

Section 3 The Circulation of Ocean Water

Directions of motion in a wave

How many directions of motion in a wave are there? What are they?

What is the resulting motion? –

Draw and label a profile view of a wave – Fig. 8-24 on p. 403.

What is the relationship between wave base and wavelength? -

Show the directions of movement of the water in the wave you drew.

Write the definitions of the terms and give their Czech meanings:

Crest-

Trough [trof]-

Wave height –

Wavelength –

Wave base –

Swell – a regular pattern of waves of similar wavelength.

x

Upwelling – a process by which deep, cold water comes to the surface

What do you think the following phrase mean? First explain in English.

To be on the same wavelength –

The beginning, middle, and end of a wave

Fill in the gaps with one of these words: According across caused during either eventually flatter forward lengths motion other pattern ratio swell times transmit until

Many ocean waves begin in a state of total confusion. They form in a storm area and are _____ by the winds associated with the storm. The water surface under a storm center at sea has a very irregular _____ of waves. Waves of different heights and _____ are formed by the winds within the storm center. Some of the waves exceed a height-to-length _____ of 1 to 7 and collapse. Other waves interact with each _____ to make the surface of the ocean even more confused. Ships and other surface objects such as offshore oil-drilling rigs have a very difficult time _____ a storm at sea. Waves _____ energy that is directly proportional to the square of the wave height. A wave two meters high has four _____ as much energy as a wave one meter high.

The middle stage of a wave is much more regular than its beginning. As waves move away from a storm center, they separate _____ to wavelength. Waves with long wavelength travel faster. Eventually a regular rhythmic pattern of waves called _____ develops. It can cover hundreds of kilometers of open ocean, with the waves all moving _____ without breaking or collapsing. The orbital _____ within the waves of ocean swell is circular. The energy is transmitted _____ the ocean with very little loss.

Most waves _____ end up on a beach. As ocean swell _____ nears the shore, the water becomes shallower. Where the ocean bottom is above wave base, the orbital motion of the water in waves changes from circular to elliptical. As the water continues to become shallower, the elliptical orbit becomes _____. At the same time, the wavelength shortens and the wave height increases _____. The wave can no longer maintain its shape and collapses, _____ as a foaming mass of water or as a forward-breaking mass of water. The area near the ocean's margins where breaking waves occur is called **surf zone**.

Check yourself

What force in nature creates most ocean waves? –

What aspect of wave motion is responsible for the development of swell? –

Describe what happens to a wave as it nears the shore – you may use Fig. 8-27 on p.406 to copy it on this worksheet.

Effects of wave action

Fill in the gaps with suitable words. If you have no idea, choose one of the words from the clue below the text.

In _____ to the waves of stormy seas, there are also huge waves that form as a result of wave interference. Wave shapes are additive. When the swells from different storm centers pass through the same water and the crests and _____ coincide, a single crest forms that is _____ in height to the sum of the two original crests. When two or more high waves of about the same wavelength have their crests coincide, the resultant **rogue wave** is usually big enough to cause problems for ships. They can form and disappear very quickly. The south-eastern _____ of Africa is known for fairly frequent rogue waves which develop heights up to twenty meters.

Along the margins of the oceans, waves can directly attack the land. The constant **pounding of waves** can, over long periods of time, reduce boulders and rocky _____ to particles of gravel and sand. Waves also create movement of _____ particles and water in the surf and on the beach. Waves _____ the shore diagonally, which causes a zigzag motion of water along a coastline. The sand may be moved hundreds of kilometers. If the _____ of sand from rivers and eroding sea cliffs _____ to stop, then most of the sand beaches would eventually disappear. The coastline along the Pacific of North America has a narrow continental _____. In A _____ places, submarine canyons cut across the shelf and fairly close to the shore. The sand that is moving along the shore _____ down into these canyons and drains onto the ocean bottom.

Perhaps the most rapid damage to a shoreline is caused by a huge wave called a **tsunami** – a group of waves with fourteen or more crests caused by an underwater _____ somewhere along the ocean _____. At sea, the waves of a tsunami may have a height of only 2 m and a wavelength of up to 160 km. It can take up to 15 minutes for successive wave crests to pass a given point on the surface of the ocean even _____ they may be traveling more than 600 km _____ hour. _____ of their height-to-length ratio, these waves are scarcely noticeable out at sea.

But as the waves of a tsunami approach the shore and the water becomes shallower, they can _____ to a height of 50 m. Railroad locomotives can be tossed like toys, buildings smashed, trees snapped like toothpicks. Whole villages and cities can be _____ out. Tsunami are most _____ around the margins of the Pacific Ocean.

Clue: Addition approach because bottom build cliffs coast common earthquake equal few loose per shelf slips supply though troughs were wiped

Note the different ways of translating the word **pounding**:

Pounding of hammer / heart – bušení, rány

Pounding of hooves (sg. hoof) – dusot kopyt

Pounding of guns – odstřelování

Writing Summaries & Translating

Tides

Read the text on tides on p. 409 and take notes to write a summary as your homework.

Deep ocean circulation

What causes circulation in the deeper ocean waters? –

Why are some of the world's major fisheries located in areas of upwelling?-

Hometask Translation

The beginnings of some sentences are already given as in sentence transformation.

Je možné, že kaňony a údolí byla vytvořena ledovci během poslední doby ledové.
The canyons and valleys ...

Domníváme se, že Středozevní moře se vytvořilo, když ho uzavřely dva kontinenty.
The Mediterranean Sea ...

Svoji domněnku založili na skutečnosti, že ...

Liší se hloubka oceánských pánví značně?

Jaké neobvyklé druhy organismů se nacházejí v obohacených vodách kolem aktivních vulkanických riftových údolích?

Když je omezena cirkulace hlubokých vod, mohou se v horkých pramenech vytvářet solanky.

