UNIVERSITI KUALA LUMPUR
INSTITUTE OF MEDICAL SCIENCE TECHNOLOGY

FINAL EXAMINATION

MARCH 2025 SEMESTER

COURSE CODE	:	HDB20803
COURSE TITLE	:	TOXICOLOGY
PROGRAMME NAME	:	BACHELOR OF BIOMEDICAL SCIENCE (HONOURS)
DATE	:	21 JUNE 2025
TIME	:	9:00AM - 12:00PM
DURATION	:	3 HOURS

INSTRUCTIONS TO CANDIDATES

1. Please read the instructions given in the question paper CAREFULLY.
2. This question paper is printed on both sides of the paper.
3. This question paper consist of TWO sections.
4. Answer ALL questions for Section A.
5. Section B consist of four questions. Answer THREE (3) questions only.
6. Please write your answer on the answer booklet provided.
7. Please answer all questions in English only.
8. Please answer MCQ/EMQ questions using OMR sheet. ☐ *Tick if applicable*
9. Refer to the attached Formula/ Appendies. ☐ *Tick if applicable*

THERE ARE 14 PAGES OF QUESTIONS INCLUDING THIS PAGE

SECTION A (Total: 40 marks)

Answer ALL questions.

Please use the answer booklet provided.

1. Which of the following BEST describes the purpose of the Ames test in toxicology?

   A. Measuring the carcinogenic effects of environmental pollutants.

   B. Determining the teratogenicity of pharmaceutical drugs.

   C. Evaluating the mutagenic potential of chemical substances.

   D. Assessing acute toxicity levels in experimental animals.

2. Choose the CORRECT pair of toxicity tests and their descriptions.

   A. Acute Test: Involves carcinogenicity bioassay.

   B. LD_{50} Test: Determined by the dose required to kill 50 tested animals.

   C. Subchronic Test: May be able to detect neurotoxicity.

   D. *In vivo* Test: Involves chemical structure analysis.

3. Choose the correct order of toxic agents having the lowest to the highest LD_{50} value.

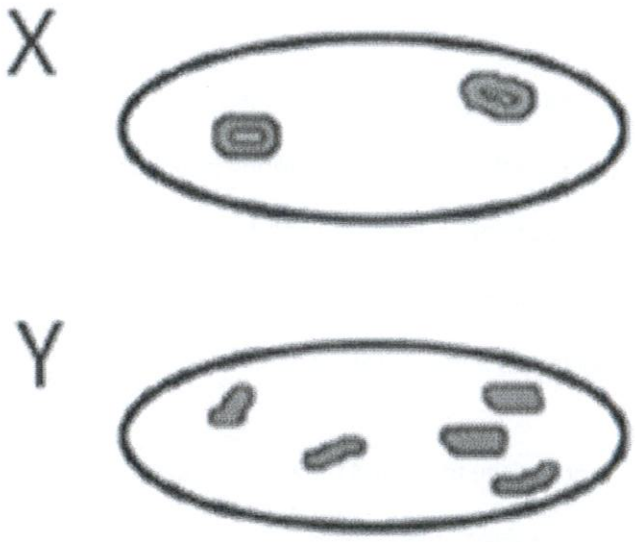
   A. Sucrose < Ethanol < Nicotine < Botulinum toxin

   B. Botulinum toxin < Nicotine < Ethanol < Sucrose

   C. Nicotine < Botulinum toxin < Sucrose < Ethanol

   D. Ethanol < Sucrose < Botulinum toxin < Nicotine

4. The figure below shows two plates, X and Y obtained from Ames Test where both are tested with a chemical *Z*. Plate Y was added with liver microsomal preparation while plate X was not.



Based on the observation from plates X and Y, we can conclude that chemical Z _____.

A. exhibits carcinogenicity effects

B. is mutagenic but requires metabolic activation

C. is a direct-acting mutagen

D. inhibits bacteria proliferation only in plate X

5. The organs least involved in systemic toxicity are _____.

A. hematopoietic system and lungs

B. liver and kidney

C. brain and peripheral nerves

D. muscle and bone

6. Oxidants are toxic components of cigarette smoke. Why are they dangerous?

   A. They cause cilia to quit beating so lungs get clogged with particles.

   B. They can damage the DNA of lung cells.

   C. They block surfactant secretion so that alveoli collapse.

   D. They are mediators that attract immunocells.

7. A family reported symptoms of dizziness, lightheadedness, and cyanosis almost immediately after sharing a meal. Blood drawn for routine testing was described as "black colored". Methylene blue therapy was initiated for suspected methemoglobinemia after the patients were found to have extremely high methemoglobin levels (range: 21.1%-87.0%). What is the function of methylene blue treatment in this case.

