

Big ideas and questions

- The energy of a photon depends inversely on its wavelength.
- An object that absorbs light perfectly emits black-body or thermal radiation. The spectrum of the radiation is brightest at a wavelength that is shorter at higher temperature. The power that is emitted depends on the area of the object and the fourth power of temperature.

- An electron in an atom may have certain discrete energies; it cannot have any energy.
- When an atom emits a photon, an electron drops from a higher energy level to a lower one. When an atom absorbs a photon, an electron jumps from a lower energy level to a higher one.
- Each element emits (and also absorbs) a unique set of spectral lines, its fingerprint. These spectral lines correspond to transitions between the atom's discrete energy levels, which are unique for each element.
- Explain the absorption spectrum produced by a cool gas cloud in front of a star.

- A bigger telescope collects more light and has better angular resolution.
- Why does a radio telescope see such a fuzzy image when compared with an optical telescope of the same diameter? How do astronomers build radio telescope that have the same angular resolution as optical telescopes?
- What are reasons for building telescopes in space?

- On Earth, why is iron primarily in the core and why is silicon on the crust?
- What are effects of plate tectonics?
- Why are meteor craters rare on earth and common on the moon, even though they would have been bombarded by meteors at the same rate?
- What is the greenhouse effect?
- How does the carbon-dioxide cycle regulate the surface temperature of Earth? Why was water liquid on Earth even in the past when the sun was fainter?
- What is the evidence that human activity is warming Earth?
- Gravity of the planet, mass of the gas molecule, temperature of the atmosphere—how do these parameters affect the ability of a planet to retain the gas?
- What are mechanisms for a terrestrial planet to gain and lose atmosphere?
- Venus is too hot; Mars is too cold. Why is the earth just right, not too cold and not too hot?
- Venus is too hot. Why did the greenhouse effect fail to make the temperature on Venus moderate?
- What is the key evidence that Venus lost its water?
- What is the evidence that Mars has water?
- What is the evidence that Mars had liquid water at one time?
- Why did Mars become cooler so that liquid water disappeared?
- What is the evidence that Mars used to have a hot interior?