

Instructions: This test has the same format as before. If you need more room please turn the paper over. Point weightings are indicated in parenthesis. For questions that include laboratory data with the precision digit of the measured physical quantity underlined, please use the rules for precision and significant figures. So for this, the last test of the summer poets class, Good Luck! Note: If you would like for me to get materials back to you other than through the campus mail, please indicate how (if you want me to send it to you through the mail, an self addressed envelop and postage is always appreciated, or just give me an address):

A. Short Answer Questions. Select the *best* answer for multiple choice questions. (1 point each question unless otherwise indicated.)

- \_\_\_\_\_ 1. As the angle of incidence increases, the angle between the incident ray and the surface:  
a) increases    b) decreases    c) stays the same
- \_\_\_\_\_ 2. The image formed by a plane mirror  
a) is not magnified                      b) is a virtual image  
c) is as far behind the mirror as the object is in front of it  
d) all of the above
- \_\_\_\_\_ 3. If you stand four feet in front of a plane mirror, you see yourself basically in the same way as someone would see you if she were  
a) four feet away from you                      c) eight feet away from you  
b) two feet away from you
- \_\_\_\_\_ 4. A ray of light in air hits the surface of water at an angle of incidence of 30 degrees. When it passes into the water it  
a) bends toward the perpendicular  
b) bends away from the perpendicular  
c) does not bend at all
- \_\_\_\_\_ 5. When looking at a rock in water, it appears ? the surface than it actually is.  
a) farther away from;    b) closer to;    c) the same distance from.
- \_\_\_\_\_ 6. (1 ½) Can you take a picture of a virtual image? (yes, no)  
\_\_\_\_\_ Can you project a real image on a screen? (yes, no)  
\_\_\_\_\_ Can you project a virtual image on a screen? (yes, no)
- \_\_\_\_\_ 7. (1 ½) In the velocity of sound lab, if the distance between the two nodes is 65.4 cm and the tuning fork frequency is 256 Hz, what would a student calculate for the speed of sound from this data?
- \_\_\_\_\_ 8. The aberration occurring in lenses which refers to light rays which pass through the outer portion of the lens being focused at a different point than those rays passing through the center is called ?.
- \_\_\_\_\_ 9. REVIEW QUESTION: From the periodic table, pick **all** of the following elements that have a deficiency or one electron in its outer shell:  
a) Mg; b) Na; c) Sr; d) Cs; e) Cl; f) S

- \_\_\_\_\_ 10. REVIEW QUESTION: Find the *precision* of the following area:  
Area = 25.2 ft x 8.95 ft
- \_\_\_\_\_ 11. Sound is converted into an electrical signal by what device?
- \_\_\_\_\_ 12. When two tuning forks are struck, differing in frequency of only a couple hertz, the interference that results is a rapid increase and decrease in the loudness of sound known as ?.
- \_\_\_\_\_ 13. REVIEW QUESTION: At a rarefaction, the density of air is ? what it would be in the absence of the rarefaction. Choose from: (a) higher than; (b) lower than; (c) the same as.
- \_\_\_\_\_ 14. An echo is heard from a surface 4 seconds after the shout. How far away is the smooth surface?  
Note: Use the speed of sound in this and subsequent problems as 340 m/s or 1100 ft/sec.
- \_\_\_\_\_ 15. What two characteristics of the surface in question #14 would result in the maximum reflection of sound?
- \_\_\_\_\_ 16. What is the significance of the "wobbling" of a star?
- \_\_\_\_\_ 17. REVIEW QUESTION: A physical quantity designating the number of waves given off by a vibrating object every second is called ?, and is in units of ?.
- \_\_\_\_\_ 18. The particular part of the ear that is similar to the "resonant tube apparatus" that we used in our laboratory is called the ?.
- \_\_\_\_\_ 19. The part of the electromagnetic spectrum that carries the greatest frequency and also greatest energy waves is called ?.
- \_\_\_\_\_ 20. An eye defect which occurs because the cornea is not spherically shaped, but instead has a cylindrical shape is called ?.
- \_\_\_\_\_ 21. The part of the retina of the eye that plays a big part in allowing a person to use peripheral vision is called ? while the part of the retina of the eye in acute vision is the ?.
22. As the object distance from the eye is changed, the eye, because of its finite size is unable to change the image distance. What remarkable adaptation occurs?
- \_\_\_\_\_ 23. If an object is at an infinite distance from a converging or diverging lens, the **incident** light rays strike the lens (a) bending away from each other (b) bending toward each other (c) parallel to each other (d) differently depending upon whether the lens is converging or diverging.
- \_\_\_\_\_ 24. For a single source of light and a diverging lens, the image produced is always (a) virtual, erect, smaller, (b) virtual, inverted, larger (c) real, inverted, smaller, (d) real, erect, larger (e) none of these.
- \_\_\_\_\_ 25. In the theory of color, if red is subtracted from the color spectrum, the result is named ?.
- \_\_\_\_\_ 26. In the theory of color, if red *and* blue is subtracted from the color spectrum, the result is named ?.
- \_\_\_\_\_, \_\_\_\_\_ 27. (2) In the theory of color, the three additive primaries are called ?, ?, and ?; if these three colors are added together the resulting color is *theoretically* ?.
- \_\_\_\_\_, \_\_\_\_\_ 28. (2) In the theory of color, the three subtractive primaries are called ?, ?, and ?; if these three colors are added together the resulting color is *theoretically* ?.

