

DEA 3500: HUMAN FACTORS: THE AMBIENT ENVIRONMENT (Fall 2017)

NAME: _____

HOMEWORK 3

Due Date: November 21st in class

(NOTE: You will need to consult the readings as well as your class notes to complete the homework)

1. Indicate whether each of the following statements is true (T) or false (F).
 - a. visible light is electromagnetic radiation from 10^{-15} m to 10^4 m in length T / F
 - b. colored light is visible electromagnetic radiation from ~300-1500nm T / F
 - c. at low light levels peak retinal sensitivity is around 405 nm T / F
 - d. at high light levels peak retinal sensitivity is around 550-555 nm T / F

2. What photoreceptors are active in responding to light in:
 - a) photopic vision _____
 - b) scotopic vision _____
 - c) mesopic vision _____
 - d) total darkness _____

3. Indicate whether each of the following statements is true (T) or false (F).
 - a. all cold sources reflect 84.375% blue light T / F
 - b. some artificial lamps emit mainly yellow/orange light T / F
 - c. the hottest objects always appear white T / F
 - d. red light has a higher color temperature than blue light T / F
 - e. sunlight has a color temperature of ~5,000 degrees K T / F
 - f. color temperature accurately measures color appearance T / F
 - g. different spectral compositions can have the same color temperature T / F
 - h. different spectral compositions can change the colors of objects T / F

4. What characteristics of light produce the following sensations?
 - a. sensation of color _____
 - b. sensation of brightness _____

5. In the Munsell color cone diagram, what do the following represent?
 - a. central, vertical axis _____
 - b. central equator _____
 - c. distance from central, vertical axis _____

6. What do the following units measure?
 - a. lumen _____
 - b. candela _____
 - c. foot candle _____
 - d. foot lambert _____

7. In the C.I.E. system, what do the following symbols represent?
 - a. Z _____
 - b. X _____
 - c. y _____
 - d. z _____

8. Indicate whether each of the following statements is true (T) or false (F).
- a. all colors can be specified with 2 chromaticity coordinates T / F
 - b. color saturation is highest at the center of the chromaticity diagram T / F
 - c. pure colors always have a single chromaticity coordinate T / F
 - d. artificial black light is invisible T / F
 - e. the spectrum locus is the center of the chromaticity diagram T / F
 - f. color brightness and chromaticity are independent T / F
 - g. color temperature can be plotted on the chromaticity diagram T / F
9. From the inverse square law, calculate the missing values for the following situations.
- a. source = 1000 cd, distance = 6.56 feet, illuminance = _____ lux
 - b. source = 400 cd, distance = 3m, illuminance = _____ footcandles
 - c. source = _____, distance = 2m, illuminance = 150 footcandles
 - d. source = 150-cd, distance = _____ feet, illuminance = 100 lux
10. Calculate the missing values for the following conditions.
- a. luminance = 20 fL, illuminance = 80 fc, reflectance = _____
 - b. luminance = 20 cd/m², illuminance = 450 lux, reflectance = _____
 - c. luminance = _____ fL, illuminance = 550 lux, reflectance = 0.6
 - d. luminance = 50 fL, illuminance = _____ fc, reflectance = 0.8
 - e. luminance = _____ cd/m², illuminance = 28 fc, reflectance = 0.7
 - f. luminance = 100 cd/ft², illuminance = _____ lux, reflectance = 0.25
11. Indicate whether each of the following statements is true (T) or false (F).
- a. lamps of the same wattage may not have the same light output T / F
 - b. lamps of the same wattage have the same color temperatures T / F
 - b. fluorescent lamps use less energy than incandescent lamps T / F
 - c. incandescent lamps always last longer than fluorescent lamps T / F
 - d. incandescent lamps produce more light per watt than fluorescent lamps T / F
12. Indicate whether each of the following statements is true (T) or false (F).
- a. visual acuity and visual contrast are the same thing T / F
 - b. tasks requiring high acuity need high illumination levels T / F
 - c. increasing illuminance changes visibility but not contrast T / F
 - d. visibility is not affected by exposure time to the target T / F
13. Indicate whether each of the following statements about the color rendering index (CRI) is true (T) or false (F).
- a. the CRI is an approximate indicator of color appearance T / F
 - b. a CRI of 35 improves color inspection performance accuracy T / F
 - c. some colors appear to be brighter when the CRI exceeds 90 T / F
 - d. all fluorescents have higher CRI values than incandescent lamps T / F
 - e. all colors will appear dull under a low CRI (<80) lamp T / F

