

**DEA 3500: HUMAN FACTORS: THE AMBIENT ENVIRONMENT
(Spring 2013)**

NAME: _____

**HOMEWORK II
Due Date: 18th April 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. all visible light is from sunlight T / F
 - b. light is electromagnetic radiation from 10^{-15} m to 10^{-12} m wavelength T / F
 - c. visible colored light is from ~380-760 (780) nm T / F
 - d. visible light takes 15 minutes to reach earth from the sun T / F
 - e. at low light levels peak retinal sensitivity is around 500 nm T / F
 - d. at high light levels peak 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) blue light _____
 - e) green light _____
 - f) red light _____
 - g) white light _____

3. Indicate whether each of the following statements is true (T) or false (F).
 - a. all cold light sources reflect 63% red light T / F
 - b. high color temperature lamps emit mainly yellow/orange light T / F
 - c. the hottest objects always appear blue T / F
 - d. red light has a higher color temperature than green light T / F
 - e. noon sunlight has a color temperature of ~5,500 K T / F
 - f. light color temperature accurately measures illuminance T / F
 - g. color temperature specifies the spectral composition of light T / F
 - h. different light spectral 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 equatorial circumference _____
 - 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 and terms represent?
- a. Z _____
b. X _____
c. y _____
d. z _____
e. spectrum locus _____
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 perimeter of the chromaticity diagram T / F
c. pure colors always have a single chromaticity coordinate T / F
d. the z coordinate measures artificial black light T / F
e. the illuminance level is the center of the chromaticity diagram T / F
f. color appearance and luminance are synonymous terms 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 = 520 cd, distance = 48 inches, illuminance = _____ lux
b. source = 600 cd, distance = 2m, illuminance = _____ footcandles
c. source = _____ cd, distance = 2.5m, illuminance = 250 footcandles
d. source = 2514 lm, distance = _____ feet, illuminance = 1620 fc
10. Calculate the missing values for the following conditions.
- a. luminance = 30 fL, illuminance = 90 fc, reflectance % = _____
b. luminance = 40 cd/m², illuminance = 40 fc, reflectance% = _____
c. luminance = _____ fL, illuminance = 500 lux, reflectance = 0.5
d. luminance = 50 fL, illuminance = _____ fc, reflectance = 0.8
e. luminance = _____ cd/m², illuminance = 45 fc, reflectance % = 40%
f. luminance = 200 cd/ft², illuminance = _____ fc, reflectance = 0.25
11. Indicate whether each of the following statements is true (T) or false (F).
- a. lamps of the same wattage always have the same light output T / F
b. lamps of the same wattage always have the same color temperatures T / F
b. fluorescent lamps use less energy than incandescent lamps T / F
c. LED lamps last longer than fluorescent lamps T / F
d. incandescent lamps produce more light per watt than fluorescent lamps T / F
e. all LED lamps emit more infrared than fluorescent lamps T / F
f. all CF lamps have higher color temperatures than LEDs T / F
g. Hi pressure sodium lamps have higher color temperatures than CFLs T / F
h. Clear metal halide lamps can have higher color temperatures than CFLs T / F
i. Computer screens can have a luminance ~250 cd/m² T / F

12. Indicate whether each of the following statements is true (T) or false (F).
- a. visual acuity and visual contrast are different concepts T / F
 - b. high visual acuity tasks benefit from high contrast T / F
 - c. increasing illuminance always improves visual acuity T / F
 - d. visibility is affected by exposure time to the target T / F
 - e. bright light sources can cause glare T / F
 - f. low contrast tasks are less susceptible to glare effects T / F
13. Calculate the missing values for the following visibility situations assuming photopic conditions. Note, D is viewing distance, θ is the visual angle, H is the targets height or detail.
- a. D = 300 cm, H = 4 cm, θ = _____ min
 - b. θ = 11.21 sec, D = 3 nautical miles, H = _____ feet
 - c. H = _____ in, D = 20 feet, θ = 60 sec
14. Indicate whether each of the following statements about the color rendering index (CRI) is true (T) or false (F).
- a. the CRI is an accurate indicator of color appearance T / F
 - b. a CRI of 65 improves the appearance of reds T / F
 - c. some colors appear to be brighter when the CRI exceeds 90 T / F
 - d. most fluorescents have higher CRI values than incandescent lamps T / F
 - e. lamps with a CRI >85 should be used in florist shops T / F
15. 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. visual tasks performance can improve with increasing illuminance T / F
 - c. small detail, low contrast tasks require high illuminance T / F
 - d. visual task performance is not affected by the observer's age T / F
16. 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. 150 fc is adequate for reading hard pencil handwriting on gray paper T / F
 - c. 150 lux is sufficient for reading good xerography (photocopies) T / F
 - d. 10,000 fc is the minimum 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 at least 20 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
17. Indicate whether each of the following statements is true (T) or false (F).
- a. direct light sources in the field of view cause spread glare T / F
 - b. polished work surfaces can be a source of specular glare T / F
 - c. wearing contact lens decreases disability glare effects T / F
 - d. discomfort glare always impairs visual performance T / F
 - e. discomfort glare can be affected by observer's age T / F
 - f. retinal adaptation processes can change perceived discomfort glare T / F

