

Exercise walk-through

13.3

Refraction

AP Physics 2

Refraction and Snell's law

Crossing into a new medium, light changes speed and bends:

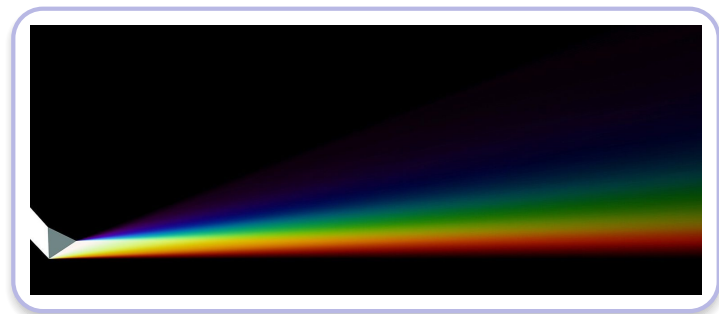
Snell's law

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

index
more.

$n = c/v$; higher n bends light

Past the **critical angle**
($\sin \theta_c = n_2/n_1$): **total internal reflection**
– fibre optics.



Refraction bends light at boundaries

Exercises 2.1-2.3

2.1 Light passes from air ($n = 1.0$) into glass ($n = 1.5$) at 40° to the normal. Find the angle of refraction. [2]

2.2 State what happens to the speed of light entering a denser medium. [1]

2.3 State the condition for total internal reflection to occur. [1]

Exercises 2.1-2.3

2.1 Light passes from air ($n = 1.0$) into glass ($n = 1.5$) at 40° to the normal. Find the angle of refraction. [2]

2.1

- $$\sin \theta_2 = \frac{n_1 \sin \theta_1}{n_2} = \frac{1.0 \sin 40^\circ}{1.5} = 0.428 \Rightarrow \theta_2 = 25^\circ$$

2.2 State what happens to the speed of light entering a denser medium. [1]

2.2

- it decreases

2.3 State the condition for total internal reflection to occur. [1]

2.3

- the light must go from a denser to a less dense medium at an angle above the critical angle

Exercises 3.1-3.2

3.1 Snell's law is

[1]

☐

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

B $n_1 \theta_1 = n_2 \theta_2$

C $\sin \theta = n$

D $n = c/v$ only

3.2 Total internal reflection occurs when light travels

[1]

☐

A from less dense to more dense at any angle

B from more dense to less dense above the critical angle

C exactly along the normal

D through a vacuum

Exercises 3.1·3.2

3.1 Snell's law is

[1]

☐

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

B $n_1 \theta_1 = n_2 \theta_2$

C $\sin \theta = n$

D $n = c/v$ only

3.1 A

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

3.2 Total internal reflection occurs when light travels

[1]

☐

A from less dense to more dense at any angle

B from more dense to less dense above the critical angle

C exactly along the normal

D through a vacuum

3.2 B

- from more dense to less dense above the critical angle.

Exercise 3.3 (a)

3.3 Light passes from water ($n = 1.33$) toward air ($n = 1.0$).

(a) Find the critical angle.

[3]

Exercise 3.3 (a)

3.3 Light passes from water ($n = 1.33$) toward air ($n = 1.0$).

(a) Find the critical angle.

[3]

(a)

- $\sin \theta_c = \frac{n_2}{n_1} = \frac{1.0}{1.33} = 0.752 \Rightarrow \theta_c = 48.8^\circ$

Exercise 3.3 (b)

3.3 Light passes from water ($n = 1.33$) toward air ($n = 1.0$).

(b) State what happens to light striking the surface above this angle.

[1]

Exercise 3.3 (b)

3.3 Light passes from water ($n = 1.33$) toward air ($n = 1.0$).

(b) State what happens to light striking the surface above this angle.

[1]

(b)

- it is totally internally reflected