

Last name _____ First
name _____ SID _____

Essay questions (20 pts): pick **one** and only one to answer. Write a page or two (or whatever is appropriate) on this sheet. Cover the important points in a clear and concise manner – as if you have only a few minutes to tell the President (or your roommate) what he needs to know. Clear, effective writing is important.

1. When most people hear about "waves" they think of water waves. But in physics there are many other kinds of waves. What properties do all waves have in common? List other kinds of waves that have been presented in this course. For each kind of wave, describe its particular properties.
 2. Humans may be disturbing the atmosphere in a way that will be detrimental to future life. Discuss this subject. Be as specific as possible. Describe not only the facts, but also the points that many people misunderstand.
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Short questions (1 point each, 20 points total). Read the questions carefully so that you don't misinterpret them (e.g. by missing a word such as "not").

1. The wavelength of visible light is closest to:
 - 1 mm
 - 1 micron
 - 10^{-8} cm
 - 10^{-13} cm
2. Infrared radiation can (check all that apply):
 - cause cancer
 - cause sunburn
 - help snakes locate prey
 - create ozone
3. The colors of a soap bubble indicate
 - light is a wave
 - light is a particle
 - light travels slower in soap
 - light travels faster in soap
4. "Red eye" demonstrates
 - light is a wave
 - air absorbs blue more than red
 - camera film is sensitive to red
 - the eye is a retroreflector
5. Sound tends to bend towards
 - colder air
 - warmer air
 - denser air
 - less dense air
6. Thunderheads stop rising when they reach
 - the carbon-dioxide layer
 - colder air above them
 - the ozone layer
 - the top of the atmosphere
7. A light year is approximately
 - 3×10^7 seconds
 - 3×10^7 meters
 - 10^{16} seconds
 - 10^{16} meters
8. A particle really does travel at the speed of light. (Be careful; only one answer is correct.) We conclude:
 - its energy is infinite
 - it violates Special Relativity
 - its energy is zero
 - its rest mass is zero
9. For the last million years, the climate has been generally:
 - cold, with brief warm periods
 - warm, with brief cold periods
 - about half warm and half cold
 - not known, although we hope to find out soon.
10. A nuclear reactor cannot turn into an atomic bomb because:
 - It contains control rods
 - It requires slow neutrons
 - Emergency systems will stop it
 - It is primarily U-235
11. Diamonds are pretty because in them
 - light travels very slowly
 - light travels very fast
 - there is color dependent absorption
 - light velocity depends on color

12. A successful fisherman will throw the spear

- above the fish image
- below the fish image
- right at the fish image
- it depends on how close the fish is

13. Most of the light emitted by an incandescent bulb is

- infrared
- red
- green
- ultraviolet

14. The advertising slogan "Whiter than white" means that the material:

- absorbs IR
- emits UV
- emits IR
- emits visible light

15. If you double the absolute temperature, the total radiation

- is reduced to half
- doubles
- increases by 4
- increases by 16

16. Dew forms when the ground cools

- by emitting UV
- by emitting IR
- by emitting visible
- by conduction downwards

17. Fiber optics are used instead of radio for communication because:

- light travels faster
- light has more power
- light is cheaper
- light has a higher frequency

18. We know the Earth has a liquid core because:

- P waves bounce off it
- S waves won't travel there
- L waves do travel there
- seismic waves go slower

19. Beats show that sound

- velocity depends on frequency
- is a wave
- is longitudinal
- is transverse

20. Multispectral cameras are useful because:

- They can detect UV and X-rays
 - They can distinguish colors in the visible range that the eye cannot
 - They can make more accurate measurements of Red, Green, and Blue
 - They detect Cyan, Magenta, and Yellow instead of Red, Green, and Blue
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