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## DEFINITION OF A WAVE

**What are Waves?**  
**What are “progressive waves”?**  
**Progressive Waves**

**LONGITUDINAL WAVE**  
 Particles (color) move back and forth in direction of energy transmission. These waves transmit energy through all states of matter.

**TRANSVERSE WAVE**  
 Particles (color) move back and forth at right angles to direction of energy transmission. These waves transmit energy only through solids.

**ORBITAL WAVE**  
 Particles (color) move in orbital path. These waves transmit energy along interface between two fluids of different density (liquids and/or gases).

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### DIMENSIONS OF A WAVE OF WATER

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**Still-Water Line** - The level of the ocean if it were flat without any waves.  
**Crest** - The highest part of the wave above the still-water line.  
**Trough** - The lowest part of the wave below the still-water line.  
**Wave Height** - The vertical distance between the crest and the trough.  
**Wavelength** - The horizontal distance between each crest or each trough.  
**Wave Period** - The time it takes for two successive waves to pass a particular point.  
**Wave Frequency** - The number of waves that pass a particular point in a given time period.  
**Amplitude** - The amplitude is equal to one-half the wave height or the distance from either the crest or the trough to the still-water line.

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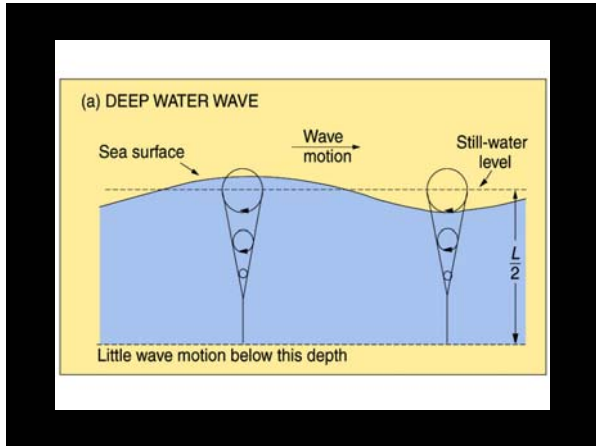
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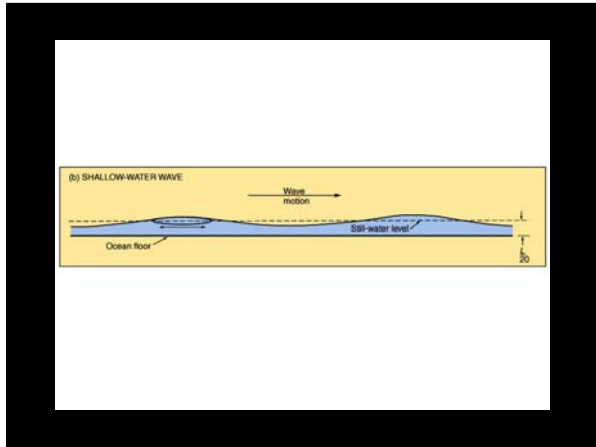
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(c) RELATIONSHIP OF WAVELENGTH TO WATER DEPTH

Shallow-water wave	Transitional wave	Deep-water wave
$L > 20$	$L > 2$ but $< 20$	$L < 2$
$\left[ \frac{d}{L} = 1 \right]$	$\left[ \frac{d}{L} = 1 \right]$	$\left[ \frac{d}{L} = 1 \right]$
$(d < L/20)$	$(d < L/2 \text{ but } > L/20)$	$(d > L/2)$

> = greater than  
< = less than

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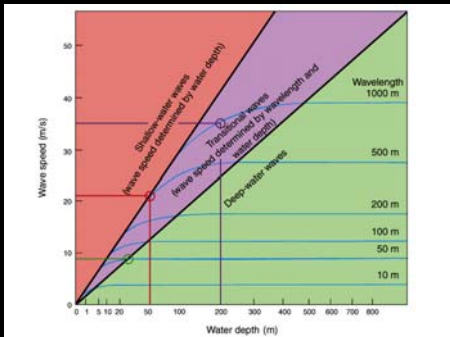
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## Idealized Relationship Between Wave Speed and Water Depth




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## HOW ARE WAVES FORMED?

