Name _____ Date _____ Class _____

Enrichment **LESSON 3**

Eclipses and Tides

The gravitation between Earth, the Moon, and the Sun results in a cyclic rise and fall of ocean waters on Earth. The tides are caused primarily by the Moon—not the Sun—because the Moon is about 400 times closer to Earth than the Sun is. But there are some complications in this model.

Tide Irregularities

The Moon revolves around Earth, Earth revolves around the Sun, and all are revolving around the center of mass for the Galaxy; as their spatial relations change, they influence the tides differently. Also, Earth is not covered by water—some of it is land. Some ocean waters, such as estuaries, are shallow and protected from vigorous tides. All this means that the tides in every location on Earth are not as regular and predictable as the phases of the Moon and the revolution of Earth.

Spring Tides and Neap Tides

When the Sun, the Moon, and Earth are aligned in that order, the Sun and the (new or full) moon affect the waters of Earth to produce spring tides. These larger-than-normal tides are caused by the Sun and the Moon joining forces. When the Sun and the Moon are at right angles to one another, such as when the Moon is at first quarter or last quarter phase, they produce a neap tide. Neap tides are weaker than normal tides.

False Tides

A rip tide is not a tide in the lunar gravitational sense. This type of tide occurs when storm waves affect the shape of underwater sandbars near shore and a part of the sandbar breaks out. Outflowing currents rush through this gap, sometimes catching swimmers unaware. They are powerless to swim against the current, but they can swim parallel to it. When they are out of the rip area, they can then swim toward shore.

A tidal wave is another event that is not a lunar gravitational tide. Tidal waves are caused by a deep-sea geologic event, such as an earthquake, the collapse of a seamount or the wall of a continental shelf, or the Storm tides, also called storm surges, are swells of water that are pushed ahead of a hurricane. A storm surge often causes more damage to an area than the storm itself, especially when the storm surge coincides with a high tide. Storm tides are caused by storms, not the Moon's or the Sun's gravity.

Applying Critical-Thinking Skills

Directions: *Respond to each statement.*

1. **Summarize** at least three main influences on tidal movements.
2. **Compare** surfing in an incoming neap tide to surfing in an incoming spring tide.
3. **Infer** at least one reason why rip tides, tidal waves, and storm tides became associated with gravitational tides.