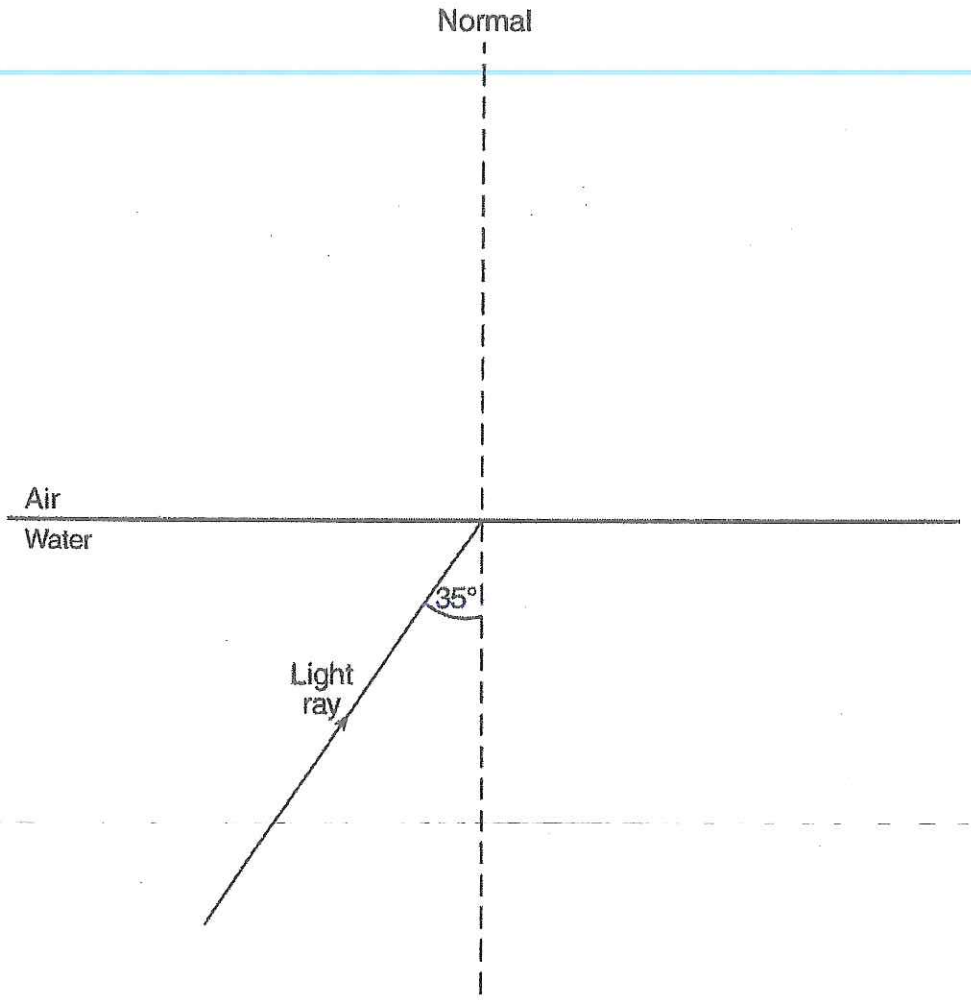
Topic 6B and C Long Answer Review
Skills 48-51

Base your answers to questions **321** and **322** on the information below.

A light ray with a frequency of 5.09×10^{14} hertz traveling in water has an angle of incidence of 35° on a water-air interface. At the interface, part of the ray is reflected from the interface and part of the ray is refracted as it enters the air.