1. Wind Generated Waves
2. Earthquakes, Storms (Pressure)
3. Sun and Moon (Tide Waves)

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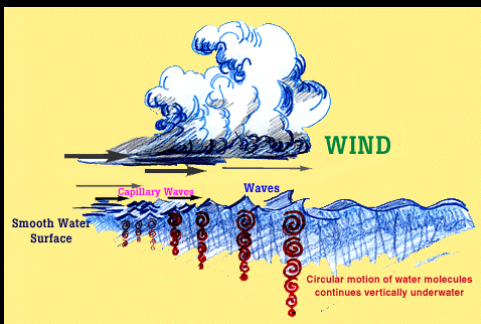
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## Stommel's Model of the Deep-Water Circulation of the World Ocean




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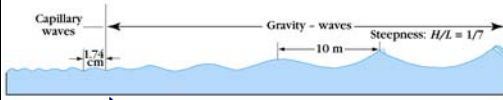
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**Restoring Force- the force that acts to destroy waveforms or restore them to "still water levels"**



Restoring Force is Surface Tension

Restoring Force is Gravity

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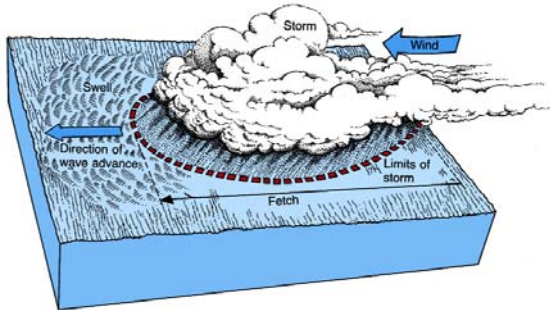
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**Three factors important in increasing the amount of energy transferred to waves:**



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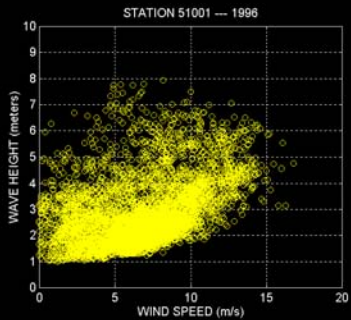
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### Relationship in the Real World!



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**TABLE 10-2** Fetch and Duration Required To Produce Fully Developed Sea for a Given Wind Speed.

Wind Speed km/h (mi/h)	Fetch km (mi)	Duration h
20 (12)	24 (15)	2.75
30 (19)	77 (48)	7
40 (25)	176 (109)	11.5
50 (31)	380 (236)	18.5
60 (37)	660 (409)	27.5
70 (43)	1093 (678)	37.5
80 (50)	1682 (1043)	50
90 (56)	2446 (1517)	65.25

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**TABLE 10-3** Description of Fully Developed Sea for a Given Wind Speed

Wind Speed km/h (mi/h)	Average Height M (ft)	Average Length m (ft)	Average Period s	Highest 10% Waves m (ft)
20 (12)	0.33 (1)	10.6 (34.8)	3.2	0.75 (2.5)
30 (19)	0.88 (2.9)	22.2 (72.8)	4.6	2.1 (6.9)
40 (25)	1.8 (5.9)	39.7 (130.2)	6.2	3.9 (12.8)
50 (31)	3.2 (10.5)	61.8 (202.7)	7.7	6.8 (22.3)
60 (37)	5.1 (16.7)	89.2 (292.6)	9.1	10.5 (34.4)
70 (43)	7.4 (24.3)	121.4 (398.2)	10.8	15.3 (50.2)
80 (50)	10.3 (33.8)	158.6 (520.2)	12.4	21.4 (70.2)
90 (56)	13.9 (45.6)	201.6 (661.2)	13.9	28.4 (93.2)

