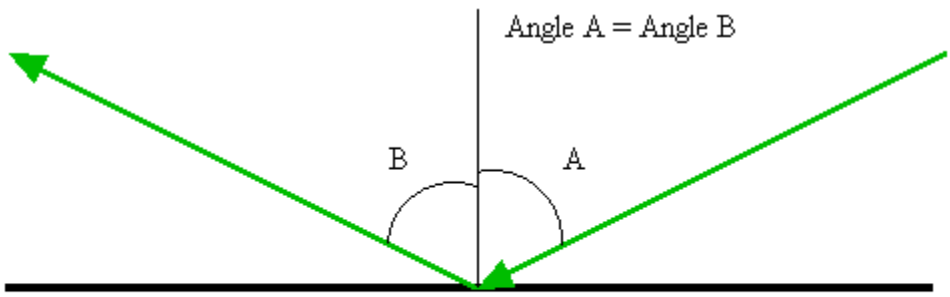
Gloss Versus Reflectivity:

Common in our building industry is the ambiguous discussion between *gloss level* and *reflectivity* and much to the surprise of many professionals within the industry - there is a big difference between the two. This discussion becomes very important in situations where a façade material requires a very high brightness yet cannot have direct light such as headlights bouncing back into a driver's eye. This topic will be completely relevant in a tunnel lining application.

The below discussion details the distinct difference between gloss or 'Specular diffusion' and reflectivity or 'Lambertian diffusion.

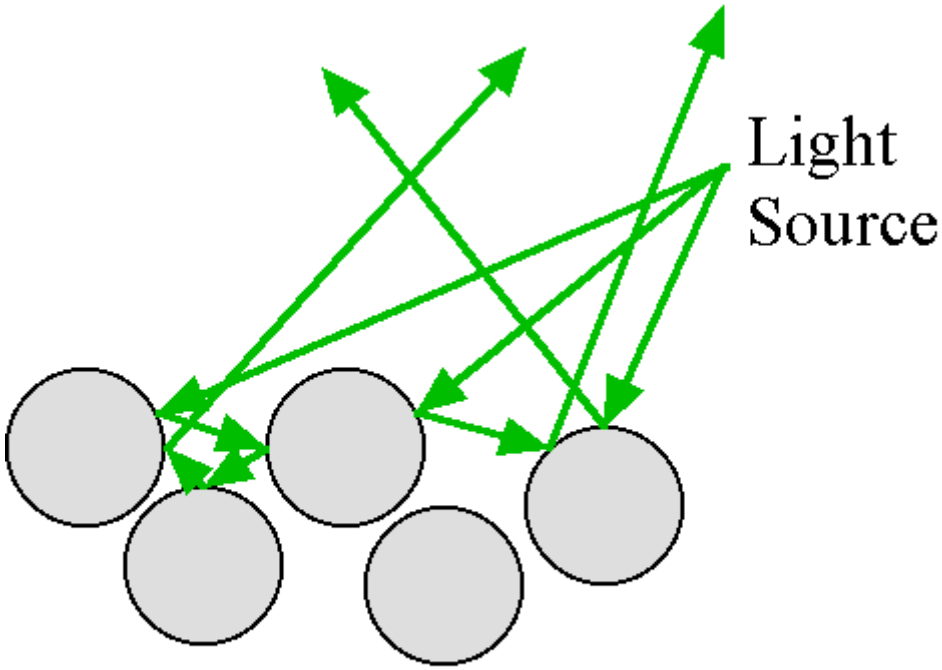
When a photon of light hits an atom (or other particle), it gets absorbed and re-emitted, usually as another photon and usually as a photon of the same type (color and energy). These re-emitted photons get sprayed out in all directions, but some directions are more likely than others. That's the nature of quantum mechanics: to describe the likelihood or *probability* of an event. The theory of this re-emission and how these probabilities are calculated was one of the contributions of the great physicist Richard Feynman (1918 - 1988); it's called *Quantum Electrodynamics* or **QED** for short. It turns out that when photons hit a simple flat layer of atoms, like the surface of a pane of glass or metal plate, the most likely direction of re-emission is exactly at the same angle the incoming photons were absorbed. The result is that the great majority of photons striking the plate are re-emitted so that the "angle of incidence A equals the angle of reflection B". This simple case is called *Specular Reflection*; here's the diagram.



Simple Specular Reflectance

Shiny, flat, glossy surfaces, such as mirrors, calm lakes, flat shiny metals, and crystals, reflect light in a specular way. In fact, this is what is usually meant by the word "reflection." You get the strongest reflection if the angle of your eyesight toward the surface is the same as the angle of the light hitting the surface.

However, many surfaces are made of many small granules, or random atoms not in a crystal pattern. Here, the light reflects from many small pieces, back and forth, and comes out in totally random directions. This is usually called *diffusion* or *Lambertian* reflectivity (after the 18th century mathematician Johann Lambert); here's a diagram.



Lambertian reflectance (diffusion)

In diffusion or Lambertian reflectance, light gets bounced off in all directions and there is no direction in which your eye will see more intensity.

As an example, suppose you paint a wall in "eggshell white," a paint which diffuses the light. This wall will maintain an even pleasant "glow" no matter where your lights are placed and no matter what angle you view it at. Now, if you give this wall an additional coat of high-gloss polyurethane varnish, it will shine. A floor lamp will be reflected from it in such a way that, from certain directions, you will see a harsh, bright image of the lamp and maybe even the bulb itself. That's why walls and ceilings in homes are not painted in this way.