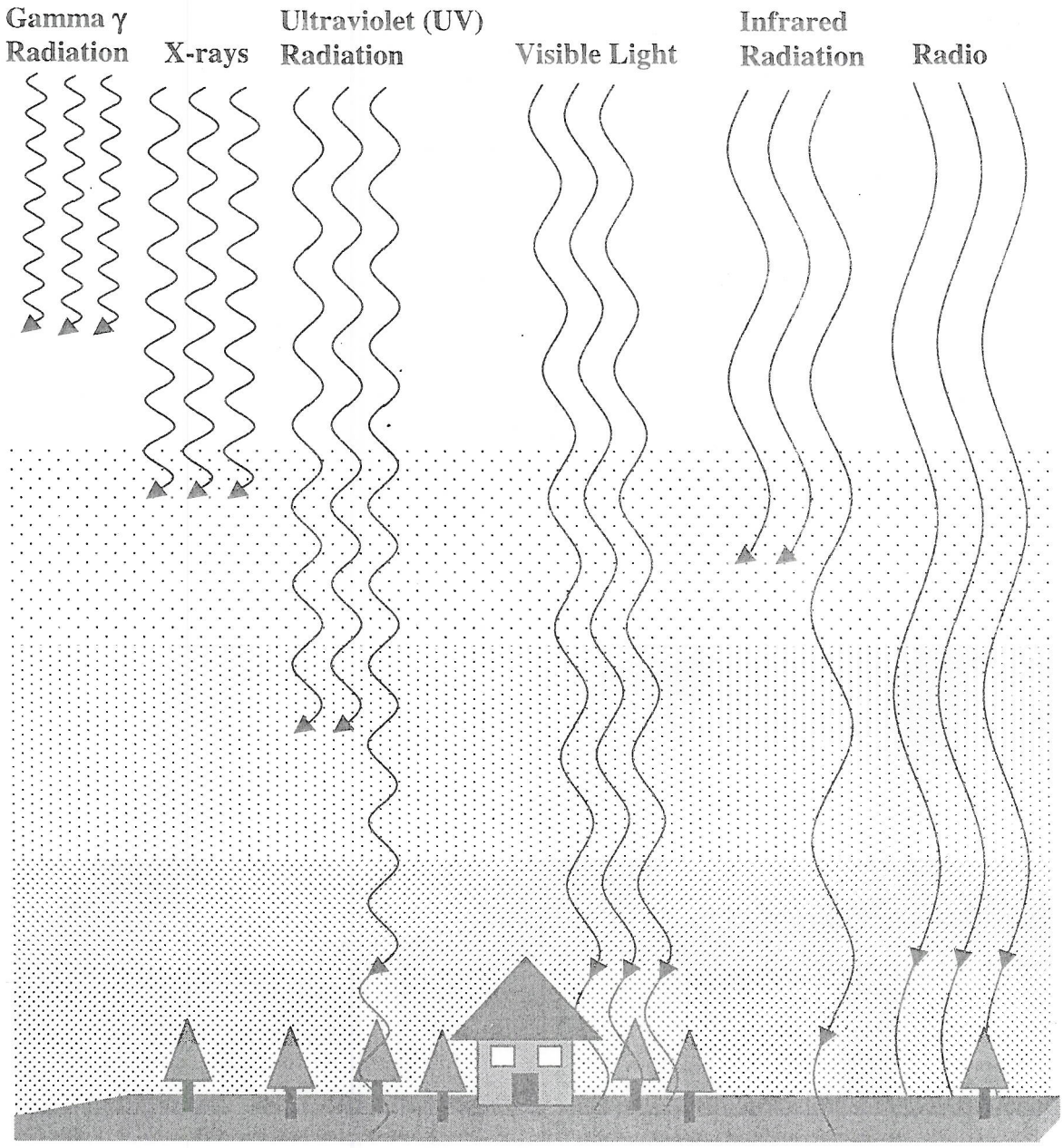
The drawing shown below illustrates the amount that different wavelengths of light are able to penetrate Earth's atmosphere. The dotted/shaded regions are used in this drawing to depict the different layers and densities of air in Earth's atmosphere. Notice that the atmosphere can be transparent to light at some wavelengths (lines passing through the atmosphere to the surface of Earth) and yet can also completely block other wavelengths of light (lines being absorbed in the atmosphere).



1) Which, if any, of the different wavelengths of light (electromagnetic radiation) shown in the above image are able to **entirely** penetrate Earth's atmosphere and reach the surface?

2) Which, if any, of the different wavelengths of light (electromagnetic radiation) shown in the above image are able to **partially** penetrate Earth's atmosphere and reach the surface?

3) Which, if any, of the different wavelengths of light (electromagnetic radiation) shown in the above image are **not at all** able to reach Earth's surface?

4) Federal funding agencies must form committees to decide which telescope projects will receive funds for construction. When deciding which projects will be funded, the committees must consider:

   i. how efficiently telescopes work at different wavelengths,

   ii. that telescopes in space are much more expensive to construct than Earth-based telescopes, and

   iii. that certain wavelengths of light are blocked from reaching Earth's surface by the atmosphere.

   Knowing this, consider each pairing of telescope proposals listed below (a-d) and state which proposal you would fund. Explain the reasoning behind your decisions.

   a)

   Project Delta:
   A gamma ray wavelength telescope, located in Antarctica, used to look for evidence of the presence of a black hole.

   Project Theta:
   A visible wavelength telescope used in the search for planets outside the solar system, located on a university campus.

b)

Project Beta:
An X-ray wavelength telescope, designed specifically to look at the Sun, that is located near the North Pole.

Project Alpha:
An infrared wavelength telescope used to view supernovae, placed on a satellite in orbit around Earth.

c)

Project Rho:
A UV wavelength telescope used to look at distant galaxies and placed high atop Mauna Kea in Hawaii at 14,000 ft above sea level.

Project Sigma:
A visible wavelength telescope used to observe a pair of binary stars located in the constellation Ursa Major, placed on a satellite in orbit around Earth.

d)

Project Zeta:
A radio wavelength telescope that is placed on the floor of the Mojave desert, used to detect potential communications from distant civilizations outside our solar system.

Project Epsilon:
An infrared wavelength telescope, located in the high elevation mountains of Chile, used to view newly forming stars (protostars) in the Orion nebula.