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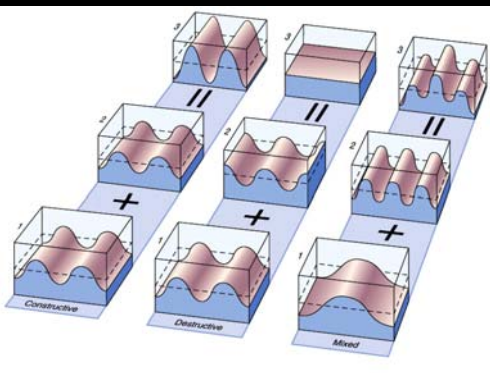
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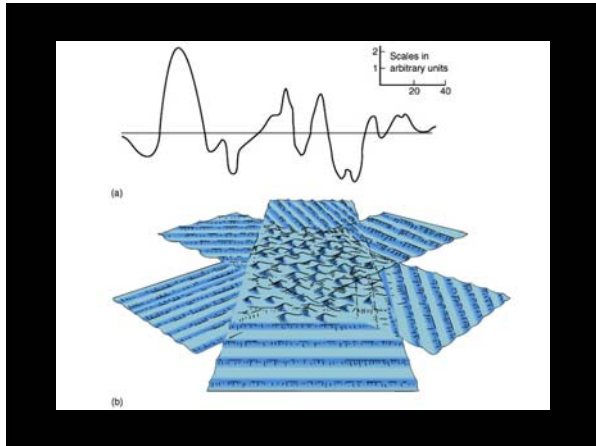
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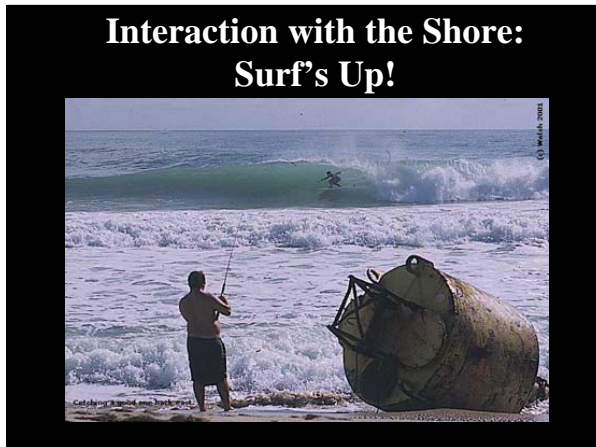
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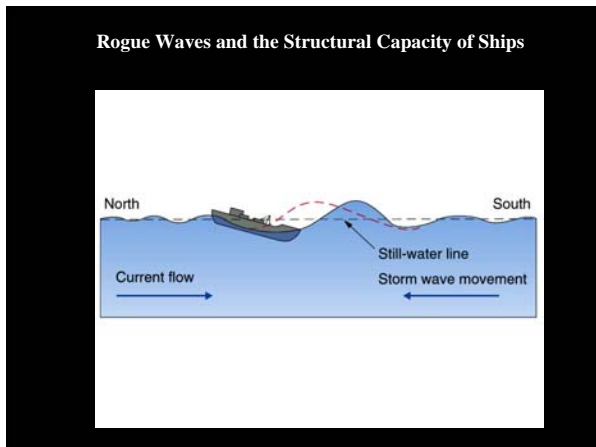
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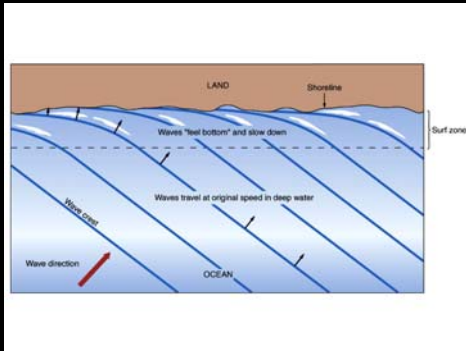
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### Refraction of Waves as They Near Shore



