

Except for questions 25, 27, 29b, 29d, 30 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)

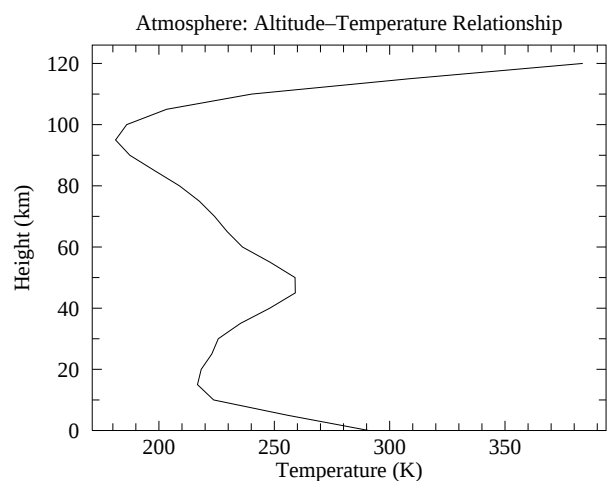
1. Since an ice skater spins faster and faster as she draws her arms in close to her body, her angular momentum is increasing.
2. Doppler effect: Stopped in the station the train's whistle sounds an A (440 Hz), but after it has passed me at high speed at a railroad crossing it sounds an A[#] (466 Hz).
3. Radio waves move slower through space than X-rays.
4. In comparing two photons of light, the photon with the bigger wavelength will have the bigger energy.
5. Our Sun produces an emission spectra.
6. Every object is incandescent, but the light emitted may not be visible to humans.
7. Red light has a higher frequency than blue light.
8. A microwave photon carries more energy than a ultraviolet photon.
9. The main reason for building large Earth-based telescopes is to magnify the tiny images of stars.
10. The main reason for building space-based telescopes is to get them closer to the stars.
11. Long focal length lenses make big images; large f-number lenses make dim images.
12. In a refracting telescope the objective is a lens.
13. It seems natural that planets rich in high melting point materials are found near the Sun, whereas planets with lots of volatiles are found far from the Sun. However, some exoplanets seem to defy this trend.
14. High temperatures favor disorder; low temperatures favor a state of minimum energy.
15. Our planetary system (together with the Sun) formed about $4\frac{1}{2}$ billion years ago from a small part of a giant molecular cloud.
16. Homo-nuclear diatomic molecules like N₂ do not contribute to the greenhouse effect.

Give a short explanation (5 pts each)

17. Report three types of energy. What does 'conservation of energy' mean?
18. The second law of thermodynamics states that the entropy of the Universe can not decrease. What is entropy? Which has more entropy: a pound of liquid water or a pound of ice? In terms of entropy what is required to turn liquid water into ice?
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 longest to shortest wavelength: infrared, microwave, ultraviolet, X-ray, orange.
21. 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 (i.e., what did they look like). Why are the spectra different (i.e., what processes produce the distinctive features of those spectra)?
22. How did you measure the focal length of a lens in class?
23. NASA has asked for your help in designing a new telescope. Specifically they have four questions for you to answer. However, since NASA isn't paying you much for your answers, you may select any three of questions to answer.
 - (a) What should we do to assure that the new telescope will have the best possible resolution?
 - (b) What should we do to assure that the new telescope will have the maximum possible magnification?
 - (c) What should we do to assure that the new telescope will be able to photograph the dimmest possible objects?
 - (d) If we can't do all of the above, which should we drop from consideration?
24. List the terrestrial planets in our Solar System. List the Jovian planets. Report two distinguishing characteristics (and which type has which characteristic) of these two types of planets.
25. Three factors that control whether a particular molecule is retained or lost from a planet's atmosphere are the planet's _____, the atmosphere's _____ and the molecule's _____. Report these factors, and state how each factor would need to change to make it *more* likely that the particular molecule is *retained*.
26. Define and give an example of two of the following three methods of heat transfer: conduction, convection, radiation.

27. The graph displays the relationship between altitude and temperature in the Earth's atmosphere. Locate, name, and label (directly on this graph) the layers in the Earth's atmosphere. According to this graph ground level and heights of 45 km and above 120 km are hotter than nearby layers. In each case report the cause of the high temperature region shown in the graph.

