# DEA 350: HUMAN FACTORS: THE AMBIENT ENVIRONMENT (Spring 2005)

**NAME: _____**

## HOMEWORK II
## Due Date: 21st 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 electromagnetic radiation from $10^{-15}$ m to $10^{4}$ m in length T / F
   b. colored light is visible electromagnetic radiation from ~300-1300nm T / F
   c. at low light levels peak retinal sensitivity is around 400-420nm T / F
   d. at high light levels peak retinal sensitivity is around 550-555 nm T / F

2. What photoreceptors are active in the following light conditions:
   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 80% blue light T / F
   b. artificial lamps all produce yellow/orange light T / F
   c. the hottest objects always appear bright red T / F
   d. blue light has a higher color temperature than red 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 lowest 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 colorless light T / F
   e. the spectrum locus is the most central point of the chromaticity diagram T / F
   f. chromaticity determines the brightness of a color 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 = 1-cd, distance = 3m, illuminance =_____ footcandles
   b. source = 200-cd, distance = 5m, illuminance =_____ lux
   c. source = _____, distance = 2m, illuminance = 50 footcandles
   d. source = 150-cd, distance = _____ feet, illuminance =100 lux

10. Calculate the missing values for the following conditions.
    a. luminance = 40 fL, illuminance = 80 fc, reflectance = _____
    b. luminance = 20 cd/$m^2$, 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/$m^2$, illuminance = 28 fc, reflectance = 0.7
    f. luminance = 100 cd/$ft^2$, 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 have the same light output T / F
    b. lamps of the same wattage can have different color temperatures T / F
    b. fluorescent lamps use more energy than incandescent lamps T / F
    c. incandescent lamps always last longer than fluorescent lamps T / F
    d. fluorescent lamps produce more light per watt than incandescent lamps T / F

12. Indicate whether each of the following statements is true (T) or false (F).
    a. visual acuity and contrast are the same thing T / F
    b. tasks with high contrast require low illumination levels T / F
    c. increasing illuminance changes visibility but not contrast T / F
    d. visibility is 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 extremely accurate indicator of color appearance T / F

b. a CRI of 45 improves color inspection performance accuracy T / F
c. all 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 increases linearly with illumination level T / F
c. small detail, low contrast tasks require high illuminance levels 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 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 absorb all of the light and 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 increases 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. reduced 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. illumination levels, luminance ratios and screen size are the three main 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 150-250 lux are recommended for computer screens T / F
e. computer screen 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 ear only detects frequencies from 100 to 15,000 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 B 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 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. sociocusis:_____

24. Indicate whether each of the following statements is true (T) or false (F).
    a. sociocusis 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 duration 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 112dB 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 necessarily equally annoying T / F
b. road traffic and aircraft noises are not equally annoying T / F
c. >60% of people will be highly annoyed at a noise with an $L_{dn}$ of 52 dB T / F
d. noise complaints cease with an $L_{dn} < 50$ dB T / F
e. widespread complaints never 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. ideally, sound readings should always be taken in the free field 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, thin, sealed enclosure T / F
b. an acoustic absorbing enclosure is most effective in reducing low frequency components of machine noise <100Hz 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 horizontal motion T / F
h. semicircular canals respond to constant velocity movement T / F