 4 | HS-ESS1-7 |
| 5 | HS-ESS1-4 |
| 6 | HS-ESS1-7 |