1. • Could you ever ionize a hydrogen atom by having it absorb a photon of visible light? Explain fully.

2. • Why was it so important to be able to measure distances to stars?

3. • An airplane flying at a constant velocity over a French corn field drops a bowling ball. Describe the path of the falling ball, its velocity, and where it hits in relation to the position of the airplane at the instant of release. **NEGLECT AIR RESISTANCE.**

4. • Why does a very heavy person break chairs and light people don't?

5. • A small radio transmitter is dropped from the top of a tall building. You stand with a radio receiver directly below the falling transmitter. You have tuned your receiver to receive the transmitter when it was standing still (before it was dropped). Describe, in detail, how you must tune your receiver to continue to receive the transmitter from the time it is dropped until just before it hits you.

6. • Two stars are equally bright and equally large. One is red and the other is blue. Which one is farther away? Explain fully.

7. • Why do astronomers use telescopes?

8. • Can you ionize an atom of hydrogen with an infrared photon?

9. • Rock A is dropped on the surface of the earth. At the same instant rock B is tossed downward. Both rocks leave my hand simultaneously, but B starts with a downward velocity of 10 ft./second while A starts with a velocity of 0 ft./second. Compare their velocities 1 second later, 2 seconds later, 3 seconds later.

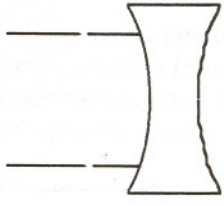
10. • Comment on the luminosity of faint (low brightness) stars which show large proper motions.

11. • You have a lamp which emits light at the wavelength of the Balmer α spectral line. You tie the lamp to a rope and whirl the lamp around your head. Describe the observed wavelength of Balmer α 1) which you see and 2) which a friend standing 100 feet away sees as the lamp whirls around.

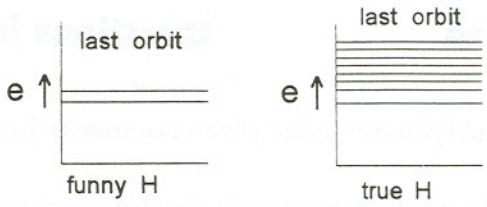
12. • Explain why blocking off part of a lens does not block off part of the image but just makes the image dimmer.

13. • Why was the proof that stars are similar objects to our Sun so difficult and why did it take so many centuries?

14. • The drawing shows the cross-section of a weird lens with red light entering it from the left. Draw what happens to the red light.



15. • Imagine a new atom called "funny hydrogen" which has the ground state, first excited state, and second excited state exactly the same as real hydrogen but in this funny atom, beyond the second excited state the atom is ionized (see drawing). Compare the Lyman series in funny hydrogen to the actual Lyman series.



16. • Pressing on the gas pedal of your car causes the engine, transmission, and tires to produce a force which propels your car. Why on a straight, level highway do you need to press on the gas pedal in order to maintain a constant velocity?

17. • Can a cool star ever produce more blue light than a hot one?

18. • Why do modern telescopes use mirrors rather than lenses?

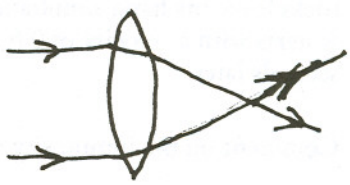
19. • Does the Earth's orbital motion around the Sun produce a Doppler shift in the light of *all* stars in the sky?

20. • How are the masses of stars determined?

21. • If all stars had the same size (area) would there be a relation between their color and their luminosity? Explain fully.

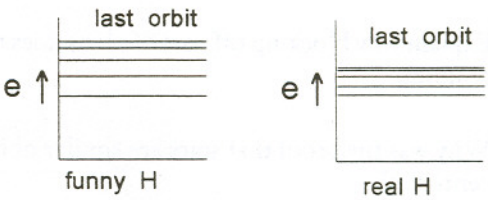
22. • A cloud of hydrogen gas is placed between you and a perfect radiator. At the wavelength of Balmer α you see a dark line in the spectrum of the perfect radiator. Even if every photon from the perfect radiator at the wavelength of Balmer α is absorbed, the dark line is not completely dark. Why?

23. • The drawing shows rays of blue light from a distant star and focused by the lens. Draw the rays of red light from the same star and show where they reach a focus.



24. • Discuss some of Galileo's contributions to science and their value.

25. • The drawing shows the energy levels of funny hydrogen. Its energy levels look exactly the same as real hydrogen except that they are twice as far apart. Describe the changes in the Lyman and Balmer series caused by this change.



26. • The drawing shows an energy-level diagram for a new chemical element, Strange Hydrogen. Using the same convention for naming spectral lines compare Strange Hydrogen to Hydrogen.