321. Identify *one* characteristics of this light ray that is the same in *both* the water and the air.

Frequency

322. Calculate the angle of refraction of the light ray as it enters the air. [Show all work, including the equation and substitution with units.]

n_1 (water) $= 1.33$ $\theta_2 = ?$

n_2 (air) $= 1$

$\theta_1 = 35°$

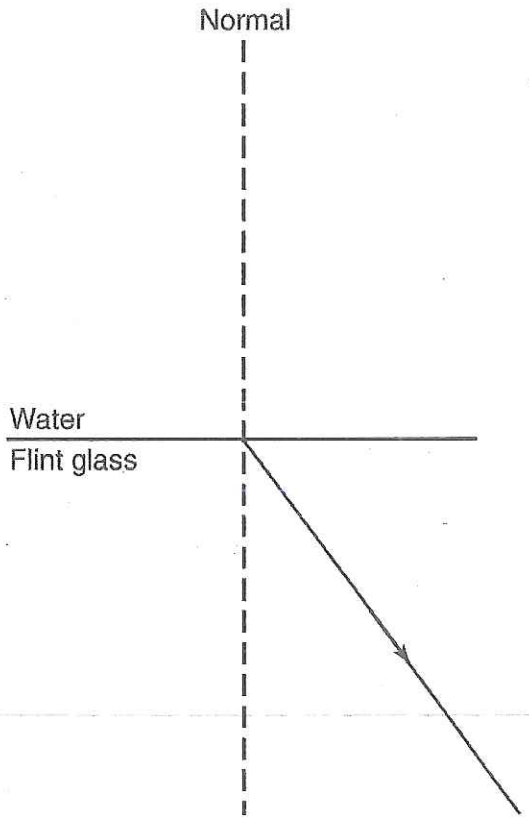
$n_1 \sin\theta_1 = n_2 \sin\theta_2$

$1.33 \sin 35° = 1 \sin\theta_2$

$\theta_2 = 49.7°$

Base your answers to questions **323** and **324** on the information below.

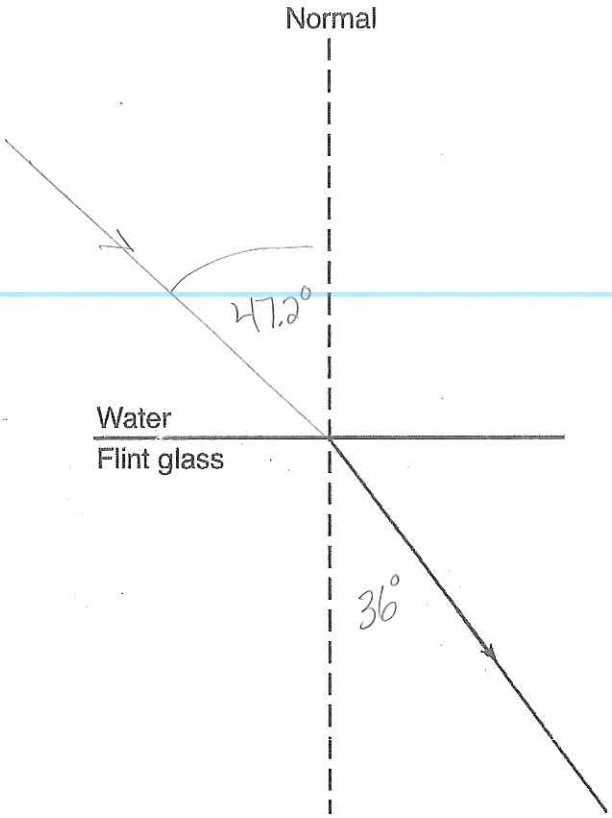
A light ray ($f = 5.09 \times 10^{14}$ Hz) is refracted as it travels from water into flint glass. The path of the light ray in the flint glass is shown in the diagram below.