   A. Induce hemoglobin

   B. Oxidize methemoglobin

   C. Reduce methemoglobin

   D. Inhibit hemoglobin

8. All of the following has been linked to human lung cancer EXCEPT

   A. Carbon monoxide

   B. Asbestos

   C. Beryllium

   D. Cigarette smoke

9. Which of the following best defines biomagnification?

   A. Use of multiple pesticides simultaneously.

   B. Accumulation of substances through food chains.

   C. Reduction in pesticide usage.

   D. Decrease in pesticide toxicity with dilution.

10. Which of the following pesticides inhibits acetylcholinesterase?

    A. Pyrethroids.

    B. Organochlorines.

    C. Triazines.

    D. Organophosphates.

11. Which document provides safety information on pesticide ingredients, health hazards, and first aid?

    A. Fertilizer Manual.

    B. Certificate of analysis.

    C. Product brochure.

    D. Material Safety Data Sheet (MSDS).

12. Which factor has the greatest impact on teratogen effects?

    A. Birth weight.

    B. Timing of exposure.

    C. Paternal age.

    D. Mother's mood.

13. What is the name of the disease caused by mercury pollution in Japan?

    A. Bhopal Syndrome.

    B. Itai-itai Disease.

    C. Minamata Disease.

    D. Blue Baby Syndrome.

14. Secondary air pollutants are formed by _____.

A. mechanical separation

B. direct industrial discharge

C. chemical reactions in the atmosphere

D. leaching of soil

15. Particulate matter (PM) can be categorized based on _____.

A. size, origin, and chemical composition

B. source and temperature

C. weight and color

D. shape and temperature

16. Which of the following is a water-borne disease?

A. Scabies.

B. Typhoid.

C. Bilharzia.

D. River blindness.

17. Occupational exposure to pollutants requires monitoring to prevent _____.

A. acute toxic effects

B. chronic health conditions

C. water shortage

D. equipment malfunction

18. Which of the following substances can accumulate in breast milk?

    A. Proteins.

    B. Carbohydrates.

    C. Water-soluble vitamins.

    D. Lipophilic substances like DDT and PCBs.

19. A point mutation is _____.

    A. replacement of one nucleotide with another

    B. entire gene deletion

    C. duplication of a chromosome

    D. loss of a chromosome

20. Fetal Alcohol Syndrome (FAS) is typically associated with _____.

    A. no mental impact

    B. chronic alcohol intake during pregnancy

    C. binge drinking only

    D. exposure to secondhand smoke

21. What role do checkpoint systems play in preventing cancer development?

    A. Arresting the cell cycle for repair or apoptosis.

    B. Allowing DNA repair to occur.

    C. Inducing mutations.

    D. Promoting cell division.

22. In carcinogenesis, what are oncogenes and tumor suppressor genes primarily involved in?

A. Regulating cell growth.

B. Initiating mutations.

C. Initiating apoptosis.

D. Promoting inflammation.

23. What is the role of apoptosis in cancer development?

A. Preventing DNA repair.

B. Eliminating damaged cells.

C. Inducing mutations.

D. Promoting cell growth.

24. What is a consequence of genetic instability in carcinogenesis?

A. Increased apoptosis.

B. Enhanced DNA repair.

C. Reduced mutation rate.

D. Accumulation of mutations.

25. How can chronic inflammation contribute to cancer development?

A. By inducing mutations directly.

B. By promoting apoptosis.

C. By altering tissue microenvironment.

D. By enhancing DNA repair.

26. What is an example of a non-mutagenic carcinogen?

A. Ionizing radiation.

B. Ultraviolet (UV) radiation.

C. Chronic inflammation.

D. Tobacco smoke.

27. What can alter the process of initiation in carcinogenesis?

A. Activation of oncogenes.

B. Mutation accumulation.

C. High efficiency of DNA repair.

D. Inhibition of apoptosis.

28. Permissible Exposure Limit (PEL) is associated with _____.

A. minimum ventilation rate in office spaces

B. threshold for acceptable noise levels in residential areas

C. maximum allowable concentration of workplace chemicals

D. recommended dietary intake limits for workers

29. Which stage of carcinogenesis is characterized by invasive growth and metastasis?

A. Termination.

B. Promotion.

C. Progression.

D. Initiation.

30. Which of the following is a primary air pollutant?

