

**DEA 350: HUMAN FACTORS: THE AMBIENT ENVIRONMENT
(Spring 2008)**

NAME: _____

**HOMEWORK II
Due Date: 24th April in class**

**(NOTE: You will need to consult the readings as well as your class notes to complete the homework.
5 points per answer)**

1. Indicate whether each of the following statements is true (T) or false (F).
 - a. visible light is invisible electromagnetic radiation T / F
 - b. colored light is visible electromagnetic radiation from ~380-780nm T / F
 - c. peak photopic retinal sensitivity is around 550nm T / F
 - d. peak scotopic retinal sensitivity is around 450-455 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. blue light indicates cold source temperatures T / F
 - b. incandescent bodies are “hot” sources T / F
 - c. the hottest objects always appear red T / F
 - d. red light has a higher color temperature than blue light T / F
 - e. noon sunlight has a color temperature of ~5,500 degrees K T / F
 - f. color temperature accurately measures color spectra T / F
 - g. different spectral compositions can have the same color appearance 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?
- Z _____
 - X _____
 - y _____
 - z _____
8. Indicate whether each of the following statements is true (T) or false (F).
- not all colors can be specified with 2 chromaticity coordinates T / F
 - color brightness is lowest at the center of the chromaticity diagram T / F
 - pure colors always have a single chromaticity coordinate T / F
 - color saturation is the same as color purity T / F
 - the spectrum locus is the center of the chromaticity diagram T / F
 - color brightness and chromaticity are independent T / F
 - 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.
- source = 560 cd, distance = 4.5 feet, illuminance = _____ fc
 - source = 200 cd, distance = 2m, illuminance = _____ lux
 - source = _____, distance = 5 feet, illuminance = 50 footcandles
 - source = 450-cd, distance = _____ feet, illuminance = 35 footcandles
10. Calculate the missing values for the following conditions.
- luminance = 30 fL, illuminance = 80 fc, reflectance = _____
 - luminance = 28 cd/m², illuminance = 400 lux, reflectance = _____
 - luminance = _____ fL, illuminance = 646 lux, reflectance = 0.6
 - luminance = 50 fL, illuminance = _____ fc, reflectance = 0.8
 - luminance = _____ cd/ft², illuminance = 39 fc, reflectance = 0.45
 - luminance = 30 cd/m², illuminance = _____ lux, reflectance = 0.25
11. Indicate whether each of the following statements is true (T) or false (F).
- lamps of the same wattage have the same light output T / F
 - lamps of the same wattage have the same color temperatures T / F
 - fluorescent lamps use less energy than incandescent lamps T / F
 - incandescent lamps always last longer than fluorescent lamps T / F
 - 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).
- visual acuity and visual contrast are the same thing T / F
 - tasks requiring high acuity need high illumination levels T / F
 - increasing illuminance changes contrast T / F
 - 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).
- the CRI is an approximate indicator of color appearance T / F

- b. a CRI of 21 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 increases noise levels in university corridors T / F
 - b. 300 lux is ideal for reading hard pencil handwriting on gray paper T / F
 - c. 500 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 be more than 1 lux T / F
 - g. high levels of illumination are always preferable to low 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. reflected glare is caused by direct light sources in the field of view T / F
 - b. polished work surfaces can be a source of direct glare T / F
 - c. matte surfaces can decrease glare T / F
 - d. discomfort glare always seriously 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 sensitivity is always greater for people with glasses T / F
 - h. disability glare effects can be affected by observer's age T / F
 - i. wearing contact lens eliminates 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 blue 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 older 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. luminance ratios and screen size are the only two lighting considerations with computer screen use 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. a light level of 750 lux is ideal 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 >10,000Khz | 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 ~25% of nerve deafness in the USA | T / F |
| b. temporary hearing losses always last more 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 105 dBA | T / F |
| b. the noise dose is the sum of the partial noise doses | T / F |
| c. a TWA of 95 dBA is the action level | T / F |
| d. daily exposure to 1,000 impulse noises of 108 dB is safe | T / F |

26. Calculate the following for a worker who spends 2 hours at 90 dB, 5 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 equally annoying T / F
- b. road traffic and aircraft noises are not always equally annoying T / F
- c. >54% of people will be highly annoyed at a noise with an L_{dn} of 56dB T / F
- d. noise complaints cease with an $L_{dn} < 35$ dB T / F
- e. widespread complaints can occur with a normalized L_{dn} of 57 dBA T / F

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

- a. sound readings should always be taken close to 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, sealed enclosure T / F
- b. an acoustic absorbing enclosure is least effective in reducing low frequency components of machine noise <100Hz T / F
- c. 6-mm thick safety glass produces peak noise reduction at 250 Hz T / F
- d. ear inserts always attenuate noise better than external ear muffs T / F
- e. hearing protectors with the highest NRR are the best choice T / F
- f. the semicircular canals are the size of a grain of rice T / F
- g. the utricle detects forward/backward head motion T / F
- h. semicircular canals respond optimally to a constant velocity T / F