323. Identify *one* physical event, other than transmission or refraction, that occurs as the light interacts with the water-flint glass boundary.

reflection (accompanies refraction)

324. Using a protractor and straightedge, on the diagram below, draw the path of the incident light ray in the water.



$\theta_2 = 36^\circ$

$\theta_1 = ?$

$n_1 = 1.33$ (water)

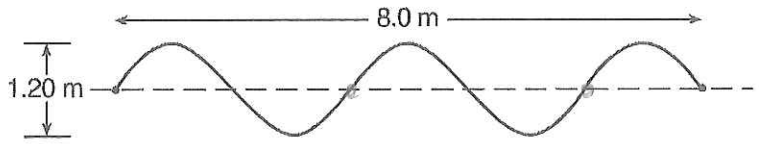
$n_2 = 1.66$ (flint glass)

$n_1 \sin\theta_1 = n_2 \sin\theta_2$

$1.33 \sin\theta_1 = 1.66 \sin 36^\circ$

$\theta_1 = 47.2^\circ$

Base your answers to questions **325** and **326** on the diagram below, which shows a wave in a rope.



325. Determine the amplitude of the wave.

.6 m (amplitude is from crest to equilibrium or trough to equilibrium)

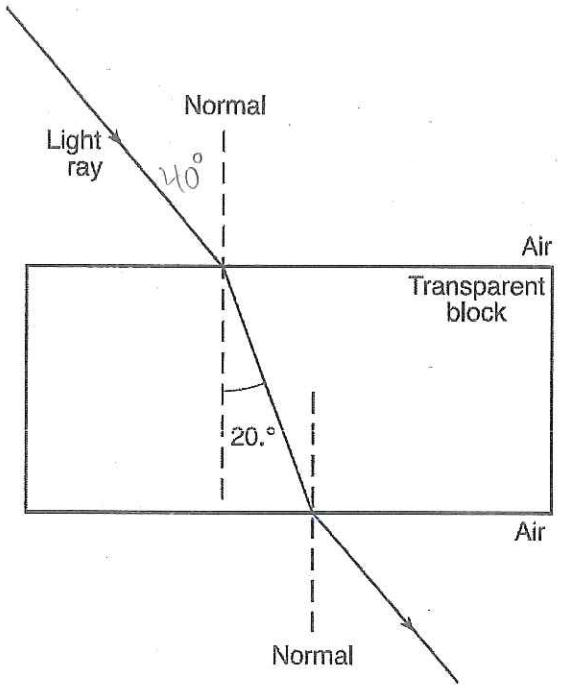
326. Determine the wavelength of the wave.

2.5 cycles = 8m

wavelength = $\frac{8\text{m}}{2.5\text{cycles}}$ = 3.2m

Base your answers to questions **327** and **328** on the information below.

A ray of monochromatic light ($f = 5.09 \times 10^{14}$ Hz) passes through air and a rectangular transparent block, as shown in the diagram below.



327. Calculate the absolute index of refraction for the medium of the transparent block. [Show all work, including the equation and substitution with units.]

$\theta_1 = 40^\circ$
$n_1 = 1$
$n_2 = ?$
$\theta_2 = 20^\circ$

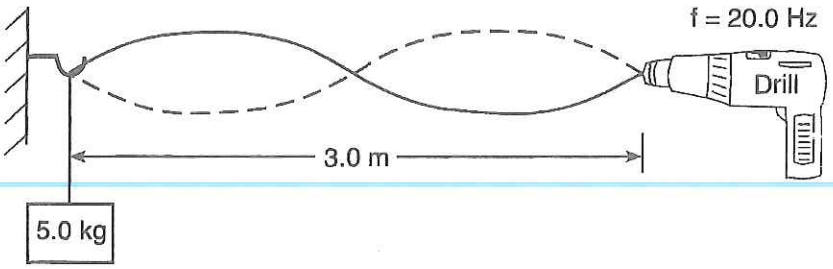
$n_1 \sin\theta_1 = n_2 \sin\theta_2$
$1 \sin 40^\circ = n_2 \sin 20^\circ$
$n_2 = 1.88$

328. Using a protractor, determine the angle of incidence of the light ray as it enters the transparent block from air.

40°

Base your answers to questions **329** and **330** on the information below.

One end of a rope is attached to a variable speed drill and the other end is attached to a 5.0-kilogram mass. The rope is draped over a hook on a wall opposite the drill. When the drill rotates at a frequency of 20.0 Hz, standing waves of the same frequency are set up in the rope. The diagram below shows such a wave pattern.