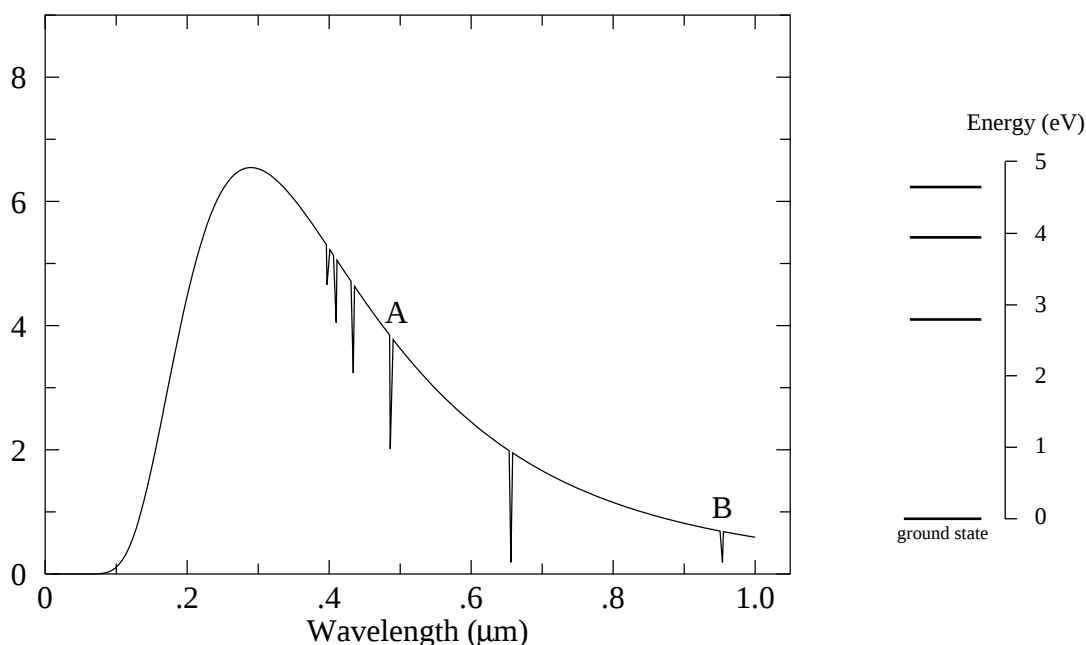


28. If you increase the amount of CO_2 in the Earth's atmosphere what is the feared consequence? If you decrease the amount of O_3 in the Earth's atmosphere, what is the feared consequence?

Write out a complete answer (10 pts each)

29. The below is a simulation of the spectra of a star.

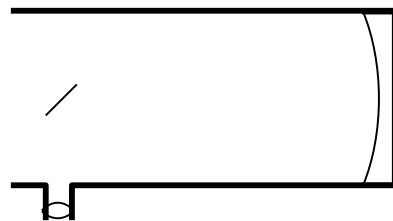
- Notice the labeled features **A** and **B**. What are these features called? What causes these features?
- Draw (in the area to the right of the spectra) the electron movements that would produce **A** and **B**; label which movement makes which feature.
- What is the numerical value of the peak wavelength?
- Sketch directly on top of the existing plot how the entire graph would change if the star producing the light were hotter.
- If the temperature of the star changed describe (words!) how/if features like A & B would change.



30. Find below a sketch of a refracting telescope. Using the provided paper ruler-copy measure and report the numerical value of: the aperture, focal length, and f-number of the refractor's objective.

Find to the right a sketch a Newtonian reflecting telescope. Show and label: an arrow pointing in the direction to the stars, the objective, aperture, and eyepiece.

Why are some telescopes put in space?

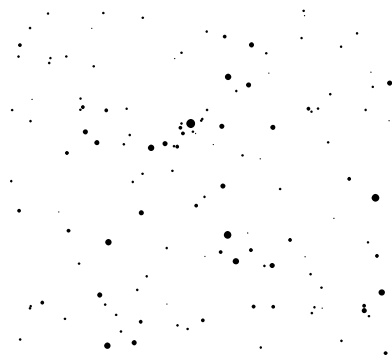
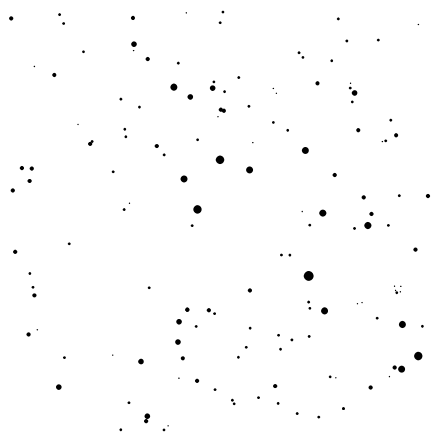


31. In class we derived a formula for “the” temperature of a planet:

$$T = T_{\odot} \sqrt{\frac{R_{\odot}}{2a}} \left[\frac{1 - A}{\epsilon} \right]^{1/4}$$

Name/describe three of the factors in this formula. For each factor report how *decreasing* the factor would change the planet’s temperature. What is this “the” temperature of? How/why could the “surface” temperature differ from this formula temperature?

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



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