

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

1. Generally speaking, the bigger the musical instrument the bigger the frequency it produces.
2. Archimedes taught that as you move down in a fluid the pressure increases so that for any submerged object the pressure differences result in a net force equal to the weight of the fluid displaced: $\Delta P = \rho gh$.
3. For sound: the smaller the wavelength the bigger the frequency.
4. An atom from which an electron has been removed is called an *ion*.
5. Every isotope of carbon has the same number of protons in its nucleus.
6. If you increase the temperature of a gas you are increasing the average speed of the particles making up that gas.
7. High temperatures break apart composites.
8. A hot ionized gas could be called a *plasma*.
9. In comparing two photons of light, the photon with the smaller wavelength will have the smaller energy.
10. Standard incandescent light bulbs produce an emission spectra.
11. Red hot is hotter than white hot.
12. In a refracting telescope, the objective is a lens.
13. Astronomers seek places where the stars don't twinkle as that means good seeing.
14. A resolution of 2 arcsec is better than one of 1 arcsec.
15. A radio interferometer is a device used to reduce the interference of nearby radio stations.
16. The Earth is like a giant electromagnet powered by the temperature difference between the mantle and the inner core.
17. Because of the high temperatures found there, the exact center of the Earth is made of liquid metal—mostly iron.
18. The *mantle* of the Earth covers the Earth's crust
19. The Earth is estimated to be approximately $4\frac{1}{2} \times 10^9$ years old.
20. Like light, shear waves can be polarized.

Give a short explanation (5 pts each)

21. The binoculars used at the observatory were labeled 7×50 . What do the 7 and 50 mean?
22. Sketch a picture of an atom. Label nucleus, protons, neutrons, and electrons. Where are the quarks located?
23. Define *wavelength*, *frequency*, and *amplitude*.
24. Order the following list of types of light from shortest to longest wavelength: X-rays, microwaves, blue, red, AM radio, and infrared.
25. Describe the Doppler effect.
26. Sketch a Cassegrain focus telescope. Label: objective, aperture, and the direction to the stars.
27. Define *resolution* of a telescope. What factors affect the resolution of telescopes?
28. Describe how you could measure the focal length of a lens.
29. Consider two famous old telescopes: the “great refractor” at Yerkes Observatory in Williams Bay WI and the Hale telescope on top of Mt. Palomar (5600 feet up and 40 miles west of San Diego, CA). The great refractor is a f/19, 40 inch telescope on the shores of Lake Geneva. The Hale has a 200 inch mirror and may be configured as a f/3.3 Newtonian. Which telescope should you use to photograph dim objects? Which telescope shows the finest details? Which telescope produces the most “magnified” images?
30. Looking through a spectroscope (as you did in class), describe exactly what you would see: (A) looking at a fluorescent light and (B) looking at an incandescent light.
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 *increasing* the factor would change the planet’s temperature.

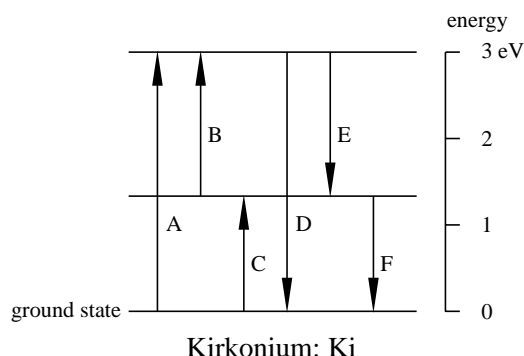
32. The book says that the Earth (meaning the solid part) is differentiated. What does this mean?
33. What is the difference between *mafic* and *felsic* rock? Where in the interior of the Earth would you expect to find mafic and felsic rock? Why?
34. ^{14}C has a half-life of about 6000 years. If in a particular sample 75% of the ^{14}C originally present has decayed, how old is the sample?
35. Define two of the following three rock types: sedimentary, metamorphic, igneous.

