OPERATING INSTRUCTIONS

AND SUGGESTED ACTIVITIES

REFLECTION AND REFRACTION TANK

RRT001

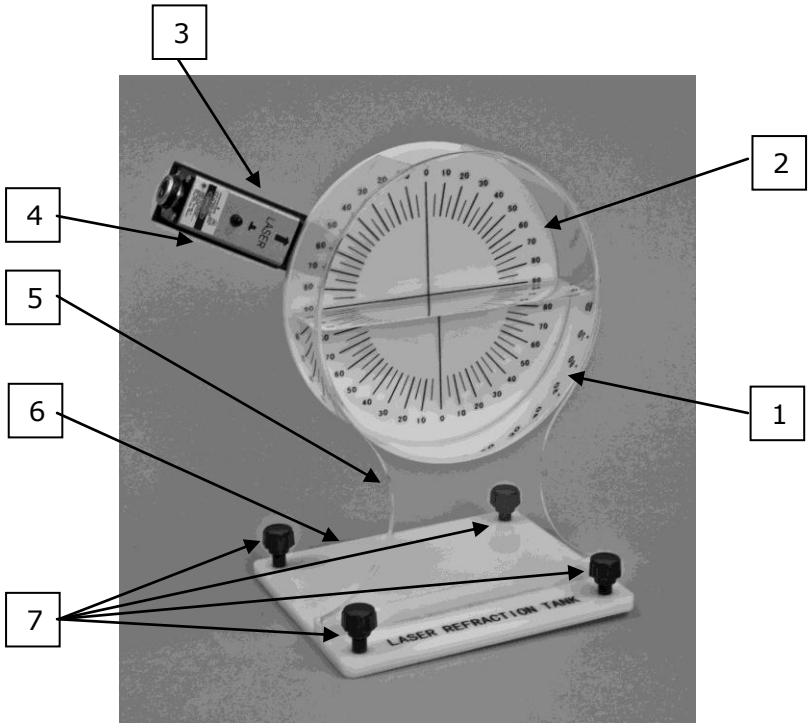

Figure 1

DESCRIPTION

The Reflection and Refraction Tank RRT001 is designed for physics or physical science students to verify two fundamental laws of geometric optics – the laws of reflection and refraction. Students can also observe the variation of the intensity of the reflected and refracted rays qualitatively. This instrument allows students to study the angles of incidence, reflection and refraction at an air/liquid interface and to see the total reflection of a ray in the liquid.

The unit consists of an acrylic water tank, which is backed with a 360° scale mounted on a base with leveling feet, and a laser attached magnetically to a metal arm that can rotate to provide a bright, sharp incident light ray from any direction.

IDENTIFICATION OF THE PARTS (See *Figure 1*)

1. Clear acrylic water tank
2. 360° scale on white back plate
3. Laser
4. Magnetic attachment
5. Support plate
6. Base
7. Leveling Screws
8. Wing nut to fix arm angle (on rear – not shown)

SPECIFICATIONS

Water Tank:	Transparent acrylic; diameter 16cm, thickness 5cm.
Laser:	Class II, maximum output ≤ 1mW, with momentary switch Batteries: AG13 (3 – included)
Overall Dimensions:	26cm x 17cm x 14cm (H x W x D)
Net Weight:	0.8kg

BACKGROUND

Reflection

When a light ray strikes the interface between two optically different media, reflection can occur and the light ray does not enter the second medium, but "bounces off" – it is *reflected*. The law of reflection states that the angle of reflection, θ_2, is always equal to the

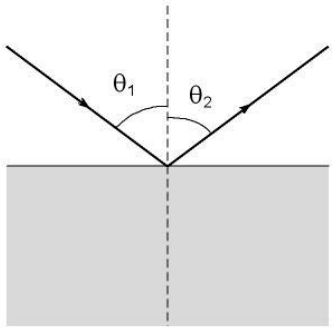

Figure 2

angle of incidence, θ_1. These angles are measured from the direction normal to the interface (see *Figure 2*).

Refraction

Another possible outcome when a light ray strikes the interface between two optically different media is that the light ray succeeds in entering the second medium, but its path is bent at the interface. This is called *refraction*. The law of refraction (known as *Snell's Law*) states that when a light ray travels from one medium into another, the ratio of the sines of the angles of incidence and refraction is a constant whose value depends on the pair of materials involved. When a light ray travels from air into a different medium we have:

$$\sin \theta_1 / \sin \theta_2 = n \qquad (1)$$

and when the light ray travels from the medium into air,

$$\sin \theta_1 / \sin \theta_2 = 1 / n \qquad (2)$$

where θ_1 is the angle of incidence, and θ_2 is the angle of refraction (see *Figure 3*).
The constant n is called the *index of refraction* of the medium with respect to air. If instead of air, the medium were immersed in water, the behavior would be the same but the value of n would be different.