B. Longer Answer Questions:

1. (4) REVIEW QUESTION: Define "standing waves." Also define resonance. Compare "standing waves" and resonance.

2. (4) DEFINE:

dispersion

cataracts

ultraviolet

archebacteria

3. (3) What are cones? Use the theory of color to describe why some people are "blue-green" color-blind.

4. (4) REVIEW QUESTION: Define and distinguish between a longitudinal wave and a transverse wave and give two examples of each.

5. (3) Distinguish between pitch, quality of sound, and loudness of a sound wave, and relate these sound characteristics directly to the physical quantitative description of the wave. (Hint: Remember the oscilloscope demonstration on Tuesday.)

6. (2) REVIEW QUESTION: (a) Sketch the second overtone writing down the sequence of nodes (N) and antinodes (A) for a vibrating string

(b) (2) Define and distinguish between nodes and antinodes for

(i) a closed pipe such as we used in the sound lab

(ii) a vibrating string

7. (3) Define and give an example of the "doppler effect".

8. (4) Discuss what happens when a plane moves faster than the speed of sound and how its design must be modified and why. Also discuss or use a series of diagrams to show what is heard by a person on the ground when a plane flies overhead that is flying faster than the speed of sound. And finally, what is the "Mach Number?"

9. (4) (a) (2) Discuss those acoustical factors that are important in the design of a music hall--such as the Ordway or Orchestra Hall. Don't forget to include in your discussion "reflection of sound," "absorption of sound," and "reverberation time." (b) (1) Why is it that there are separate halls for orchestras and theaters? (c) (1) What acoustical problems exist for the St. Paul Cathedral in downtown St. Paul?
10. (a)(4) What is the "Law of reflection?" Illustrate by drawing in an appropriate surface, rays, and angles. Assume an angle of incidence of 30 degrees for your incident ray in your diagram.
11. (4) What is the "Law of Refraction?" Illustrate by drawing in an appropriate surface, rays, and angles. Assume an angle of incidence of 30 degrees for your incident ray in your diagram.
12. (4) (a) Define "critical angle". Use a series of diagrams if helpful in your explanation. (b) What is "total internal reflection", and how does it relate to critical angle? (c) List two examples of the use of total internal reflection.

13. (2) In class we illustrated by a ray diagram how one could use two prisms as a periscope as is used in a navy submarine. This question is similar to that. Please illustrate by a ray diagram how two right-angle prisms could be used to see behind oneself. Start with the source giving off a typical light ray and trace its path into the correctly aligned prisms and then into the eye.

14. (+2 bonus) Start with an object and trace a typical light ray which passes through a thick parallel piece of glass. Let your angle of incidence be approximately 60 degrees.

15.(4) List 4 of the many characteristics necessary for a carbon-oxygen-water type of life according to Dr. Bracewell of Stanford University.

16. (4) (a) Draw a diagram of the human eye and identify the crystalline lens, the ciliary muscles, the retina, the cornea. (b) Mention or illustrate what happens for (i) a myopic eye, and (ii) a hyperopic eye and include what is used to correct for each of these conditions

16. (4) A poet in performing her pendulum lab took the following data: (I) a 9.0 in length pendulum took 52 seconds for 60 cycles; (ii) a 16.0 in length pendulum took 69.6 seconds for 60 cycles.

- (a) Find the period for each case.
- (b) If she found the period to be proportional to the square root of the length, find the constant of proportionality.

17. (4) Describe how the acceleration due to gravity can be measured by using two photocells and a timer.

18. (4) Describe how one can use a tuning fork and a resonance tube apparatus in order to measure the speed of sound.

19. (4) In the lens lab the following graph was obtained.

(a) Write down the mathematical equation that accompanies this graph.

(b) What is the focal length of the lens?

HAVE A GREAT REMAINING SUMMER, EVERYONE! JA