329. Calculate the speed of the wave in the rope. [Show all work, including the equation and substitution with units.]

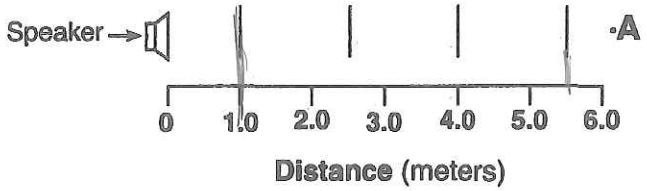
$v = f\lambda$ $(20\text{Hz})(3\text{m}) = 60\text{m/s}$

330. Determine the wavelength of the waves producing the standing wave pattern.

$\lambda = \frac{\text{meters}}{\text{cycle}} = \frac{3\text{m}}{1\text{cycle}} = 3\text{m}$

Base your answers to questions 331 and 332 on the information and diagram below.

The vertical lines in the diagram represent compressions in a sound wave of constant frequency propagating to the right from a speaker toward an observer at point A.



331. The speaker is then moved at constant speed toward the observer at A. Compare the wavelength of the sound wave received by the observer while the speaker is moving to the wavelength observed when the speaker was at rest.

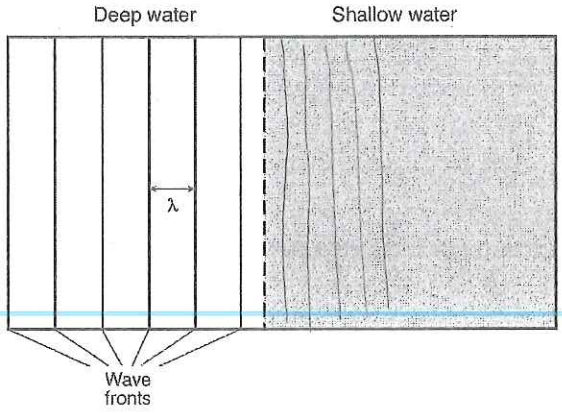
Wavelength will decrease (since frequency increases)

332. Determine the wavelength of this sound wave.

4.5m = 3cycles $\quad \lambda = \frac{4.5\text{m}}{3\text{cycles}} = 1.5\text{m}$

(5.5m - 1m)

333. A wave generator having a constant frequency produces parallel wave fronts in a tank of water of two different depths. The diagram below represents the wave fronts in the deep water.



As the wave travels from the deep water into the shallow water, the speed of the waves decreases. On the diagram above, use a straightedge to draw *at least three* lines to represent the wave fronts, with appropriate spacing, in the shallow water.

Since velocity decreases, wavelength also decreases

334. A student and a physics teacher hold opposite ends of a horizontal spring stretched from west to east along a tabletop. Identify the directions in which the student should vibrate the end of the spring to produce transverse periodic waves.

up and down
or north and south

335. A beam of monochromatic light has a wavelength of 5.89×10^{-7} meter in air. Calculate the wavelength of this light in diamond. [Show all work, including the equation and substitution with units.]

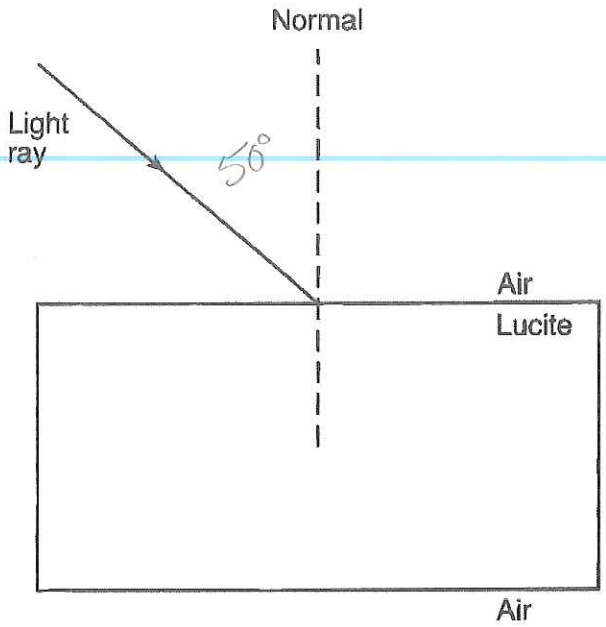
$\frac{n_2}{n_1} = \frac{\lambda_1}{\lambda_2}$ $\quad \frac{2.42}{1} = \frac{5.89 \times 10^{-7}\,m}{\lambda_2}$