Write out a complete answer (10 pts each)

36. At the March Meeting of the Astronomical Science Society, astronomers at the Dakota University in Lower Livermore (DULL) announced the discovery of a new element (Kirkonium) in the atmosphere of Jupiter. (Find below the energy levels for this new element.) The DULL astronomers displayed two spectra demonstrating the existence of Kirkonium: (A) an absorption spectra of light reflected from Jupiter's atmosphere as observed from Earth and (B) an emission spectra of light from regions of Jupiter's atmosphere excited by lightning bolts as observed by a probe orbiting Jupiter.

- (a) Sketch spectra A. Using the transition labels from the below energy diagram, label two absorption lines.
- (b) Sketch spectra B. Using the transition labels from the below energy diagram, label two emission lines.

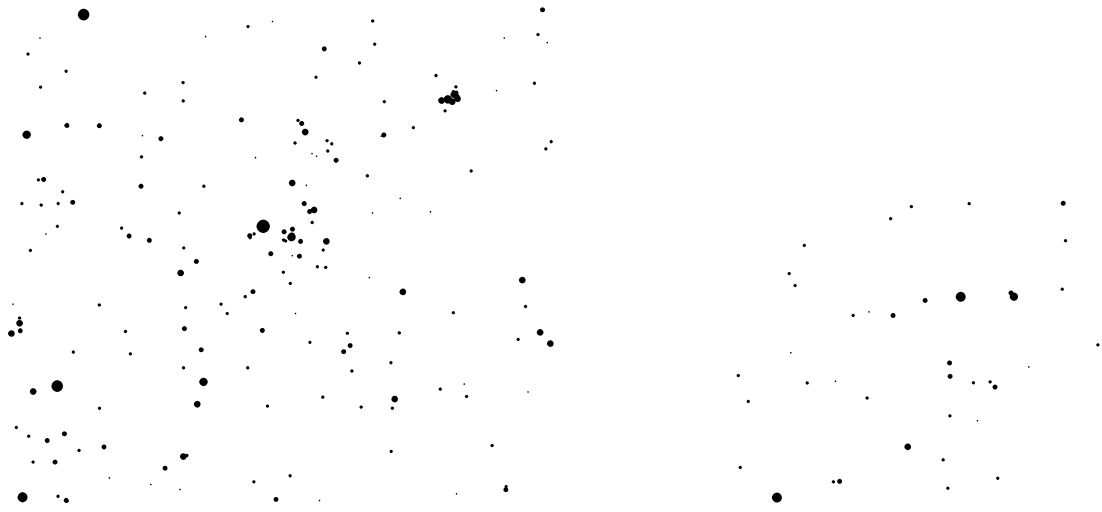
Be sure to include x and y labels on your spectra!



37. Sketch and label three spectra: (A) the spectra of the light produced by a very hot object (say, 30,000 K), (B) the spectra of the light produced by hot object (say, 3000 K) and (C) the spectra of the light produced by a room temperature object (say, 300 K). Assume that the objects are identical in every way except temperature. In order to make the relationships between these spectra clear, draw all three on one set of axes. Which object produces the most infrared radiation? Which produces the most visible radiation? For each object: describe the color you see produced by the object. Be sure to include x and y labels on your spectra!

38. List the terrestrial planets. List the gas giant planets.
- (a) List two characteristics shared by all the terrestrial planets.
 - (b) Report one characteristic that the Earth *has* but the other terrestrial planets do not have.
 - (c) List two characteristics shared by all the gas giant planets.
 - (d) Report one characteristic that the Earth *has* and all the gas giant planets also have.

39. Make a sketch of the cross section of the upper layers of rock on the Earth. The sketch should accurately show how pieces of the Earth's crust are created and destroyed. Label: mid-ocean rift zone, oceanic crust, continental crust, lithosphere, asthenosphere, mantle, convection cell, subduction, area of mountain building, and which way the plates are moving.
40. Name each of the below constellations.



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