

Last name _____ First name _____ SID _____

Essay questions: pick **one** and only one to answer. Write a page or two (or whatever is appropriate) in your blue book or on the back of this handout. The essay is worth 20 points. The essay should be clear, organized, and well-written.

1. In some science classes they teach that light travels in straight lines. But this is not always true. Why it is widely believed that light behaves this way? Give example that show the situations in which it is not true. Use numbers whenever possible.
 2. Waves have a peculiar property: they can cancel. Give examples of cancellation for sound, light, water, and earthquakes. Explain why cancellation is so difficult to observe for light.
 3. Most people have never heard of a "sound channel". Given two examples of sound channels. Describe how the velocity of sound varies with location, and how this affects the direction of the waves. Give examples of the practical use of these channels.
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Brief questions (worth 1 point each, 20 points total)

1. According to Muller, the flying disks that crashed near Roswell were:
 - microphones
 - wave generators
 - lasers
 - U-2 airplanes
2. Because of evaporation, the air above the surface of a lake becomes cool. Sound in the air above the lake will tend to:
 - bend upward away from the surface
 - bend downward towards the surface
 - go in a straight line parallel to the surface
 - go alternatively up and down
3. Thunderclouds tend to rise until
 - they rain out all their water
 - they reach air that is colder than they are
 - they hit the carbon-dioxide layer
 - they reach air that is warmer than they are
4. The slowest earthquake wave is the
 - L wave
 - P wave
 - S wave
 - M wave

5. Fiber optics are replacing electrical wires primarily because:
- light travels very fast
 - light travels (mostly) in straight lines
 - light is less expensive than electricity
 - light has a higher frequency
6. If the pinhole camera, more blurring occurs if
- the hole is made very large (but not if it is very small)
 - the hole is made very small (but not if it is made very large)
 - the hole is either very large or very small
 - never, since there is no lens in a pinhole camera
7. Red-eye occurs because the eye is
- a pinhole camera
 - a corner reflector
 - a retroreflector
 - backed with a glowing retina
8. The "index of refraction" measures
- the frequency of light
 - the speed of light
 - the period of light
 - density of the glass
9. GPS refers to
- a method of rescuing pilots designed during WWII
 - a project to detect nuclear explosions
 - a system for detecting submarines
 - a system using many artificial Earth satellites
10. When we say a man is colorblind, we mean that:
- everything looks black and white (or gray)
 - Unlike others, he can't see ultra-violet or infra-red
 - he can sense only three colors
 - he can't distinguish red from green
11. A pigeon bobs its head back and forth
- to communicate using low frequency sound
 - to estimate distances
 - to keep its balance better
 - because it is a predator
12. water waves are
- pure transverse waves
 - pure longitudinal waves
 - both transverse and longitudinal
 - compressional

13. An "octave" refers to two frequencies which differ by a factor of:
- 1.5
 - 2
 - 7
 - 8
14. If the time between the S and P waves is 10 seconds, the distance to the earthquake is approximately:
- 2 miles
 - 10 miles
 - 50 miles
 - 20 miles
15. The velocity of sound is approximately:
- 1000 ft per second
 - 1 mile per second
 - 5 miles per second
 - 186,284 miles per second
16. A water wave has a wavelength of 10 meters, and a frequency of 2 cycles/sec. Its velocity is:
- 5 meters per second
 - 10 meters per second
 - 20 meters per second
 - 50 meters per second
17. Land fill is dangerous because:
- the frequency of an earthquake increases
 - the wavelength of an earthquake increases
 - they tend to focus earthquake energy
 - the amplitude of the earthquake increases
18. The center of the earth is:
- pure rock
 - liquid rock
 - liquid iron
 - solid iron
19. Beats measure:
- frequency
 - the difference between two frequencies
 - loudness
 - the presence of noise
20. Stealth airplanes:
- are invisible to the unaided eye
 - must fly above the atmospheric sound channel
 - emit no infrared radiation
 - avoid having shapes like corner reflectors