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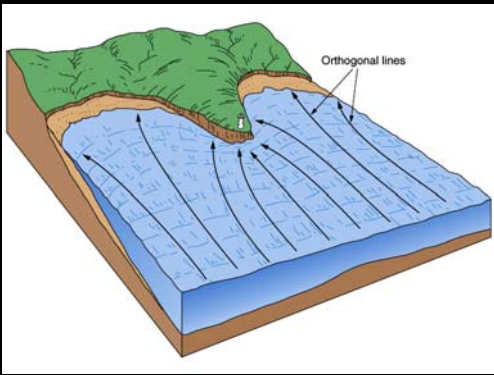
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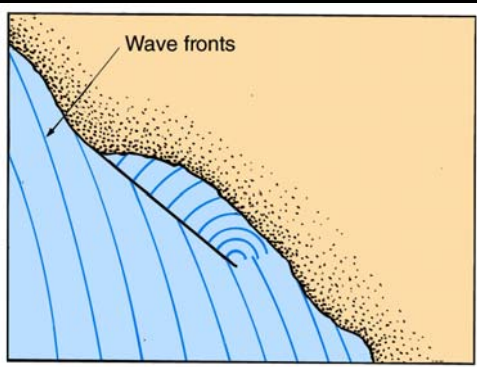
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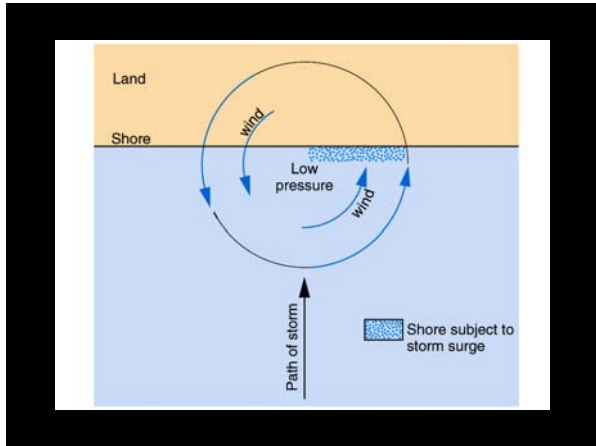
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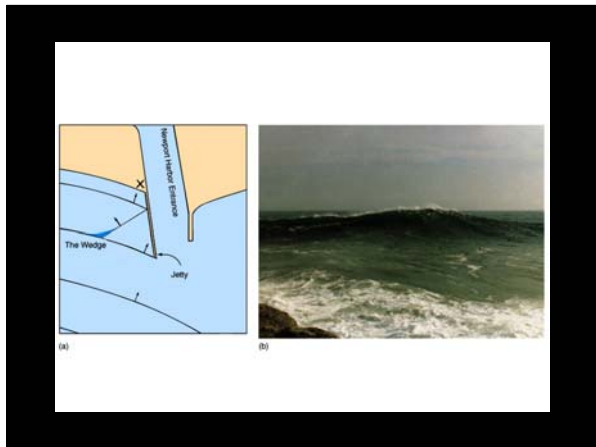
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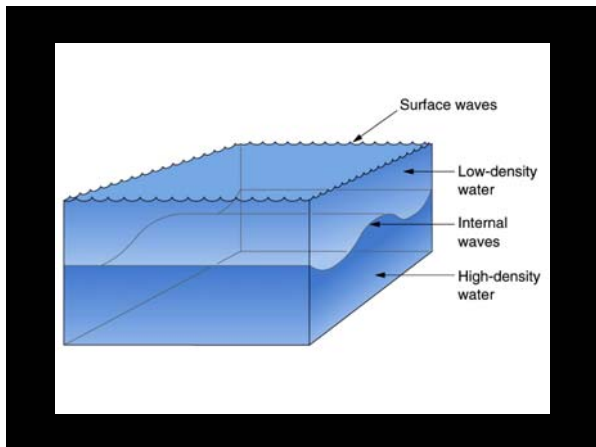
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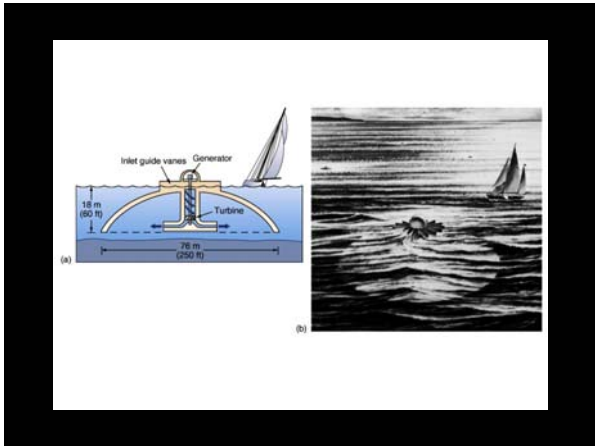
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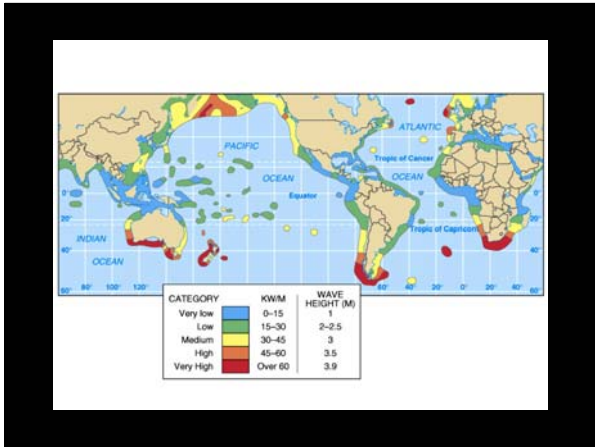
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