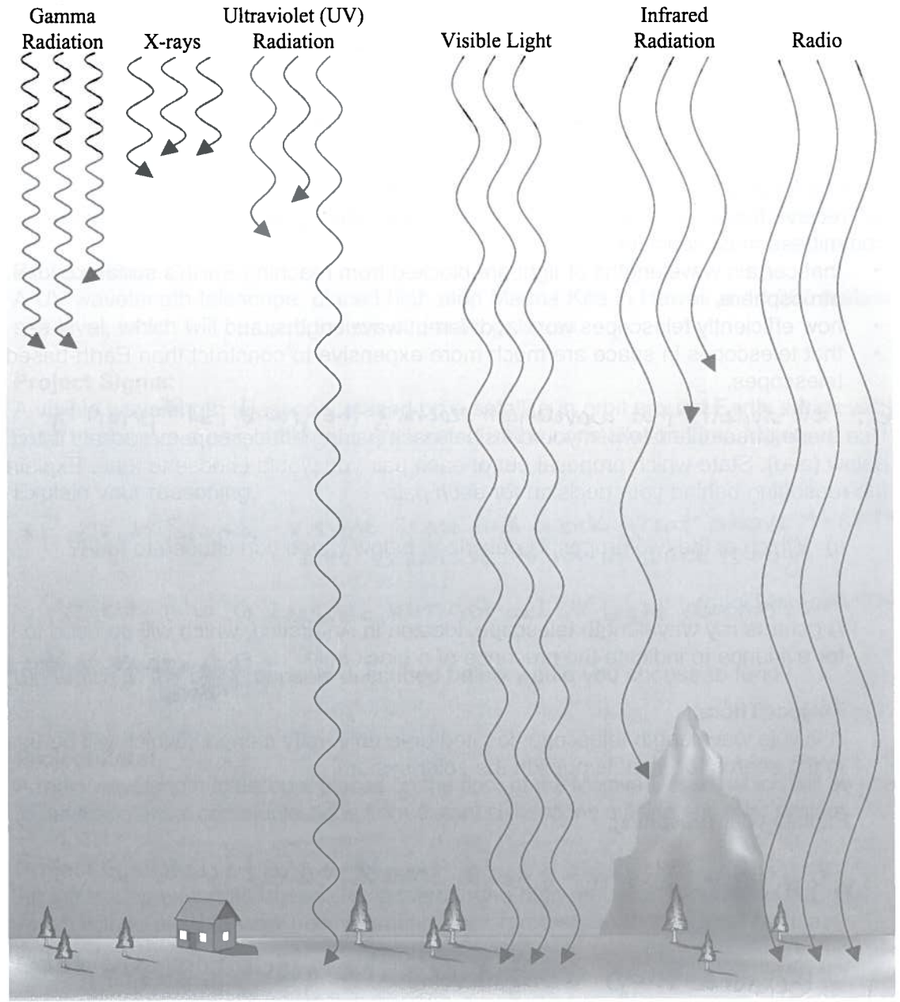
The drawing below illustrates the amount that different wavelengths of light are able to penetrate down through Earth's atmosphere. The shaded regions are used in this drawing to depict different layers in Earth's atmosphere. Notice that the atmosphere can be completely transparent to light at some wavelengths (all three lines passing through the atmosphere to the surface of Earth) and yet can also completely absorb other wavelengths of light (all three lines stopping in the atmosphere before reaching Earth's surface).



1) Which, if any, of the different wavelengths of light (electromagnetic radiation) shown in the image on the previous page are able to *completely* penetrate Earth's atmosphere and reach the surface? Visible, radio

2) Which, if any, of the different wavelengths of light (electromagnetic radiation) shown in the image on the previous page only *partially* penetrate Earth's atmosphere and reach the surface? UV, IR

3) Which, if any, of the different wavelengths of light (electromagnetic radiation) shown in the image on the previous page are *completely* absorbed in Earth's atmosphere and never reach the surface? Gamma, X ray

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:
   - that certain wavelengths of light are blocked from reaching Earth's surface by the atmosphere,
   - how efficiently telescopes work at different wavelengths, and
   - that telescopes in space are much more expensive to construct than Earth-based telescopes.

**NOTE: Tell students that wavelength reaching the ground is 1st priority

Use these three criteria when you consider each pairing of telescope proposals listed below (a–d). State which proposal out of each pair you would choose to fund. Explain the reasoning behind your decision *for each pair.*

a) Which of the two proposals described below would you choose to fund?

Project Delta:
A gamma ray wavelength telescope, located in Antarctica, which will be used to look for evidence to indicate the presence of a black hole. → ~~Gamma rays don't reach ground~~

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

Explain your reasoning.

*Project theta - cheap, small, easy to use

Gamma rays won't reach the ground, so project delta won't work

b) Which of the two proposals described below would you choose to fund?

Project Beta:
An X-ray wavelength telescope, located near the North Pole, which will be used to examine the Sun.

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

Explain your reasoning.

*Project alpha - IR telescopes work best above the atm.

Xrays won't reach the ground so project beta doesn't work

c) Which of the two proposals described below would you choose to fund?

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

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

Explain your reasoning.

*Project Sigma - visible scope will work great above the atm. It's expensive to put in space though

Project Rho is feasible, but not all UV light reaches the ground.

d) Which of the two proposals described below would you choose to fund?

Project Zeta:
A radio wavelength telescope, placed on the floor of the Mojave Desert, which will be 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, which will be used to view newly forming stars (protostars) in the Orion nebula.

Explain your reasoning.

Both are very feasible. Project Zeta is most feasible if we consider only that all radio waves reach the ground. Project Epsilon would work, but not all IR reaches the ground + would be more expensive + hard to get to.