

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

**NAME:** \_\_\_\_\_

**HOMEWORK 2**  
**PRINT THIS OUT AND HAND IT IN BY THE DUE DATE**

**Due Date: October 19 in class**

**NOTE: You will need to consult the course texts and class notes, as well as the EPA IAQ publications to complete this homework.**

1. Products and materials can emit indoor air pollutants. Indicate whether each of the following statements about emissions is True (T) or False (F):
  - a. some kinds of particle board can emit formaldehyde T F
  - b. granite kitchen countertops can absorb radon T F
  - c. smokers when smoking inhale carbon monoxide T F
  - d. photocopiers can emit volatile organic compounds T F
  - e. carpets are a major source of indoor formaldehyde T F
  - f. paint, caulk, some adhesives can emit ozone T F
  - g. some natural woods can emit volatile organic compounds T F
  
2. Name the main human effect of exposure to a high concentration of each of the following pollutants.
  - a. Carbon monoxide \_\_\_\_\_
  - b. Ozone \_\_\_\_\_
  - c. Carbon dioxide \_\_\_\_\_
  - d. Formaldehyde \_\_\_\_\_
  - e. Mycotoxins \_\_\_\_\_
  - f. Asbestos \_\_\_\_\_
  - g. Radon \_\_\_\_\_
  
3. Say if each of the following statements is true or false.
  - a. the threshold limit value is the highest concentration of an indoor air pollutant which will cause cancer T F
  - b. time-weighted average pollutant values approximate a person's exposure to indoor air pollutants over an 8 hours period T F
  - c. indoor air quality is defined by the presence of hazardous particles, fibers, organisms or gases in the air inside buildings T F
  - d. indoor air quality standards for pollutants are always based on the rate of carbon dioxide dilution by ventilation T F
  - e. contaminants emit pollutants at constant rates T F
  - f. thermal conditions affect volatile organic compounds emissions T F
  - g. levels of fungal contamination increase in bright sunlight T F
  - h. ozone levels are affected by sunlight T F

4. Say whether the following are symptoms of the "sick building" syndrome:

- |                         |     |    |
|-------------------------|-----|----|
| a. headache             | Yes | No |
| b. eyestrain            | Yes | No |
| c. backache             | Yes | No |
| d. lethargy             | Yes | No |
| e. stomach ache         | Yes | No |
| f. difficulty breathing | Yes | No |
| g. irritated skin       | Yes | No |

5. Say whether each of the following can be a fatal building-related illness?

- |   |     |    |
|---|-----|----|
| a. Asbestosis                           | Yes | No |
| b. Sick building syndrome               | Yes | No |
| c. Humidifier fever                     | Yes | No |
| d. Legionnaire's disease                | Yes | No |
| e. Aspergillosis (fungal contamination) | Yes | No |
| f. Raynaud's disease                    | Yes | No |
| g. Hypersensitivity pneumonitis         | Yes | No |

6. What are the two main types of mechanical air-handling systems in large office buildings?

- a. \_\_\_\_\_  
b. \_\_\_\_\_

7. What is the size (maximum aerodynamic diameter in microns of particles) stopped at each of the following points along the respiratory pathway?

- a. bronchial passages: \_\_\_\_\_  
b. nasal mucosa (nose): \_\_\_\_\_  
c. alveoli: \_\_\_\_\_

8. Indicate the major source of each of the following indoor air pollutants.

- a. radon \_\_\_\_\_  
b. carbon dioxide \_\_\_\_\_  
c. carbon monoxide \_\_\_\_\_  
d. formaldehyde \_\_\_\_\_  
e. phthalates \_\_\_\_\_

9. Briefly describe two ways that an investigator can distinguish between "sick building" syndrome (SBS) and building related illness (BRI)?

