

**OPTICAL ENGINEERING NOTE #71
BLACKBOARD OPTICS KITS***

I would really like to meet the genius who thought that suction cups would hold a 3 kilogram block of plexiglass on a dusty chalkboard for more than two minutes the fourth semester that they would have been in use. Forever may he be condemned to teaching critical angle with his invention to unruly seventh graders!

A saner and more intimate way of demonstrating with this equipment is to lay the plexiglass shapes on a tabletop with white computer paper underneath. And instead of their funky white light sources**, use the idealized ray of light, a laser beam.

Gluing a glass stirring rod onto the output end of the laser focusses the top and bottom of the beam (but not the horizontal axis) to form a triangular plane of light, to intersect the target paper as a straight line, ready to be reflected, refracted, or diffracted for your demonstration pleasure.

To demonstrate the definition of focal length, a pair of lasers can be utilized to produce the parallel beams. After that, the two lasers can be aimed so that their beams crisscross, to show that rays emanating from a common point are reunited on the image side. Better yet, a low-frequency diffraction grating can split the beam into many, all starting at the same point, to show greater detail of the focussing, including the zonal nature mismatch of some of the aberrations¹. With a pair of laser/grating combinations magnification can be witnessed.

An accessory not included with these sets are solid and fillable prisms to demonstrate different indices of refraction. But they do include a solid isosceles right triangle prism, (missing from our set!), to demonstrate dispersion and retroreflection thanks to TIR, and an equilateral one is available as an accessory.

FOOTNOTES

*Available from: Klinger Educational Products Corporation, Scientific Supplies for Education and Industry, 112-19 14th Road, College Point, New York 11356-1453, 718-461-1822.

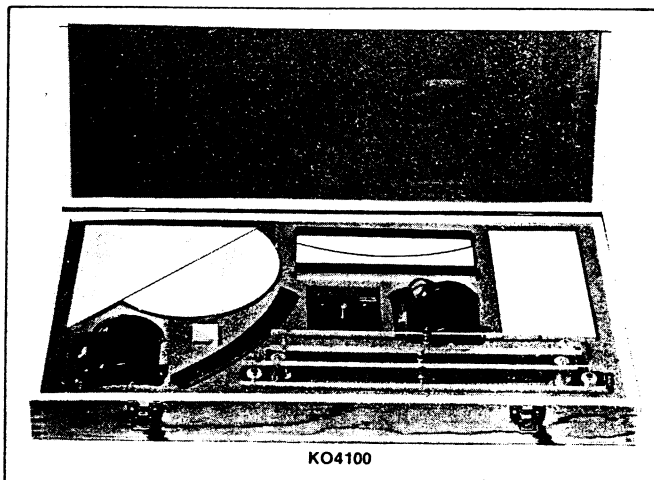
**Notice that neither batteries nor power supply for them are included.

BLACKBOARD OPTICS®

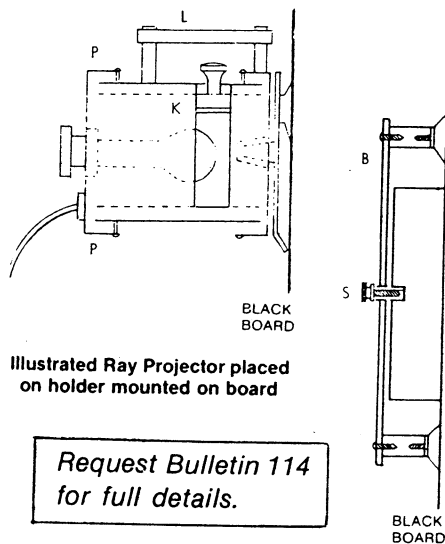
The Klinger laboratories proudly offer to teachers of physics and related fields a revolutionary new approach to the presentation of concepts in geometrical and physical optics.

The Blackboard Optics kit is an assembly of large Acrylite® components which may be secured singly or in combination to any classroom blackboard by means of unique suction cup supports or magnet clamps. Lenses, mirror, prisms, and light sources may be positioned in seconds; components may be rotated without shifting the supporting brackets. Actual experiments and measurements are then performed directly on the blackboard without darkening the room.

Visibility, even in large lecture halls, is assured because the plastic optical pieces are 2 inches thick and 8 inches high. The ray projectors which form part of the kit may be arranged to provide a thin pencil of light or a divergent cone by means of a simple fingertip adjustment. The path of the light in air and through the optical components is traced by skimming rays along the blackboard. With the equipment in position, the teacher can then chalk in axes, normals, tangents, virtual rays, angle identification symbols, equations, and any other information he needs to complete a vivid and dynamic demonstration.



