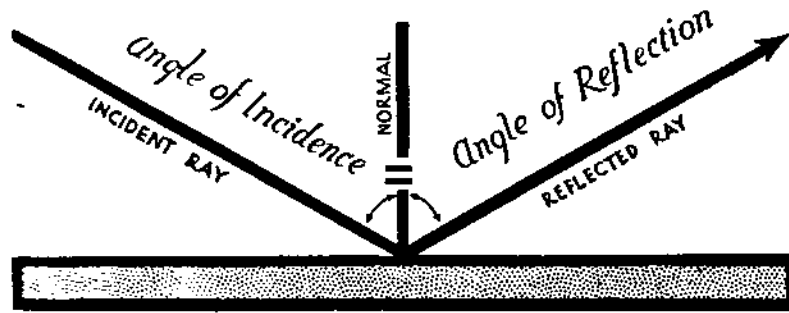# OPTICAL ENGINEERING NOTE #100:
AN OPTICAL PROTRACTOR

Even though all the major optical manufacturers boast dozens of Ph.D's woking for them, not a single one of their catalogs offers an **OPTICAL PROTRACTOR**.

Since angles used in optical engineering calculations are measured from the <u>normal</u>, an imaginary line at right angles to an optical surface, an optical protractor should have 0 degrees where the normal one has 90, and angular measure should increase on either side of that, with 90 degrees replacing the traditional 0/180 and 180/0.

Shown below is a protractor suitable for optical use. Feel free to copy this page onto <u>overhead projection material</u> to use in your optical engineering endeavours.
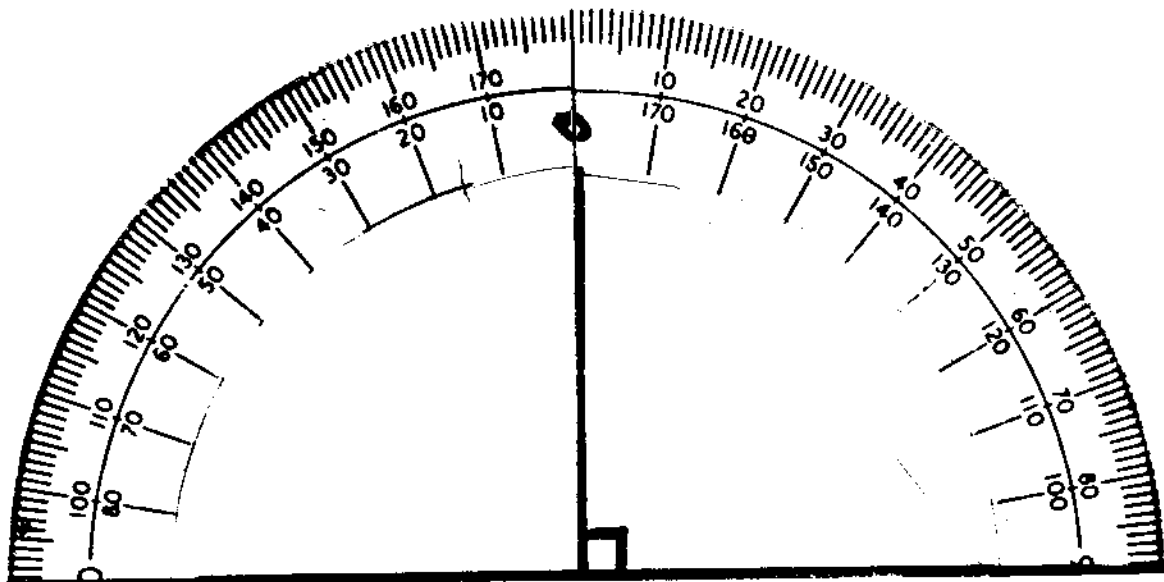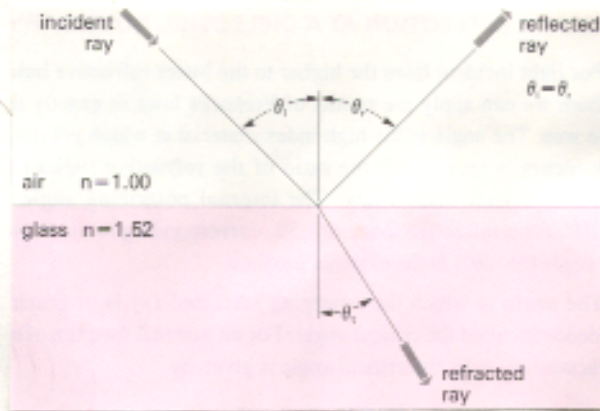
KNOW YOUR ANGLES!

Shown here are:

ANGLE OF INCIDENCE

ANGLE OF REFLECTION

ANGLE OF REFRACTION or
TRANSMITTED ANGLE

The Critical Angle is the
first angle which traps
light inside a slow moving
medium thanks to Total
Internal Reflection. As
light tries to escape a
medium with a refractive
index greater than the
surrounding medium, the
exiting light is bent away
from the normal. When a
certain incident angle value
is plugged into Snell's Law,
the refracted angle turns
out to be 90 degrees.
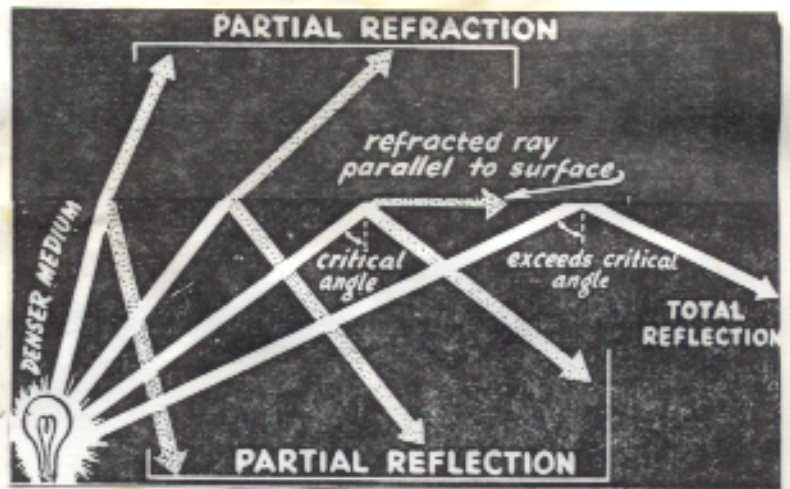
Since this is impossible, the light is perfectly reflected at the
border at this first angle, the Critical Angle, and all angles
greater than it will also cause the light to become trapped.
This phenomenon makes fiber optics, retroreflectors, corner
prisms, etc., work.

Brewster's angle is named after Sir David
Brewster, who also gave us the
kaleidoscope. He discovered that the
reflection of light incident at this
certain angle was completely polarized.
This was a method of generating polarized
light in the nineteenth century. Humble
Brewster called it the "polarizing angle",
but we honor him by not only naming this
angle after him, but also optics inside
laser cavities that polarize the output
using his principle are called Brewster
windows or Brewster stacks.