# 3055 BA SANGAM COLLEGE

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WEEK 11

SCHOOL:BA SANGAM COLLEGE YEAR 12

SUBJECT: PHYSICS NAME OF STUDENT: _____

| | |
|---|---|
| STRAND | ***GEOMETRICAL OPTICS AND WAVE MOTION*** |
| SUB-STRAND | *Waves* |
| Content Learning Outcome | ➢ *Investigate the behavior of light and other waves under various conditions, with reference to the properties of waves* |

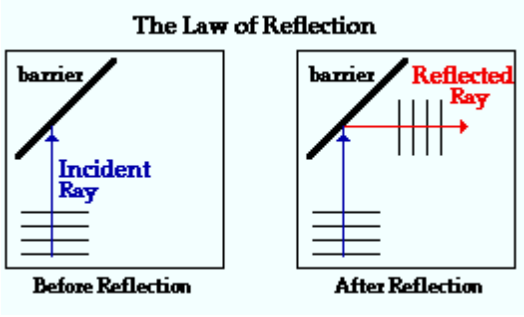
## WAVES

**REFLECTIONS AND TRANSMISSION OF WAVES:**

When waves move from one medium to another, some of the waves are reflected. Type of reflection of waves depends on the type of medium it travels through for example; moving from a slow medium to a fast medium or the other way around

**REFLECTIONS**

Waves are reflected off barriers, obeying the same laws of reflection as light. Note that the angle of incidence equals the angle of reflection.



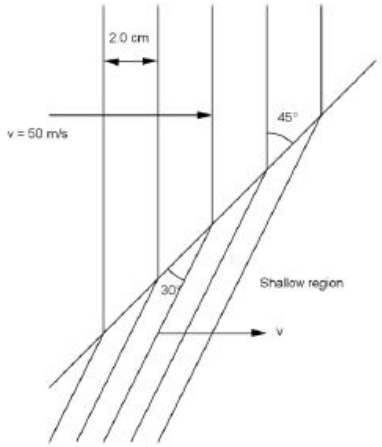

**REFRACTION**

When water waves pass between a deep region and a shallow region they obey the law of refraction. In the shallow region the waves velocity decrease (wavelength decrease and since velocity = frequency x wavelength, velocity decrease since frequency remains constant)

Waves obey Snell's law.

$$\frac{\lambda_1}{\lambda_2} = \frac{v_1}{v_2} = \frac{\sin\theta_1}{\sin\theta_2} = \frac{n_2}{n_1}$$

EG.1Water waves travelling at 5.0 cm/s and with a wavelength of 2.0cm are incident from deep water to shallow water as shown in the diagram.




Determine the relative refractive index.

$n12$= $\sin\theta 1 / \sin\theta 2$

= $\sin 45 / \sin 30$

= 1.41cm

Determine the speed of the waves in the shallow water.

$\sin\theta 1 / \sin\theta 2 = v1 / v2$

$\sin 45 / \sin 30 = 5 / v2$ ∴

$v2$=5.0 $\sin 30 / \sin 45$

$v2$=3.54cm/s

Determine the frequency of the wave

Velocity = frequency x wavelength

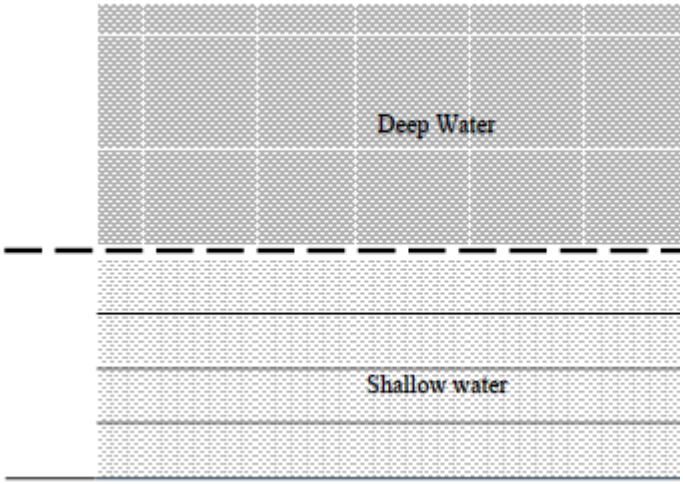
5 = frequency x 2

Frequency = 5/2

f = 2.5Hz

**ACTIVITY**

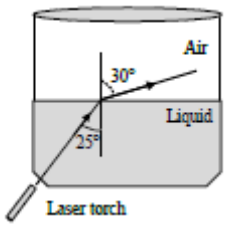
Water waves of frequency 10 Hz approach at right angles to a boundary between
shallow and deep water as shown in the diagram below.




(i) Calculate the wavelength of the waves in shallow water. **(1 mark)**

(ii) The wave now passes into deeper water where its speed is 60 $cms^{-1}$
Calculate wavelength of the waves in deep water. **(1 mark)**

A ray of light from a laser torch is incident from the surface of a liquid in a
beaker into air under standard temperature conditions as shown in the diagram
below. The light ray makes an angle of incidence of 25° and angle of refraction
of 30°.




(i) Calculate the index of refraction of the liquid. **(1 mark)**

(ii) Determine the critical angle of the liquid. **(2 marks)**

(iii) State the ideal condition for total internal reflection to occur. **(1 mark)**