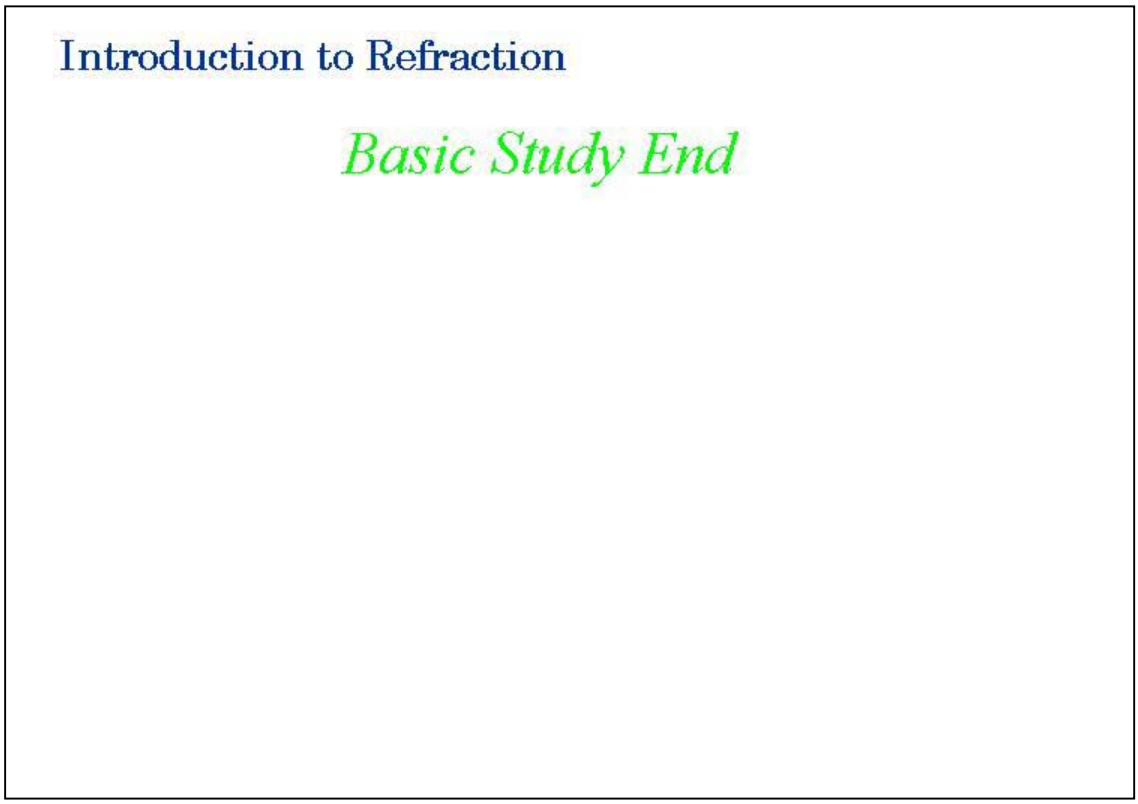
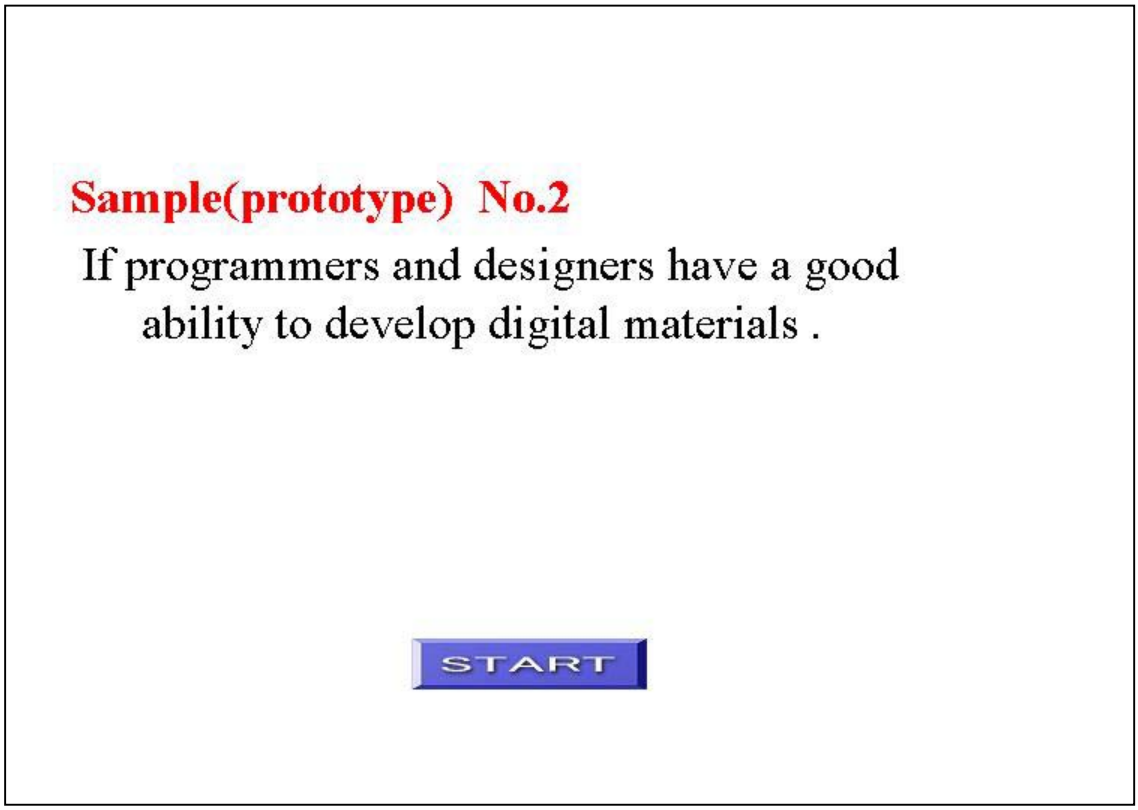

