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**

INSTRUCTIONS

Answer all questions from SECTION A and any **two** from SECTION B.

SECTION A (COMPULSORY)

There are 30 multiple choice questions. Each question carries 1 mark. There are four alternative responses for each question. Choose the best response.

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. Which of the following is not a factor affecting inhalation of toxic substances?
   A. concentration of toxic substance in the air
   B. speed of the wind
   C. length of exposure
   D. size of toxic particle

3. 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

4. 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 OSHA

5. 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

6. 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

7. Miliaria is the commonest skin disorder associated with heat load. It is classified into three based on the depth of sweat retention. When sweat accumulates in the epidermis, the disorder is:
A. Miliaria crystalline B. Miliaria rubra C. Miliaria profunda D. None of the above

8. 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

9. Which of the following are not correctly matched?
A. carcinogen - lung B. teratogens - reproductive system
C. irritant - heart D. allergen - skin

10. Which of the following properties of a chemical substance influences its harmfulness and intrinsic toxicity?
A. stability towards light B. molecular structure and functional groups
C. solubility and volatility D. all of the above

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

12. Which of the following diseases may be occupational in nature?
A. noise-induced hearing loss B. lead poisoning
C. contact dermatitis D. all of the above

13. Which of the following could be an unimportant occupational route of exposure?
A. inhalation B. dermal C. oral D. peritoneal

14. Which factor is not host-specific in influencing the extent of health risk?
A. long work shifts B. age C. previous exposures D. genetics

15. Which of the following is not a step in the risk assessment process?
A. hazard identification B. hazard evaluation or dose-response assessment
C. exposure dose D. risk characterization

16. Which of the following is not a toxicological function of the skin?
A. temperature control B. shock absorption
C. calorie reservation D. none of the above

17. 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

18. Give the correct 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

19. On a 16-point material safety data sheet, 'Acute toxicity/Effects" is found under:
    A. hazard identification B. composition/information on ingredients
    C. toxicological information D. exposure controls / personal protection

20. Occupational safety management is concerned with ..... hazards from industry.
    A. reducing B. controlling C. eliminating D. all of the above

21. Which process determines whether chemical exposure can increase the incidence of adverse health effect?
    A. hazard identification B. exposure assessment
    C. toxicity assessment D. risk characterisation

22. The main objective of risk assessment is to:
    A. evaluate hazard and minimise the risks B. remediation of contaminated sites
    C. hazard management D. know pollutant sources

23. In ventilation systems the pressure due to the flow of air within the ducting is:
    A. static pressure B. total pressure C. velocity pressure D. ambient pressure

24. Which one of the following passes through aluminium and lead, but is only stopped by thick concrete?
    A. free neutron B. beta particle C. X rays D. alpha particle

25. Which one of the following is a mechanism of movement of chemicals into the skin?
    A. intercellular lip pathway B. transcellular permeation
    C. absorption through appendages D. all of the above

26. What type of direct reading instrument would most likely be used to monitor carbon monoxide or oxygen?
    A. electrochemical B. gravimetric
    C. passive diffusion D. titrimetric

27. Which type of glare is caused by direct vision of bright light or background over long periods?
A. disability glare
B. discomfort glare
C. reflected glare
D. all of the above

28. In an dose-response study of 20 rats, it was observed that a substance dose of:
1. 0.001 mg/kg caused no observed effect
2. 0.012 mg/kg killed 10 rats
3. 0.02 mg/kg killed 20 rats.
Which of the following statements is correct about the observations?
A. The lethal dose was 0.012 mg/kg
B. LD_{50} = 0.001 mg/kg
C. NOAEL = 0.012 mg/kg
D. none of the above

29. The amount of a substance that an organism is exposed to in the environment is:
A. exposure dose B. bio-effective dose C. absorbed dose D. none of the above

30. Substances that stimulate a response from the immune system, usually the second exposure are:
A. sensitisers B. irritants C. carcinogens D. mutagens

SECTION B

1 (a) Occupational hygiene is the science and art of *anticipating, recognising, evaluating* and *controlling* of *environmental stressors* arising from the workplace. Explain the terms in italics. **[10 Marks]**
(b) Discuss factors influencing the toxicity of a substance. **[10 Marks]**

2 (a) Discuss factors influencing chemical absorption and permeation through the skin. **[10 Marks]**
(b) Describe a procedure to determine the concentration of aerosols in air at a workplace for environmental (not personal) exposure. **[10 Marks]**

3 (a) Suggest four indicators of heat stress. **[4 Marks]**
(b) Explain the environmental conditions and instruments used to determine the wet-bulb globe temperature. **[6 Marks]**
(c) Outline the three tenets of ionising radiation safety. **[6 Marks]**
(d) Explain the two types of mechanical ventilation systems used in industrial settings. **[4 Marks]**

4 (a) Discuss potential adverse effects of occupational exposure to vibrations. **[8 Marks]**
(b) Explain two control measures for whole body vibrations. **[2 Marks]**
(c) Suggest characteristics of a material that make it hazardous. **[2 Marks]**
(d) Explain the toxic effect-response nature of a toxic chemical in the presence of other toxic substances in the target organism. **[8 Marks]**

END OF PAPER