$\lambda_2 = 2.43 \times 10^{-7}$

n & λ are inverse

Base your answers to questions **336** through **338** on the information and diagram below.

A monochromatic light ray ($f = 5.09 \times 10^{14}$ *Hz*) *traveling in air is incident on the surface of a rectangular block of Lucite.*



336. What is the angle of refraction of the light ray as it emerges from the Lucite block back into air?

50°

337. Calculate the angle of refraction of the light ray when it enters the Lucite block. [Show all work, including the equation and substitution with units.]

$n_1 \sin\theta_1 = n_2 \sin\theta_2$

$1 \sin 50° = 1.5 \sin\theta_2$

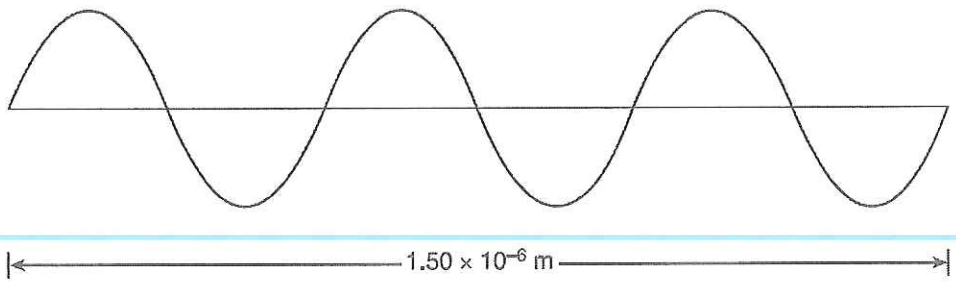
$\theta_2 = 30.7°$

338. Measure the angle of incidence for the light ray to the *nearest degree*.

50°

Base your answers to questions **339** and **340** on the information below.

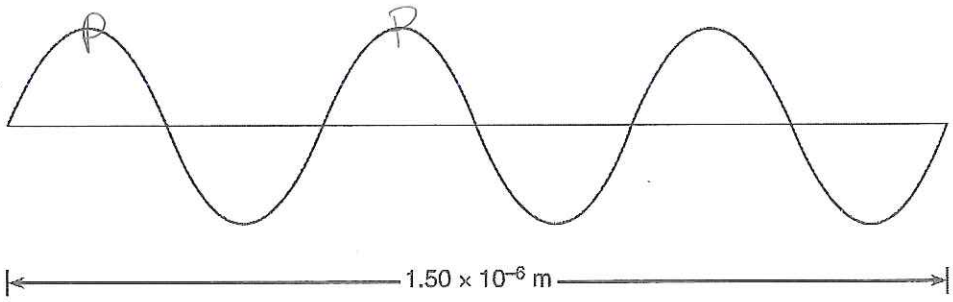
A 1.50×10^{-6}-meter-long segment of an electromagnetic wave having a frequency of 6.00×10^{14} hertz is represented below.



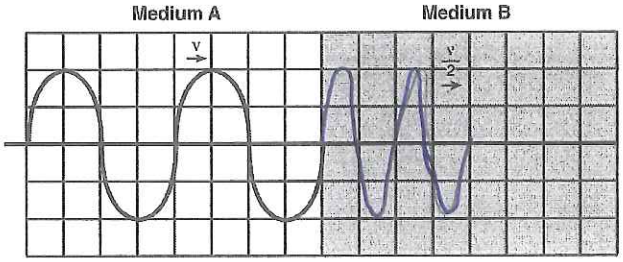
339. According to the *Reference Tables for Physical Setting/Physics*, which type of electromagnetic wave does the segment in the diagram represent?