- a. \_\_\_\_\_  
\_\_\_\_\_
- b. \_\_\_\_\_  
\_\_\_\_\_

10. Indicate the three main reasons for ventilating buildings.

- a. \_\_\_\_\_
- b. \_\_\_\_\_
- c. \_\_\_\_\_

11. Name two locations where biological growth can occur inside a ventilation system?

- a. \_\_\_\_\_
- b. \_\_\_\_\_

12. Name three control strategies used in mitigating indoor air quality problems.

- a. \_\_\_\_\_
- b. \_\_\_\_\_
- c. \_\_\_\_\_

13. An IAQ investigation is like detective work – in seeking basic information what four questions should the investigator ask occupants in investigating an indoor air quality problem? (Hint – check out I-Beam General Diagnostic Process (<https://www.epa.gov/indoor-air-quality-iaq/iaq-building-education-and-assessment-model-ibeam-diagnosing-and-solving>))

- a. \_\_\_\_\_
- b. \_\_\_\_\_
- c. \_\_\_\_\_
- d. \_\_\_\_\_

14. Say if each of the following statements is true or false:

- |  |   |   |
|--|---|---|
| a. the EPA recommends radon levels >4 picoCuries/L       | T | F |
| b. radon is only a problem in the basements of buildings | T | F |
| c. radon can be detected by its very distinctive odor    | T | F |
| d. radon is heavier than air                             | T | F |
| e. fungal growth generally requires a RH above 85%       | T | F |
| f. fungal spores can cause lung disease                  | T | F |
| g. bacteria require a RH <70% to grow                    | T | F |
| h. endotoxin is produced by gram-negative bacteria       | T | F |

15. Mold thrives in the presence of water. Name 4 ways that indoor mold growth can be controlled? (Hint – see I-BEAM Protocols for Managing Major Sources of Pollution in Buildings Table 1.4 summarizes protocols).

- a. \_\_\_\_\_
- b. \_\_\_\_\_
- c. \_\_\_\_\_
- d. \_\_\_\_\_

16. Indicate whether each of the following statements about emissions is True (T) or False (F):

- a. fungal spores require moisture, food and darkness to thrive T F
- b. viruses can penetrate to the alveolar region of the lungs T F
- c. all fungi produce toxic metabolites (endotoxins) that cause illness T F
- d. gram-positive bacteria produce the most potent endotoxins T F

17. Indicate whether each of the following statements about emissions is True (T) or False (F):

- a. respiratory illness risks are higher in air-conditioned buildings T F
- b. respiratory illness risks are higher in shared offices T F
- c. mice can be a significant source of an indoor allergen T F
- d. 55% of people are allergic to dust mites T F
- e. respirable dust particles must be <10 microns in diameter T F
- f. indoor floor dust in rural houses can contain outdoor pesticides T F

18. Indicate whether each of the following statements about emissions is True (T) or False (F):

- a. environmental tobacco smoke is a hazardous indoor air pollutant mixture T F
- b. fresh air ventilation can reduce indoor air pollutant sources T F
- c. airborne fiberglass can irritate the eyes, nose and skin T F
- d. cockroaches produce an indoor allergen T F
- e. children can be more susceptible to biological contaminants than adults T F
- f. dust mites thrive in humid conditions below 50% RH T F
- g. dust mite feces are >25 $\mu$  in size T F
- h. asbestos is only dangerous when it is inhaled T F
- i. eating iron and calcium can increase lead absorption in the body T F
- j. respirable particles are only dangerous when they are >10  $\mu$  in size T F
- k. mental and physical development is impaired by lead levels <1  $\mu$ g/dl T F

19. The US EPA describes 9 HVAC components are particularly important to maintaining good IAQ. Name four of these:

- a. \_\_\_\_\_
- b. \_\_\_\_\_
- c. \_\_\_\_\_
- d. \_\_\_\_\_

20. The US EPA describes an iterative processes to diagnose and solve typical indoor air quality problems that are not emergencies. Say whether each of the following is a step in this process.

- a. defining the user symptoms Yes No
- b. evacuating the affected locations Yes No
- c. timing how long the problems persist each year Yes No
- d. defining the time pattern of problems in relation to activities Yes No

21. The US EPA describes a series of measurements to take to diagnose and solve typical indoor air quality problems that are not emergencies. Say whether each of the following is a part of their recommendations.

- |   |   |   |
|---|---|---|
| a. in an office, ideally CO <sub>2</sub> should be measured at 11am and 3pm | T | F |
| b. CO <sub>2</sub> should only be measured if levels exceed 1000 ppm        | T | F |
| c. CO <sub>2</sub> levels >1000ppm shows that IAQ is unsatisfactory         | T | F |
| d. sorbent tubes are the most accurate CO <sub>2</sub> measure              | T | F |

22. The US EPA describes actions for effective space cleaning for good IAQ. Name four of these:

- a. \_\_\_\_\_
- b. \_\_\_\_\_
- c. \_\_\_\_\_
- d. \_\_\_\_\_