14. Indicate whether each of the following statements is true (T) or false (F).
- a. visual performance models always accurately predict task accuracy T / F
 - b. tasks performance always improves with increasing illuminance T / F
 - c. small detail, low contrast tasks require high illuminance T / F
 - d. visual task performance is affected by the observer's age T / F
15. Indicate whether each of the following statements is true (T) or false (F).
- a. low illuminance can help reduce noise levels in university corridors T / F
 - b. 950 lux is required for reading hard pencil handwriting on gray paper T / F
 - c. 300 lux is sufficient for reading good xerography (photocopies) T / F
 - d. 10,000 lux is required for surgical operating theaters T / F
 - e. public area light levels must be corrected task reflectances T / F
 - f. emergency lighting levels should always be less than 1 lux T / F
 - g. higher levels of illumination are not always preferable to lower levels T / F
 - h. transient adaptation effects can reduce visibility T / F
16. Indicate whether each of the following statements is true (T) or false (F).
- a. specular glare is caused by direct light sources in the field of view T / F
 - b. polished work surfaces can be a source of reflected glare T / F
 - c. matte surfaces can decrease glare T / F
 - d. discomfort glare always impairs visual performance T / F
 - e. discomfort glare is a subjective sensation T / F
 - f. retinal adaptation processes can change perceived discomfort glare T / F
 - g. discomfort glare is always greater for older workers T / F
 - h. disability glare effects can be affected by observer's age T / F
 - i. wearing contact lens decreases disability glare effects T / F
17. Indicate whether each of the following statements is true (T) or false (F).
- a. elderly people are most sensitive to red light T / F
 - b. intraocular light scattering can be corrected with appropriate glasses T / F
 - c. small pupil diameter increases sensitivity to disability glare T / F
 - d. transient adaptation effects take longer in younger people T / F
 - e. relative contrast requirements increase linearly with age T / F
18. Indicate whether each of the following statements is true (T) or false (F).
- a. illuminance, luminance ratios and screen size are the only three lighting considerations with computer screens T / F
 - b. lighting is only important when computer screen characters are illegible T / F
 - c. low light levels can make it easier to see computer screen information T / F
 - d. light levels of 650-750 lux are recommended for computer screens T / F
 - e. computer screen anti-glare filters can affect screen reading rates T / F
19. Indicate whether each of the following statements is true (T) or false (F).
- a. the human ear is most sensitive to low frequencies <300 hz T / F
 - b. the ideal ear detects frequencies from 20 to 20,000 hz T / F
 - c. a SPL meter measures the subjective pitch of a sound T / F

- d. the ear is most sensitive to the higher frequencies of ~5000Khz T / F
- e. the A scale most closely approximates the sensitivity of the ear T / F
- f. the C scale most closely approximates the sound pressure level T / F

20. What do we use the following units to measure?

- a. decibel _____
- b. phon _____
- c. noy _____
- d. sone _____

21. What measures might you use for each of the following?

- a. speech _____
- b. aircraft flightpath noise _____
- c. longer term-environmental/community noise _____

22. Indicate whether each of the following statements is true (T) or false (F).

- a. L_{eq} is always > SEL for sampling periods less than 1 second T / F
- b. nerve deafness causes uneven hearing loss T / F
- c. hearing aids are most useful for nerve deafness T / F
- d. conduction deafness does not result in complete hearing loss T / F
- e. conduction deafness can best be treated with hearing aids T / F

23. Define the following:

- a. presbycusis: _____
- b. sociocucis: _____

24. Indicate whether each of the following statements is true (T) or false (F).

- a. sociocucis causes 75% of nerve deafness in the USA T / F
- b. temporary hearing losses always last less than 2 minutes T / F
- c. maximum temporary threshold shifts always occur at the noise exposure frequency T / F
- d. hearing loss is mainly affected by the loudness of noise exposure T / F

25. Indicate whether each of the following statements about noise is true (T) or false (F).

- a. the permissible exposure level is a TWA of 95 dBA T / F
- b. the noise dose is the sum of the partial noise doses T / F
- c. a TWA of 85 dBA is the action level T / F
- d. daily exposure to 2,000 impulse noises of 108 dB is safe T / F

26. Calculate the following for a worker who spends 3 hours at 70 dB, 3 hours at 95 dB, 1 hour at 110 dB, 1 hour at 100dB (show your calculations)?

- a. Noise dose = _____
- b. TWA, dBA (round to nearest dB) = _____
- c. Does this noise dose exceed the OSHA permissible exposure level? Yes/No
- d. Does any partial noise dose exceed the OSHA permissible exposure level? Yes/No

27. Name 3 acoustic and 3 non-acoustic factors affecting noise annoyance.
- a. _____
 - b. _____
 - c. _____
 - d. _____
 - e. _____
 - f. _____
28. Indicate whether each of the following statements is true (T) or false (F).
- a. noises with the same L_{dn} are not equally annoying T / F
 - b. road traffic and aircraft noises are not equally annoying T / F
 - c. >66% of people will be highly annoyed at a noise with an L_{dn} of 56dB T / F
 - d. noise complaints cease with an $L_{dn} < 45$ dB T / F
 - e. widespread complaints can occur with a normalized L_{dn} of 70 dBA T / F
29. Indicate whether each of the following statements is true (T) or false (F).
- a. sound readings should always be taken distant from the noise source T / F
 - b. sound loudness and sound pressure are the same T / F
 - c. the decibel measures the spectral power of sound T / F
 - d. sound power is a useful measure for assessing general ambient noise T / F
30. Indicate whether each of the following statements is true (T) or false (F).
- a. machine noise reduction at all frequencies is best achieved by a flexible and sealed enclosure T / F
 - b. an acoustic absorbing enclosure is most effective in reducing low frequency components of machine noise < 100 Hz T / F
 - c. 6-mm thick safety glass produces peak noise reduction at 300 hz T / F
 - d. ear inserts always attenuate noise better than external ear muffs T / F
 - e. hearing protectors with the lowest NRR are always the best choice T / F
 - f. the semicircular canals are the size of a bean T / F
 - g. the utricle detects forward/backward head motion T / F
 - h. semicircular canals respond to a constant velocity T / F