

**$\alpha$ -Centauri 4.3 light-years from Earth**

**Moon 240,000 miles from Earth, 2160 miles diameter**

**Earth 93 million miles from Sun, period 365 days, 7913 miles diameter**

**Mars 142 million miles from Sun, period 687 days**

**Neptune 2.8 billion miles from Sun**

**Light travels  $3 \times 10^5$  km/sec**

1. How many paper clips, attached end-to-end, will it take to reach the moon from the Earth?
2. Harvey "Non-Stop" Pierson, a former Olympic miler, has been training to run without stopping, food, or sleep. How many hours would it take "Non-Stop" to go from Wilmington to San Francisco?
3. What is the mass, in grams, of the moon?
4. How many seconds would it take for a camera flash to reach Neptune from the Earth?
5. How many years will it take Non-Stop (see problem 2.) to run the equivalent of the distance from the earth to the sun?
6. For the interval of time between a typical human's heartbeats, how far, in millimeters, will light have traveled in vacuum?
7. An astronomer says his telescope is accurate to within 1 second of a degree. How many km is that equivalent to in the vicinity of  $\alpha$ -Centauri?
8. How fast, in km/hr, does the earth travel around the sun?
9. What is the mass, in grams, of the paper clips of problem 1?
10. How many acrobats, standing on the shoulders of the person beneath them, would be needed to reach from the Earth to the Sun?

11. What fraction of the sun's energy output is intercepted by the earth?
  
12. During the time interval of a blink, how many km has light traveled in a vacuum?
  
13. Using the scale that the distance from the Sun to the Earth is represented as 1 meter, what is the diameter of the Earth, in meters?
  
14. Using the same scale as Problem 13, how far away, in meters, is  $\alpha$ -Centauri from the Sun?
  
15. How far, in kilometers, is a light-month?
  
16. How far does light travel in a person's lifetime?
  
17. What is the volume of a sphere ( $\text{km}^3$ ) with a radius of 4 light years?
  
18. If space has a vacuum of  $10^{-20}$  atm and is filled with hydrogen at  $2^\circ\text{K}$ , what is the mass in tons of the sphere in problem 17?
  
19. The diameter of the sun is about 860,000 miles and its density is  $1\text{g/cc}$ . What is the mass of the sun in tons?
  
20. How many times larger is the mass of the interstellar matter of problem 18 compared to the sun?

21.  $\alpha$ -Centauri has a diameter of  $10^6$  km. What fraction of the sun's radiant energy does it receive?
22. If a telescope can distinguish objects 0.001 second apart, for a binary star 4 light years away, how many km is that equivalent to?
23. For an area of  $1 \text{ cm}^2$ , what fraction of the sun's energy does Neptune receive compared to the Earth?
24. Estimate Neptune's period, in days.
25. A spaceship races towards  $\alpha$ -Centauri from the Earth at 25,000 mph. How many years will the trip take?
26. When the ship lands on  $\alpha$ -Centauri (see problem 25), it fires off a neutron flare. How long, in years, will it take the light to reach Earth?
27. How many moons would be equivalent to the mass of the Sun?
28. What is the surface area of the Sun in square kilometers?
29. How long, in minutes, would it take the spaceship (see problem 25) to circumnavigate the sun?

30. How long, in days, would it take the spaceship (see problem 25) to fly from the Earth to Neptune?