Introduction to Refraction
Basic Study End


Sample(prototype) No.2
If programmers and designers have a good ability to develop digital materials .
START

Refraction in the life

(Expected time 2min)

Do you know how refraction is used for in the life ?

- Glasses ……
- Camera ……
- Diamond ring ……..

etc.

Let's make the mystery of the refraction clear.

(With a narration.)

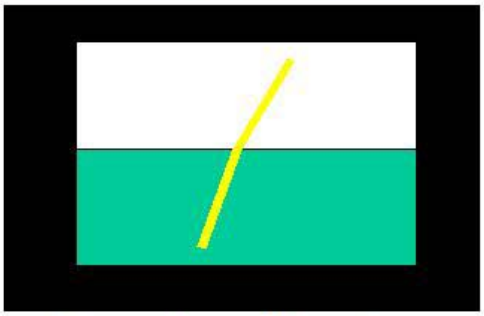
NEXT

What is the Refraction

(Expected time 3min)

◎Refraction is the deviation in the course of light as a result of being transmitted between two transparent media.

see an movie, and try to confirm it.



(an real world movie
With a narration.)

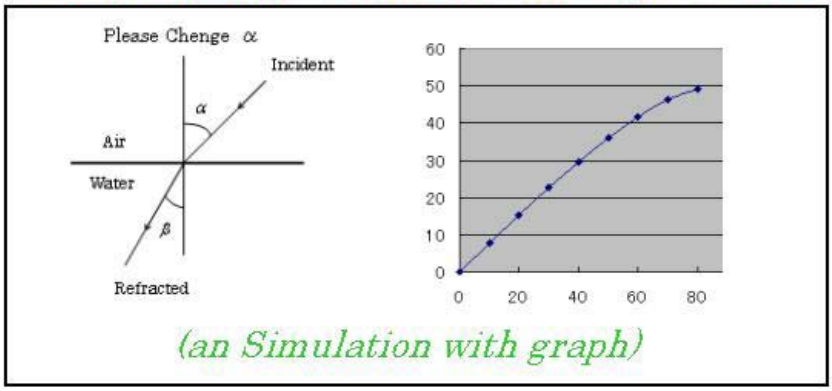
NEXT

Find Snell's law(1) *(Expected time 5min)*

You know the angle of incidence changed, and one of refraction is also changed

What is the relation? Try to find it.

Virtual Lib. angle of incidence and angle of refraction



(an Simulation with graph)

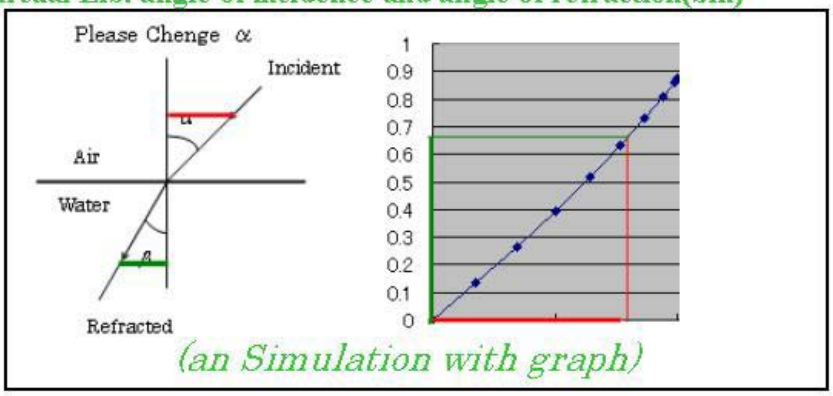
Do you find it ?write relations in the notebook.

Solution

Find Snell's law(1) *(Expected time 5min)*

What do you find?
So An angle B grows bigger when an angle A is changed bigger, too.
it is clear, but how bigger? Try the next experiment.
Do you remember Sin? It is another expression of angle.
(If you forget 'SIN' see -> *SIN*)

Virtual Lib. angle of incidence and angle of refraction(Sin)



(an Simulation with graph)

Do you find new low ?write relations in the notebook.

Solution

Find Snell's law(1)

(Expected time 2min)

It is very clear!!

