

Except for questions 24, 25, 29, 32 marks/answers on these sheets are not graded.
Record your answers on your answer sheets unless the question states otherwise!

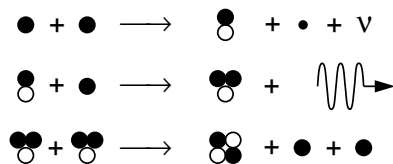
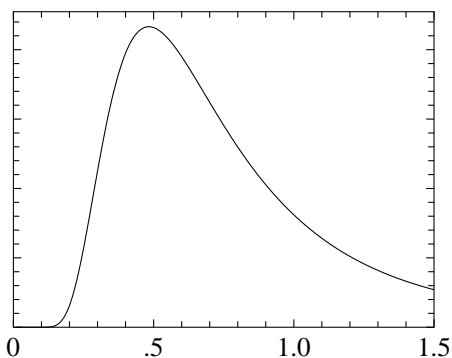
Answer TRUE or FALSE (not T or F) (2 pts each)

1. Since an ice skater spins faster and faster as she draws her arms in close to her body, her angular momentum is increasing.
2. For sound: the bigger the wavelength the higher the pitch.
3. Doppler effect: Stopped in the station the train's whistle sounds an A (440 Hz), but after it has passed me at high speed at a railroad crossing it sounds an A^b (415 Hz).
4. All the isotopes of hydrogen have one proton, but they differ in the number of neutrons.
5. The distinction between particles and waves is an illusion: everything has a wavelength.
6. High temperatures break apart composites.
7. An atom that has lost an electron is an *ion*.
8. Radio waves move slower through space than X-rays.
9. In comparing two photons of light, the photon with the lower wavelength will have the higher energy.
10. Every object is incandescent, but the light emitted may not be visible to humans.
11. Red light has a higher frequency than blue light.
12. If space is transparent, the ratio of blue light to red light from a star will not change with distance.
13. The main reason for building large Earth-based telescopes is to magnify the tiny images of stars.
14. The main reason for building space-based telescopes is to get them closer to the stars.
15. Long focal length lenses make big images; large f-number lenses make dim images.
16. In a refracting telescope the objective is a lens.

Give a short explanation (5 pts each)

17. The binoculars used at the observatory were labeled 7×50 . What do the 7 and 50 mean?
18. The second law of thermodynamics states that the entropy of the Universe can not decrease. How then is it possible for a guy to clean up his room?
19. What is the difference between hot gas and cool gas, i.e., on the atomic scale what changes as temperature increases?
20. Rank order the following types of light from from longest to shortest wavelength: infrared, microwave, ultraviolet, X-ray, yellow, green
21. Describe the physical nature of light, that is, what is it that is 'waving' in a light wave?

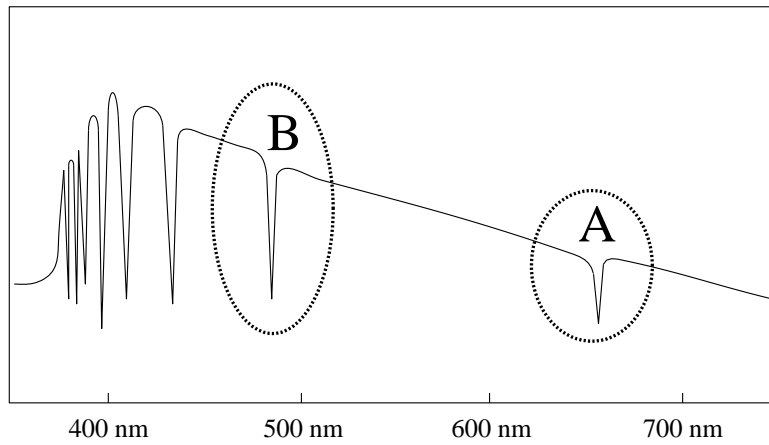
22. How would you measure the focal length of a lens?
23. In class you viewed the spectra produced by normal incandescent bulbs, Reveal bulbs, and the fluorescent tubes currently illuminating this classroom. Describe each of the three spectra. Why are the spectra different (i.e., what processes produce the distinctive features of those spectra)?
24. The below left is a spectra of a thermal (blackbody) light source at a temperature of 6000 K. Sketch directly on top of this graph the spectra of an otherwise identical thermal light source at a temperature of 4000 K. Label **B** where blue light would appear on this graph; label **R** where red light would appear.



25. The above right cartoon is a representation of the nuclear reactions that power the Sun. Directly on this diagram label/name all the participants.
26. The two most famous telescopes currently in active use are the Hubble Space Telescope (HST) and the Keck telescope. HST is a f/13, 2.4 meter telescope which is deployed in low-Earth orbit (about 600 km above the Earth). The f/1.75, 10 meter Keck telescope is on the summit of Hawaii's dormant Mauna Kea volcano, 4 km above sea level. Which telescope should you use to photograph dim objects? Which telescope shows the finest details? Which telescope produces the most "magnified" images?
27. Define *resolution*. What is *atmospheric seeing*? What does it have to do with resolution?
28. What is fusion? What is fission? How is it that both types of reactions can release energy?

Write out a complete answer (10 pts each)

29. The following page displays a somewhat simplified spectra of the star Altair. The features labeled **A** and **B** are produced by hydrogen gas in the atmosphere of the star.
- Directly on graph record the quantity displayed on each axis.
 - Consider the features labeled **A** and **B**, which are both produced by hydrogen gas in the atmosphere of the star. What exactly is happening to the hydrogen atom to produce these features?
 - Draw a properly scaled energy level diagram showing exactly how the two features are produced. Clearly show/distinguish how **A** is produced and how **B** is produced.
 - How can astronomers be sure that it is hydrogen gas that is causing these features?
 - How would **A** change in a star with a cooler surface temperature?
 - How would **A** change if Altair were moving away from the Earth at high speed?
 - How would **A** change if there were fewer hydrogen atoms in Altair's atmosphere?



30. Sketch a Newtonian reflecting telescope. Show and label: an arrow pointing in the direction to the stars, the objective, aperture, eyepiece, and focal length of the objective.

Why are some telescopes put in space?

31. Describe why the Sun doesn't explode. Your explanation should include a full statement of the Virial theorem, an explanation of why things "usually" explode, and an explanation of why you haven't seen anything explode recently.

32. Label (directly on this sheet) the below three constellations with each constellation's name.

