Chapter 6 Solutions

6.1 Point sources produce a very harsh lighting. Such images are characterized by abrupt transitions between light and dark. The ambient light in a real scene is dependent on *both* the lights on the scene and the reflectivity properties of the objects in the scene, something that cannot be computed correctly with OpenGL.

6.3 If we were to take into account a light source being obscured by an object, we would have to have all polygons available so as to test for this condition. Such a global calculation is incompatible with the pipeline model that assumes we can shade each polygon independently of all other polygons as it flows through the pipeline.

6.5 Materials absorb light from sources. Thus, a surface that appears red under white light appears so beacuse the surface absorbs all wavelengths of light except in the red range—a subtractive process. To be compatible with such a model, we should use surface absorbtion constants that define the materials for cyan, magenta and yellow, rather than red, green and blue.

6.7 Let ψ be the angle between the normal and the halfway vector, ϕ be the angle between the viewer and the reflection angle, and θ be the angle between the normal and the light source. If all the vectors lie in the same plane, the angle between the light source and the viewer can be computer either as $\phi + 2\theta$ or as $2(\theta + \psi)$. Setting the two equal, we find $\phi = 2\psi$. If the vectors are not coplanar then $\phi < 2\psi$.

6.13 If the only light source is a point light source that is located at the center of projection, there can be no shadows in the image.

6.15 If we orient the surface so it points in the direction of the halfway vector, then we have equal angles between the halfway vector and the viewer and between the halfway vector and the light source. This configuration is exactly that of a mirror which reflects all the light towards the viewer.