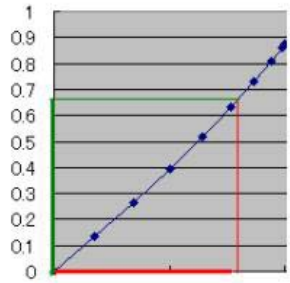
So An angle B(sin B) is big in proportion to the angle A(sin A).

it is expressed with a formula.

$\sin(\alpha) = k^* \sin(\beta)$

or

$k = \sin(\alpha) / \sin(\beta)$



(With a narration.)

Next question What is k? Can you guess?

NEXT

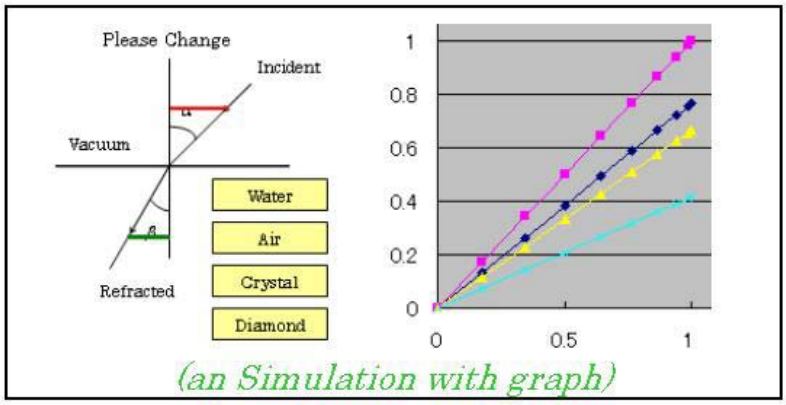
Find Snell's law(2)

(Expected time 7min)

Why Diamond is Brilliant?

You can change materials in this experiment.

Virtual Lib. refraction of materials



(an Simulation with graph)

Do you conform k?

Solution

Find Snell's law(2)

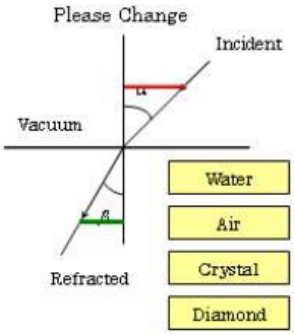
(Expected time 2min)

Each material has each refractive index.

refraction between vacuum and material
It call absolute index of refraction

$k = \sin(\alpha) / \sin(\beta)$

material	Index of refraction
Air	1.000292
Water	1.3334
Crystal	1.5446
Diamond	2.4202



(With a narration.)

You may know Why diamond is brilliant.

NEXT

Snell's law

(Expected time 3min)

Conclusion
physical phenomenon

1. An angle B(sin B) is big in proportion to the angle A(sin A).
it is expressed with a formula.
$\sin(\alpha) = k^* \sin(\beta)$ **or** $k = \sin(\alpha) / \sin(\beta)$

2.Each material has each refractive index. *(With a narration.)*
refraction between vacuum and material
It call absolute index of refraction
example. refraction between vacuum and material
$1^*\sin(\alpha) = k^* \sin(\beta)$

What is the refraction between water and crystal
or water and diamond

NEXT

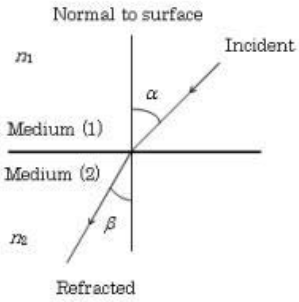
Refraction between materials *(Expected time 3min)*

◎**Refraction is the deviation in the course of light as a result of being transmitted between two transparent media.**

◎ **Angle of incidence : is the angle between the incident beam and the normal to the refracting surface at the point of incidence.**

◎ **Angle of refraction : is the angle between the refracted beam and the normal to the refracting surface at the point of refraction.**

◎ **Index of refraction: is the ratio between the speed of light in vacuum to the speed of light in a material medium**



(an animation corresponding to appearance of the lines.

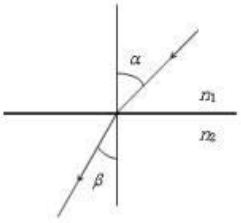
With a narration.)

NEXT

Refraction between materials *(Expected time 3min)*

◎**This law relates the angle of incidence and refraction in two media on the one hand, and the indices of refraction of the two media on the other. Mathematically, Snell's law is expressed by the following formula:**

$$n_1 \sin\alpha = n_2 \sin\beta$$



(an animation.

With a narration.)

<u>You can notice from</u> the figure that light is refracted when it is transmitted from one medium having a given value of index of refraction to another medium having a different value of index of refraction .

<u>You can also notice</u> from the figure that if , then , and if then .

NEXT

Continue

2. What is a digital material

Digital material(we call Teacher menu)

simulation, movie , animation, game

->Like electric book

Self-learning martial

->Like electric book (e-learning)

->Like electric teacher (e-learning, class room)

Is Digital material a Magic lamp?

A computer world is a magical world.

An image becomes reality.

But It only has it, and a hope doesn't match it.

We must have good images.(content , how to teach in digital materials)