EX0Q24B

BINDURA UNIVERSITY OF SCIENCE EDUCATION

DEPARTMENT OF ENVIRONMENTAL SCIENCE

BACHELOR OF SCIENCE HONOURS DEGREE IN SAFETY, HEALTH AND ENVIRONMENTAL MANAGEMENT

ESM 411

BSC PART IV EXAMINATION
Occupational Hygiene and Toxicology

2 HOURS

JUN 2024

INSTRUCTIONS
Answer all multiple choice questions from SECTION A and any two questions from SECTION B

SECTION A (COMPULSORY)

1. Toxicology is a field that studies the
A. adverse effects on humans and animals
B. adverse effects of chemicals on living organisms.
C. adverse effects of chemicals and microorganisms.
D. risk-benefit balance of chemicals for living organisms

2. The exposure assessment step in the risk assessment process identifies all *except* which of the following?
A. frequency of exposure
B. type of chemical exposure
C. length of time of exposure
C. route of exposure
E. the amount of exposure

3. What activities should be conducted during the hazard identification step of the risk assessment?
A. Profile the toxic substance
B. Identifying the sources of toxicity information
C. Identifying the exposure pathway
D. All of the above

4. Give the right sequential order of the following steps:
1. Risk assessment, 2. Hazard identification, 3. Risk management, 4. Hazard characterisation
A. 1, 2, 3, 4 B. 4, 3, 2, 1 C. 2, 1, 4, 3 D. 2, 4, 1, 3

5. What is defined as "a measurable biochemical, physiological, or other alteration within an organism that indicates health impairment or disease"?
A. Biomarker of exposure
B. Biomarker of susceptibility
C. Biomarker of effect
D. Biomarker of disease

6. ADME (Absorption, Distribution, Metabolism and Excretion) characteristics:
A. describe what happens to a compound when it has entered the body.
B. describe the toxicodynamic phase.
C. determine the bioavailability of a compound upon oral intake.
D. describe how a compound becomes toxic including the mechanism of action.

7. Which one of the following is not an effect of sweat loss during hard work?
A. Decreased work performance
B. Increased heart rate
C. Rise in body core temperature
D. None of the above

8. What does a threshold limit value-time weighted average (TLV-TWA) for a chemical represent?
A. An airborne concentration of a chemical that can never be exceeded during an 8-hour workday
B. A mean airborne concentration of a chemical believed to cause no adverse health effects to workers exposed for 8 hours/day, 40 hours/week
C. An airborne concentration of a chemical that cannot be exceeded for longer than 15 minutes during an 8-hour workday
D. An acceptable mean airborne concentration of a chemical established by the Occupational Safety and Health Administration

9. If: M = Metabolic heat production,
W = Heat energy associated with external work,
R, C = Heat gain from the environment by Radiation and Convection, respectively
E = Heat loss by evaporation,
Under severe exposure to heat,
A. $M-W\pm R\pm C-E=0$ B. $M-W\pm R\pm C > E$
C. heat energy is not stored D. body temperature equilibrates

10. The body temperature control system is analogous to thermostatic control of temperature in a house with heating and cooling capabilities. When the body temperature rises above some theoretical 'set point' temperature:
A. effector responses associated with heat gain responses are initiated
B. skin blood flow decreases
C. effector responses associated with cooling responses, e.g. shivering, are turned on
D. sweating occurs

11. Sweating of hands and feet that develop in unacclimatised individuals exposed to a hot environment is a systemic heat disorder called heat:
A. syncope B. oedema C. stroke D. exhaustion

12. Which of the following interventions to protect one from heat stress is not entirely employer based?
A. Timely replacement of lost fluid and electrolytes B. Maximise heat tolerance
C. Effective personal protective clothing D. Control of climatic work conditions

13. A was carpenter wearing propylene coveralls was working on a roof 3 m above the ground and on a sunny day. A heat stress monitor had the recordings:
Dry bulb thermometer: 33°C
Wet bulb thermometer: 20°C
Black bulb globe thermometer: 36°C

The WBGT value is:
A. 27.2°C B. Above 27.2°C C. 24.5°C D. Above 24.5°C

14. The amount of substance that is actively exerting effects to the human exposed host is:
A. exposure dose B. bio-effective dose C. absorbed (internal) dose D. none of the above

15. An organisation intends to buy fish from the local fishermen to provide food for its workers. The concentration of DDT in large fish was found to be 25 mg/kg. Further investigations showed that:
Concentration of DDT in water = 3×10^{-6} mg/l
Concentration of DDT in zooplankton = 0.03 mg/kg
Concentration of DDT in small fish = 0.5 mg/kg
Concentration of DDt in large fish = 25 mg/kg.
This finding best shows:
A. bioaccumulation B. biomagnification C. persistent organic pollutant D. all of the above

16. Which strategy prevents or reduces the spread of hazardous agents into the work environment by containing them, removing them immediately beyond the source?

