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:** Full 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.

**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 Delta - 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 atmosphere, X-rays 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 Ursus Major.

Explain your reasoning.

*Project Sigma - visible scope will work great above the atmosphere, 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.*