NO PREP

Ocean Tides

Gravitational Forces of the Moon and Sun

Includes: Student reading, case study, differentiated questions, teacher key

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Name: Period: Date:

Ocean Tides: Gravitational Forces of the Moon and Sun

The Rhythms of the Sea

One of the most visible and predictable movements of the ocean is the rise and fall of the tides. While waves and currents may seem random, tides follow a reliable cycle influenced by the gravitational pull of the Moon and the Sun. Twice daily, coastlines around the world experience a rhythm of rising and falling water that shapes ecosystems, influences human activity, and connects the ocean directly to celestial forces. Understanding tides is essential for navigation, fishing, coastal planning, and even renewable energy projects. Ancient cultures carefully observed tidal patterns for survival, while today's scientists use satellites and computer models to predict them with incredible accuracy. Tides remind us that the ocean is not an isolated system; it responds to the forces of the wider universe.

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The Science of Gravitational Pull

Tides occur primarily because of the gravitational attraction between Earth and the Moon. The Moon's pull causes a bulge of water on the side of Earth facing it. At the same time, inertia creates another bulge on the opposite side of the planet. As Earth rotates, different areas pass through these bulges, experiencing high tide when within them and low tide when between them. The Sun also exerts gravitational influence, though it is much farther away. When the Sun, Earth, and Moon align, the combined pull produces spring tides, with the highest highs and lowest lows. When the Sun and Moon are at right angles, their forces partially cancel each other out, producing neap tides, which are weaker. These predictable variations in tidal range affect ecosystems, shipping, and human infrastructure.

Key Information: Key Concepts Table

Term	Definition	Example/Impact
High Tide	Water level rises due to gravitational bulges	Bay shoreline floods
Low Tide	Water level falls between tidal bulges	Exposed tide pools
Spring Tide	Sun and Moon align, producing strong tides	Highest highs, lowest lows
Neap Tide	Sun and Moon at right angles, weaker tides	Small tidal range
Tidal Range	Difference between high and low tide	Bay of Fundy has world's largest

Case Study: The Bay of Fundy

The Bay of Fundy, located between Nova Scotia and New Brunswick in Canada, is famous for having the highest tidal range in the world. In some areas, the difference between high and low tide exceeds 15 meters (50 feet). This dramatic rise and fall occurs because the bay's shape amplifies the gravitational effects of the Moon and Sun. Essentially, the bay acts like a giant funnel, concentrating tidal energy into a narrow space. The result is an extreme tidal system that supports unique ecosystems and offers potential for tidal energy projects. For local communities, these tides are both a challenge and an opportunity. Fishermen must plan carefully to use harbors that dry out completely at low tide. Tourists flock to see famous tidal phenomena, such as the reversing falls near Saint John, where the river temporarily flows backward as the tide pushes inland. Scientists are also studying how the Bay of Fundy's powerful tides can be harnessed to generate clean energy without harming the delicate marine environment.

1. How does the shape of the Bay of Fundy amplify tidal effects?

_____

_____

2. What opportunities and challenges do extreme tidal ranges create for local communities?

_____

_____

Multiple Choice

1. What primarily causes tides on Earth?

    a) Winds pushing surface waters toward shore during seasonal storms

    b) Earth's rotation alone

    c) Earth's magnetic field

    d) The gravitational pull of the Moon and the Sun

2. What type of tide occurs when the Sun, Moon, and Earth are aligned?

    a) Diurnal tide

    b) Spring tide

    c) Neap tide

    d) Mixed tide

3. Why does the opposite side of Earth from the Moon also experience a high tide?

    a) Inertia creates a second bulge of water

    b) Earth's rotation speeds up water flow near the coastlines

    c) Tides bounce back from coastlines

    d) Water is pulled by the Sun only

Matching

Write the letter of the correct definition on the line next to each term.

Term	Definition
1. ___ Spring Tide	A) Canada's bay with world's largest tidal range
2. ___ Neap Tide	B) Water recedes, exposing tide pools and mudflats
3. ___ High Tide	C) Alignment of Sun, Moon, Earth causes strong tides
4. ___ Low Tide	D) Caused by gravitational bulges of water
5. ___ Bay of Fundy	E) Occurs when Sun and Moon are at right angles

Fill-in-the-Blank

1. The difference between high tide and low tide is called the tidal _____.

2. When the Sun and Moon are aligned, a _____ tide occurs.

3. The Bay of _____ is famous for its extreme tidal range.

Short Answer

Answer each question in 2-4 complete sentences.

1. Explain the role of the Sun in creating tides compared to the Moon.

_____

_____

_____

2. Why are spring tides stronger than neap tides?

_____

_____

_____

3. How might tidal energy projects benefit from locations like the Bay of Fundy?