Refraction of light in perspex prisms essay sample

Questions

1. What is the relationship between the angle of incidence and the angle of refraction?

The angle of incidence (formed by the ray of light travelling though air into a slab of rectangular perspex) is not directly proportional to the angle of refraction (angle formed between the ray travelling though perspex and the normal). The graph of the plotted angles of incidence against the angles of refraction is not a straight line and therefore demonstrates this. However, a constant can be found by the formula sin i / sin r which is the specific refractive index for a particular medium eg. glass. Once the refractive index of a certain medium is known, the angle of refraction can be calculated if the angle of incidence and known and vice versa. The denser the medium, the larger the refractive index. Usually, the angle of incidence is larger than the angle of refraction when a ray of light is travelling from a less dense medium to a denser one.

2. Does the refracted angle remain the same for different angles of incidence?

NO. If the angle of incidence changes, so does the angle of refraction. In no cases will differing angles of incidence produce the same angles of refraction.

3. Has the ray been refracted towards or away from the normal when going form air to perspex?

Because the ray of light is travelling from a less dense to a denser medium (air to perspex), the ray of light will bend towards the normal, if the beam was travelling from a denser medium to a less dense one, it would bend away from the normal. The ray of light entering the slab of perspex should be parallel to the ray of light emerging from the far side of the perspex (they merely experience lateral shifting).

4. Why did the rays of light refract in perspex?

Light rays refract when they meet a new medium, travelling at a different velocity – the greater the change in the velocity, the more severe the bending of the ray against the normal. However, although the velocity changes, the frequency does not. In the case of the beam travelling from air to perspex, the velocity decreases as the beam travels from the first medium to the next, thus causing the ray to bend towards the normal.

5. What is the size of the angle of refraction if the angle of incidence is 0?

The angle of refraction will also be 0 as the ray is entering along the normal, therefore there is no bending achieved whatsoever. This is also known as normal incidence.

6. What happens when the angle of incidence gets bigger than the critical angle?

In such cases, a phenomenon occurs – total internal reflection. Here, the boundary simply reflects the ray which is unable to escape from the perspex medium at all. The angle of incidence if therefore equal to the angle of reflection when this takes place.

Conclusion

∞ Changes in medium causes the refraction or “ bending” or light rays

∞ The velocity of a ray increase when entering a less dense medium

∞ The velocity of a ray decreases when entering a denser medium

∞ If the ray is travelling from a less dense to a denser medium, the angle of incidence is greater than the angle of refraction and the ray will bend towards the normal

∞ If it is travelling from denser to less dense, the ray will bend away from the normal.

∞ In perspex, at an angle of approximately 42, the angle of refraction is 90 (to the normal) which makes 42 the critical angle for perspex.

∞ The angle of incidence is not directly proportional to the angle of refraction in perspex

∞ Once the angle of incidence exceeds 42 (critical angle in perspex), total internal reflection occurs where the ray does not exit through the perspex. Instead, it is reflected at an angle equal to the initial angle of incidence.