A. Inspection and audits
B. Engineering controls
C. Administrative controls
D. Personal protective equipment

17. Sampling filters must be evaluated for:

A. collection efficiency and pressure drop
B. hygroscopicity and background contamination
C. strength and pore size
D. all of the above

18. A technique used to separate and concentrate chemicals in mixtures for subsequent quantitative analysis is:

A. spectrometry B. gravimetry C. chromatrography D. electrophoresis

19. Which of the following is not a common unit for the concentration of chemicals in the workplace air?

A. fibes / cc B. mg/kg C. ppm D. mg/m^3

20. A STEL is a 15 minute time-weighted exposure that should not be exceeded at any time during the work day even if the 8 hour TWA is within the TLV-TWA. Exposures above the TLV-TWA of the STEL should not be longer than X minutes and should not occur more that Y times a day. There should be at least Z minutes before successive exposures. Identify X, Y and Z.

	X	Y	Z
A.	30	5	30
B.	15	4	60
C.	15	6	120
D.	60	3	15

21. A substance which because of its specific toxic effect on biochemical mechanisms in the body prevents the body from absorbing, transporting or utilising oxygen for the production of usable energy is called:

A. toxin B. irritant C. asphyxiant D. mutant

22. To identify peak or ceiling concentrations of contaminant during a time of high production, the occupational hygienist will likely choose which air sampling method

A. area sampling B. integrated sampling C. personal sampling D. grab sampling

23. In ventilation systems the difference between the pressure in the exhaust system and the atmospheric pressure is called:

A. velocity pressure B. total pressure C. flow rate D. static pressure

24. Sound waves with a wave length larger than a thin barrier are little affected by its presence because the sound waves -

A. pass through the barrier
B. vibrate the barrier at the same frequency
C. bend around the barrier
D. echo off the barrier

25. Sound intensity is similar to sound pressure except that sound intensity has -

A. amplitutde and direction
B. magnitude and direction
C. frequency and magnitude
D. direction and frequency

26. A hearing conservation programme is required if employees experience an exposure to the *action level* of:

A. 90 dBA or more B. at least 80 dBA C. 80 dBA or more D. 85 dBA or higher

27. Lead shielding is used by dentists to protect against -

A. free neutrons B. beta rays C. X-rays D. alpha particles

28. Which of the following is not effective in reducing vibration hazards?

A. using a dampening material
B. balancing rotating shafts
C. increasing the frequency by half
D. restrict the duration of exposure

29. Workers in a brass foundry complain of a fever and general malaise on Mondays following a weekend respite from work. What should an industrial hygienist be equipped to obtain, upon arrival at the foundry?

A. blood samples to detect carbon monoxide exposures
B. air samples to measure exposures to zinc fume
C. potable water samples to detect PCB concentration
D. urine samples to measure exposures to lead

30. Why does the environmental pathway of chemicals has to be found in exposure assessment?

A. To predict discharge source
B. To estimate chemical dosage
C. For chemical analysis
D. To determine affected biota.

SECTION B

1. "Occupational hygiene is the science and art of *anticipating, recognising, evaluating* and *controlling* of environmental stresses arising from the workplace".
   (a) Explain the terms in italics clearly indicating what is involved. **[16 Marks]**
   (b) Suggest four examples of common environmental stressors at the work place. **[4 Marks]**

2. (a) Explain environmental and host-specific factors of occupational exposure which influence the extent of (health) risk. **[10 Marks]**
   (b) Describe five interventions on how heat stress can be reduced for people working in hot environments. **[10 Marks]**

3. Discuss hazard identification, exposure assessment and control interventions for ventilation. **[20 Marks]**

4. (a) A worker has the following exposure:

Time (h)	Noise (dBA)
4	90
2	95
2	85

   (i) Determine the % dose using OSHA's noise HCA. **[2 Marks]**
   (ii) Does the worker need to be in a hearing conservation programme? Explain your answer. **[3 Marks]**

Assume a criteria of 90dBA and an action level of 50% of PEL. OSHA noise HCA values:

Exposure time (h)	*PEL (dBA)*
32	*80*
16	*85*
8	*90*
4	*95*
2	*100*
1	*105*

(b) Copy and complete the table below for ionising radiation:

Type of ionising radiation	Examples	Main characteristic
Particulate	(i) -	-
	(ii) -	-
Electromagnetic	(i) -	-
	(ii) -	-

[6 Marks]

(c) Explain three main body organ (health) effects of ionising radiation. **[3 Marks]**

(d) Describe three control methods for internal ionising radiation hazards and their applications. **[6 Marks]**

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