18. 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 affects visual acuity 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
19. Indicate whether each of the following statements is true (T) or false (F).
- a. illuminance, luminance ratios and screen size are three lighting considerations with computer screens T / F
 - b. lighting is only important when computer screen characters are illegible T / F
 - c. high light levels can make it easier to see computer screen information T / F
 - d. light levels of 300-500 lux are adequate for computer screen use T / F
 - e. screen luminance contrast can affect visual accommodation T / F
20. Indicate whether each of the following statements is true (T) or false (F).
- a. people indoors are satisfied with ~400 lx light levels T / F
 - b. lighting can affect the incidence of headache T / F
 - c. high light levels can decrease symptoms of depression T / F
 - d. light levels of 250 lux are adequate for treating SAD T / F
 - e. lighting does not affect mood T / F
21. Indicate whether each of the following statements is true (T) or false (F).
- a. the human ear is most sensitive to low frequencies >10,000 Hz T / F
 - b. the ideal ear detects frequencies from 20 to 20,000 Hz T / F
 - c. a SPL meter measures the amplitude of a sound T / F
 - d. sound pitch is a subjective phenomenon T / F
 - e. sound loudness is a subjective phenomenon T / F
 - f. the dBA scale most closely approximates the sensitivity of the ear T / F
 - g. noise is unwanted sound T / F
 - h. auditory sensitivity is greatest <1000Hz T / F
22. What subjective phenomenon is measured by following units?
- a. decibel _____
 - b. phon _____
 - c. noy _____
 - d. sone _____
23. What measures might you use for each of the following?
- a. speech _____
 - b. aircraft flight path noise _____
 - c. longer term-environmental/community noise _____
 - d. average level of sound energy over 8 hours shift _____
 - e. sound intensity in different frequency bands _____
 - f. noise annoyance _____

24. 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 even hearing loss T / F
 - c. hearing aids are most useful for conduction deafness T / F
 - d. conduction deafness does not result in complete hearing loss T / F
 - e. loud noise exposure can cause tinnitus T / F
25. Define the following:
- a. presbycusis: _____
 - b. sociocucis: _____
26. Indicate whether each of the following statements is true (T) or false (F).
- a. sociocucis causes ~45% 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
 - e. presbycusis is irreversible T / F
 - f. there are no gender differences in hearing loss with aging T / F
27. Indicate whether each of the following statements about noise is true (T) or false (F).
- a. the permissible occupational noise 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 65 dBA is the action level T / F
 - d. daily exposure to 20,000 impulse noises of 88 dB is safe T / F
28. Calculate the following for a worker who spends 2 hours at 75 dB, 1 hour at 85 dB, 3 hours at 95 dB, 1 hour at 100 dB, 1 hour at 110dB (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
29. Indicate whether each of the following statements is true (T) or false (F).
- a. noises with the same L_{dn} are always equally annoying T / F
 - b. road traffic and aircraft noises are always equally annoying T / F
 - c. $>66\%$ of people will be highly annoyed at a noise with an L_{dn} of 46dB T / F
 - d. at 75 dBA phone conversations are mode difficult T / F
 - e. 45 dBA is the upper limit for creative work T / F
 - f. ambient and transient noise levels are always the same T / F
 - g. reverberation is the inter-reflection of sound waves inside a room T / F
 - h. reverberation time in a room depends on the listener position T / F
 - i. an STI of 0.6 is excellent T / F
 - j. 100dB sound with a 5ms rise time will cause a startle response T / F
 - h. fans are noisier when running at low speeds than high speeds T / F
 - i. cavitation can increase hydraulic machine noise T / F

30. Indicate whether each of the following statements is true (T) or false (F).
- a. sound readings should always be taken very close to the noise source T / F
 - b. sound loudness is not the same as sound pressure 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
 - e. a flexible, sealed enclosure can sometimes reduce some machine noise T / F
 - f. upholstered office screens should have an NRC of 0.85 T / F
 - g. carpets have an NRC >0.9 T / F
 - h. at 55 dB normal conversation distance is ~30 inches T / F
 - i. predictable noise can reduce clerical task accuracy T / F
 - j. noise always has a detrimental effect on task performance T / F
 - k. long-term continuous exposure to <70dB can increase CHD risks T / F
 - l. noise exposure > 90dBA can elevate diastolic BP T / F
 - m. noise at 55dBA impairs typing speed and increases errors T / F
 - n. 6-mm thick safety glass produces peak noise reduction at 1000 Hz T / F
 - o. external ear muffs can attenuate noise better than ear inserts T / F
 - p. hearing protectors with the highest NRR are always the best choice T / F
 - q. noisy environments can adversely affect sleep quality T / F
 - r. >30% of workers can be disturbed by noise in open-plan offices T / F
 - s. low frequency noise is more directional than high frequency noise T / F
 - t. pleated curtains can have an NRC of 0.55 T / F
 - u. active noise control works best with high frequency sounds T / F
 - v. the absorption coefficient of a material varies with sound frequency T / F
 - w. sound masking disrupts sound signal detection T / F
 - x. listening to music may improve work performance T / F
 - y. HPDs can attenuate a 2KHz sound by 30 dB T / F
 - z. all loud sounds are noise T / F