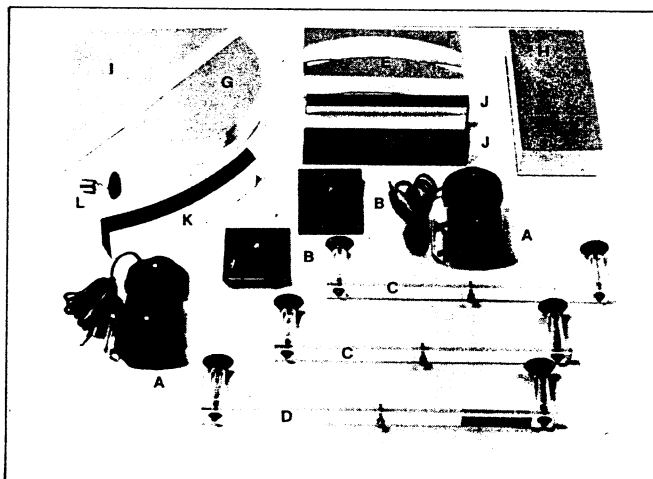
KO4100



Illustrated Ray Projector placed on holder mounted on board

Request Bulletin 114 for full details.

Clamping Bar Supporting lens



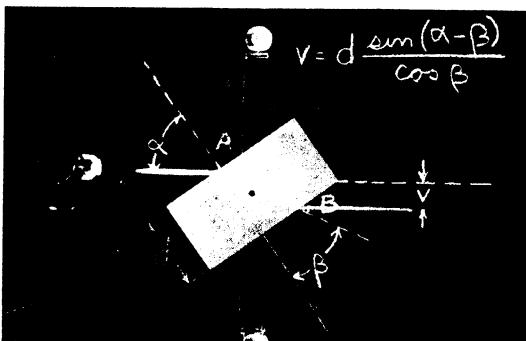
COMPONENTS

KO4100 Blackboard Optics basic kit (suction) \$695.00
 KO4100M Blackboard Optics basic kit (magnetic) 720.00

			Suction (each)	Magnetic (each)
A.	KO4101	Ray Projector	(2 pcs) \$82.00	\$82.00
B.	KO4102	Holder for Projector	(2 pcs) 16.50	17.00
C.	KO4103	Clamping bar, 13 inch	(2 pcs) 18.50	25.50
D.	KO4104	Clamping bar, 15 inch	(1 pc) 19.50	26.00
E.	KO4105	Plano convex lens	(1 pc) 52.00	52.00
F.	KO4106	Plano concave lens	(1 pc) 52.00	52.00
G.	KO4107	Semicircular lens	(1 pc) 80.00	80.00
H.	KO4108	Parallel-sided block	(1 pc) 80.00	80.00
I.	KO4109	Prism, right angle	(1 pc) 80.00	80.00
J.	KO4110	Plane mirror	(2 pcs) 22.00	22.00
K.	KO4111	Curved mirror, double	(1 pc) 33.00	33.00
L.	KO4112	Projector lamp, spare	(1 pc) 7.00	7.00
M.	KO4118	Cushioned storage cabinet	(1 pc) 90.00	90.00

KO4135 Magnetic conversion set

\$60.00



Experiment 9: Principal Displacement by a Rectangular Block

KO4120 Green Steel Chalkboard \$45.00

DEMONSTRATION POSSIBILITIES

UNIT TWO

DEFINITION OF REFLECTION ANGLE EQUATION WITH BLACKBOARD OPTICS
RETROREFLECTION WITH ORTHOGONAL MIRRORS
DIFFERENCE BETWEEN SPECULAR AND DIFFUSE REFLECTORS
WHEN A DIFFUSE REFLECTOR BECOMES A SPECULAR ONE
DEFINITION OF REFRACTION
COMPARISON OF INDEXES OF REFRACTION WITH SOLID AND FILLABLE
EQUILATERAL PRISMS
DISPERSION THROUGH PRISMS
ROUGH SURFACES DIFFUSELY EMIT LIGHT (GROUNDGLASS)
FINDING THE CRITICAL ANGLE WITH PLEXIGLASS SEMI-CYLINDER
RIGHT ANGLE PRISM EXAMPLE

UNIT THREE

DEFINITION OF FOCAL LENGTHS FOR CONCAVE AND CONVEX REFLECTORS
DEFINITION OF FOCAL LENGTHS FOR POSITIVE AND NEGATIVE LENSES
COMBINATIONS OF POSITIVE AND NEGATIVE LENSES AND THE EFFECT ON
FOCAL LENGTH
CONJUGATE DISTANCES MIRRORS AND LENSES WITH DIFFRACTION GRATING
OBJECT POINT
TELESCOPE MOCKUP (FOR UNIT 3C)

ENDNOTE

1. See the Handout, **THE SEVEN DEADLY ABERRATIONS.**