Green 6×10^{14} Hz falls between ($5.2 \& 6.1 \times 10^{14}$ Hz)

340. On the diagram below, mark *two* points on the wave that are in phase with each other. Label each point with the letter *P*.

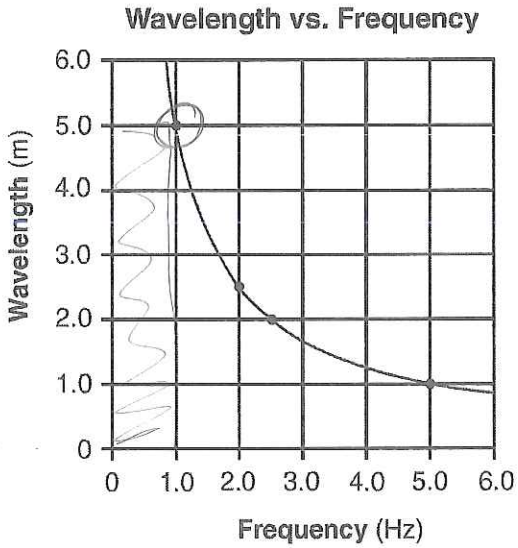


341. A periodic wave travels at speed v through medium A. The wave passes with all its energy into medium B. The speed of the wave through medium B is $\frac{v}{2}$. On the diagram below draw the wave as it travels through medium B. [Show at least one full wave.]



V = λ are direct
so if V is ÷2 λ is ÷2

342. The graph below represents the relationship between wavelength and frequency of waves created by two students shaking the ends of a loose spring.

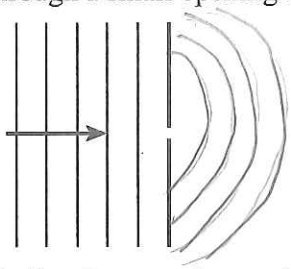


Calculate the speed of the waves generated in the spring. [Show all work, including the equation and substitution with units.]

V = λf so the area under any point is V

V = (5m)(1Hz) = 5 m/s

343. The diagram below shows a plane wave passing through a small opening in a barrier.



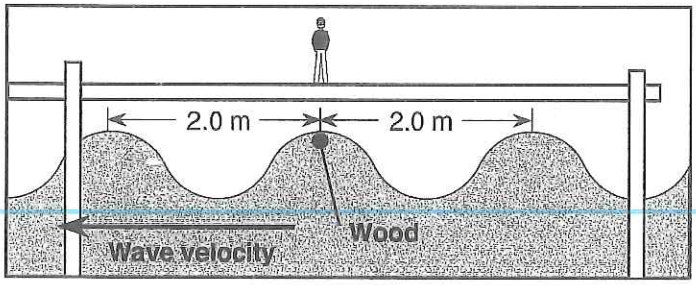
On the diagram above, sketch four wave fronts after they have passed through the barrier.

Spacing should remain Similar

Base your answers to questions **344** and **345** on the information and diagram below.

A student standing on a dock observes a piece of wood floating on the water as shown below. As a water wave passes, the wood moves up and down, rising to the top of a wave crest every 5.0 seconds.

$T = 5s$



(Not drawn to scale)

344. Calculate the speed of the water waves. [Show all work, including the equation and substitution with units.]

$v = f\lambda$ or $v = \frac{\lambda}{T} = \frac{2m}{5s} = .4 m/s$

$f = \frac{1}{5s} = .2Hz$

$= (.2Hz)(2m) = .4 m/s$

345. Calculate the frequency of the passing water waves. [Show all work, including the equation and substitution with units.]

$f = \frac{1}{T} = \frac{1}{5s} = .2Hz$