A. Sulfur dioxide.

B. Peroxyacyl nitrate.

C. Formaldehyde.

D. Ozone.

31. What is the primary purpose of a pesticide?

A. Enhance plant growth.

B. Stimulate seed germination.

C. Provide nutrients to crops.

D. To manage, repel, or eliminate unwanted organisms such as insects, weeds, or rodents.

32. Equifinality in teratogenesis means _____.

A. one cause leads to different effects

B. no effect from any cause

C. different causes can lead to same effect

D. same cause leads to one effect

33. Mutations in somatic cells resulted in _____.

A. cancer or cell malfunction

B. no phenotypic effect

C. enhanced gamete formation

D. inheritable traits

34. Oxidative stress is counteracted by the following **EXCEPT**

A. ß-carotene

B. Catalase

C. Superoxide

D. Gulathione-S-transferase

35. Which of the following toxic substances are associated with low sperm count?
i. Lead
ii. Cimetidine
iii. Tamoxifen
iv. Paraguay tea

A. ii and iii

B. ii and iv

C. i and ii

D. i and iii

36. Parathion is an organophospate insecticide which may cause neurotoxicity by binding to Acetylcholinesterase. Which of the following may be the direct effect of parathion poisoning?

A. Bradycardia

B. Hypotension

C. Urinary retention

D. Muscle cramps

37. Which of the following best describes Good Laboratory Practice (GLP)?

A. A system of quality assurance for conducting nonclinical laboratory studies.

B. A code of conduct for managing data integrity in clinical trials.

C. A set of guidelines for maintaining safety in the laboratory.

D. A framework for ensuring ethical conduct in scientific research.

38. Quantal responses in toxicological epidemiology studies may be associated with _____.

A. carcinogen

B. enzyme

C. acetaminophen

D. vitamins

39. Which of the following is the primary objective of risk assessment in toxicology?

A. Assessing the environmental fate of toxic compounds.

B. Identifying potential adverse health effects of chemical substances.

C. Evaluating the efficacy of antidotes for toxic exposures.

D. Determining the mode of action of toxic substances.

40. Which of the following statements is **NOT** a default assumption when performing *in vivo* animal tests?

A. The effects obtained in the animal test are applicable to humans.

B. High-dose exposure to toxic agents in animals is essential.

C. Humans are at least as sensitive as the most sensitive animal species.

D. Toxicity effects which occurred in animals may not occur in humans.

SECTION B (Total: 60 marks)

Answer THREE (3) questions only.

Please use the answer booklet provided.

Question 1

Gene mutations are critical events in the toxicological response to chemical exposure, often leading to serious health outcomes including cancer and inherited disorders. Analyze the types of gene mutations that can be induced by toxicants, and explain how these mutations alter normal cellular function.

(20 marks)

Question 2

A factory worker has been chronically exposed to benzene over a period of years. Based on your knowledge of carcinogenesis, apply the concept of cancer development to explain how this exposure could increase the worker's risk of developing cancer.

(20 marks)

Question 3

Particulate matter (PM) is a major component of air pollution and is known to have significant toxicological effects on human health.

(a) Analyze the physicochemical characteristics of PM that influence its toxicity in biological systems.

(6 marks)

(b) Evaluate the pathophysiological mechanisms through which PM exposure can lead to respiratory and cardiovascular diseases.

(8 marks)

(c) Discuss the population groups most vulnerable to PM toxicity and explain the reasons for their increased risk.

(6 marks)

Question 4

Toxicity studies are crucial in evaluating the safety profile of compounds. These studies are broadly categorized into *in vitro* and *in vivo* approaches.

(a) Compare and contrast *in vitro* and *in vivo* toxicity studies in terms of:
(i) Definition and methodology.
(ii) Advantages and limitations.
(iii) Ethical considerations.

(12 marks)

(b) Explain how data from *in vitro* and *in vivo* studies are used together to improve the prediction of human toxicity.

(8 marks)

END OF EXAMINATION PAPER