The relation between incident and transmitted angles is:

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

where n_1 and n_2 are the refractive indices of the respective materials. Not sure what *sin θ* means? See Chapter 10.2.

Let's take the simple example of a ray of light passing from air (n_1=1) into a diamond (n_2=2.42) and an amethyst (n_2=1.54). Figure 11-10 shows some rays, while Figure 11-11 plots the transmitted angle as a function of the incident angle.

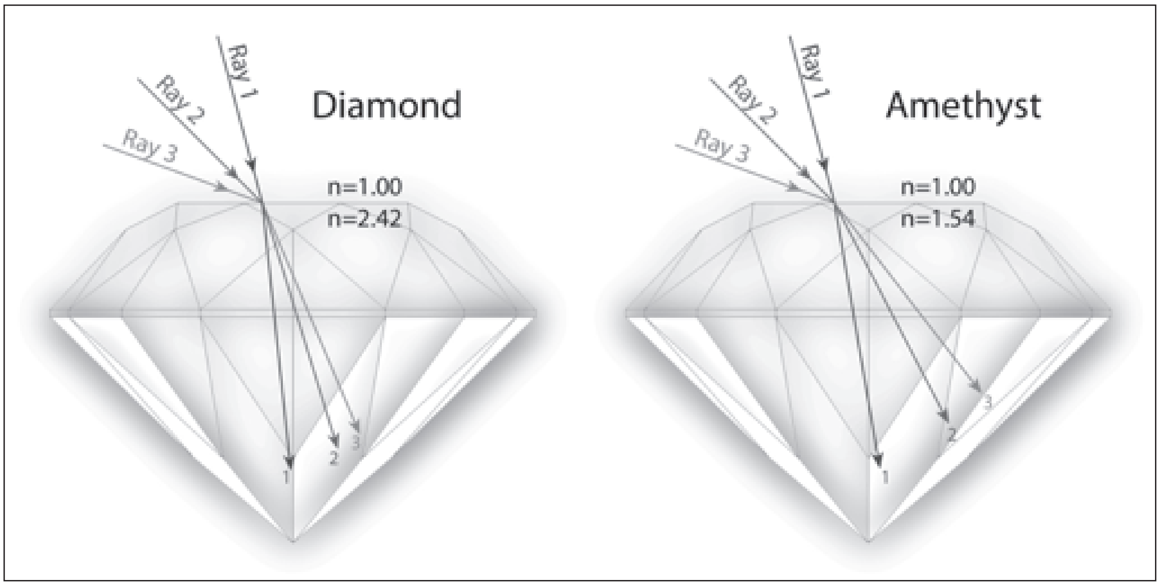

Figure 11-10 Three rays of light entering a diamond (left) and an amethyst (right). For the same incident angle, a diamond refracts the ray closer to the perpendicular (smaller θ2) than does an amethyst.

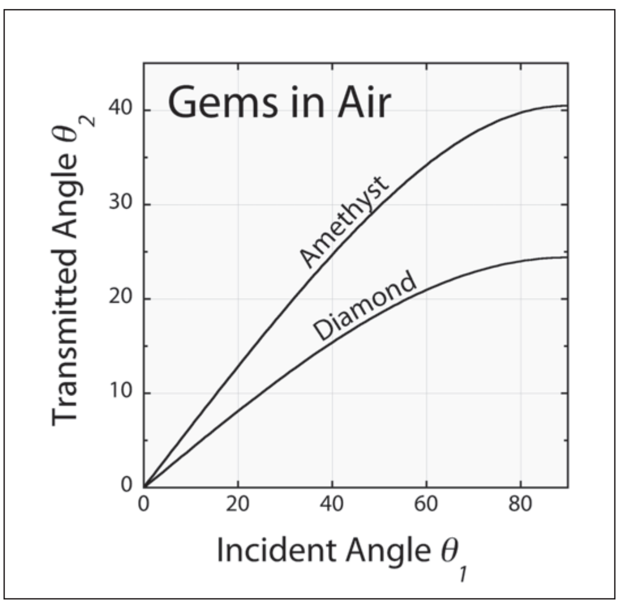

Figure 11-11 The transmitted angle θ2 as a function of the incident angle θ1 for diamond and amethyst in air.

As pointed out in Chapter 10.3, the ray transmitted into the gem is always closer to perpendicular – in other words, θ_2 is always smaller than θ_1. This explains the ability of gemstones to "collect" light from a large range of incident angles and redirect them into directions useful for the performance of the gem. Note also that this redirection is more effective for higher refractive index: for a given input ray, the value of θ_2 is always smaller for diamond than for amethyst. This greater refractive ability also means that, in general, the rays entering your eye from a diamond came from a wider spread of input angles. This translates to better subjective gem performance, since this wider range captures more photons and likely includes a greater variety of light