

**UNIVERSITY OF SWAZILAND**  
FACULTY OF HEALTH SCIENCES

**SUPPLEMENTARY EXAMINATION PAPER – JULY, 2016**

TITLE OF PAPER : RODENTS AND VECTOR CONTROL  
COURSE CODE : EHM 200  
TIME : 2 HOURS  
MARKS : 100

INSTRUCTIONS : ANSWER **QUESTION 1** AND **ANY THREE**  
QUESTIONS

: EACH QUESTION CARRIES 25 MARKS

: NO FORM OF PAPER SHOULD BE BROUGHT  
INTO NOR TAKEN OUT OF THE EXAMINATION  
ROOM

: BEGIN THE ANSWER TO EACH QUESTION ON  
A SEPARATE SHEET OF PAPER

: CALCULATORS MAY BE USED BUT THEY MUST  
BE THE SILENT TYPE

: ALL CALCULATIONS/WORK-OUT DETAILS  
SHOULD BE SUBMITTED WITH YOUR ANSWER  
SHEET

**This question paper consists of 6 printed pages including this one**

**QUESTION 1 COMPULSORY: ALL STUDENTS MUST ANSWER THIS QUESTION**

- a. **MULTIPLE CHOICE:** Write down the letter corresponding to your chosen response among the choices listed for each question. (20)
- i. Shown below is part of the antenna of an arthropod collected by a student from the Lowveld of Swaziland during a class exercise. This type of antenna are said to be:
    - A. filiform
    - B. pectinate
    - C. clavate
    - D. plumose
    - E. capitate
  
  - ii. The compound eye of an insect comprises of independent eyelets known as:
    - A. ocelli
    - B. maxillae
    - C. ommatidia
    - D. cerci
    - E. sterna
  
  - iii. The end part of the leg of an insect consist of pseudo-segments known as:
    - A. tarsi
    - B. tarsomeres
    - C. arolia
    - D. pulvilli
    - E. empodia
  
  - iv. Some Dipteran insects have a modified hind pair of wings into structures used to facilitate change of direction and maintenance of balance of the insect during flight. These structures are known as:
    - A. cerci
    - B. halteres
    - C. hemelytra
    - D. elytra
    - E. sensillae
  
  - v. The parts of the digestive system of an insect responsible for production of digestive enzymes are known as:
    - A. spiracles
    - B. salivary glands
    - C. the proventriculus or crop
    - D. gastric caeca
    - E. malpighian tubules

- vi. The male copulatory organ possessed by some male insects is known as the:
- testes
  - seminal vesicle
  - aedeagus
  - ejaculatory duct
  - vas efferens
- vii. The insect below causes disease in humans through:



- urtication
  - envenomation
  - sensitization
  - vesication
  - tissue invasion
- viii. Which of the following statements about the pupal stage of development of mosquitoes is NOT true?
- The pupa is a resting, non-feeding development stage
  - The pupa is non-motile
  - The pupa is sensitive to light
  - Development of the mosquito is arrested in the pupa stage when environmental temperature are too low
  - The pupa stage is part of a complete metamorphosis of the mosquito
- ix. A householder sets up rodent bait impregnated with a rodenticide known as bromethalin inside the kitchen which was regularly visited by rodents at night. Unfortunately, a 1 year old child finds the bait and eats part of it resulting to accidental poisoning of the child. What is the best substance are healthcare workers likely to give to the child in order to delay development of severe symptoms?
- Make the child drink a lot of cold water to dilute the rodenticide
  - Give the child a lot of milk to drink
  - Give the child vitamin K<sub>1</sub>
  - Make the child drink warm water and induce vomiting
  - Give the child tablets such as panado or paracetamol to prevent development of fever
- x. Which of the following factors determine the level of risk of pesticides to water pollution?
- Rainfall
  - Microbial activity
  - Soil temperature
  - Soil structure
  - All of the above

- b. Write **T** (for true) or **F** (for false) on each of the statements below: (5)
- i. The respiratory system of a mosquito consists of openings on the side of the abdomen also known as tracheaoles
  - ii. Ovoviviparous insects produce eggs with well-developed shells that hatch within the body of the female
  - iii. Babesiosis is a zoonotic infection of cattle that is often transmitted through tick-bites to humans
  - iv. Human scabies caused by *Sarcoptes scabiei* often affect the area between fingers and the wrists as well as other areas with skin folds of infected human hosts
  - v. The arrangement of body division in arachnids such as the house mouse mite, *Allodermomyssus sanguineus*, consists of clearly divided head, thorax and abdomen

## QUESTION 2

- a. The understanding of the anatomy of insects have been derived from detailed studies of the cockroach. Using the cockroach to illustrate, discuss:
- i. the arrangement of the circulatory system of an insect. (4)
  - ii. the arrangement of the respiratory system of a an insect such as a cockroach (4)
- b. A visitor spends a night at an inn in a remote area of a country. In the morning, the visitor notices bite marks all over the body. The inn calls you, as an Environmental Health Officer for assistance. You suspect that the bites are due to bedbugs.
- i. Describe THREE effects that bites from bedbugs are likely to cause in man. (5)
  - ii. What investigation procedures are you going to engage to determine if the biting arthropods are bedbugs or not. (2)
  - iii. Suppose you confirm that the biting arthropods are indeed bedbugs. How would you handle the problem between the visitor and the Inn? (4)
  - iv. What measures would you put in place to remove the bedbug infestation from the inn and to prevent future infestations? (6)

[25 marks]

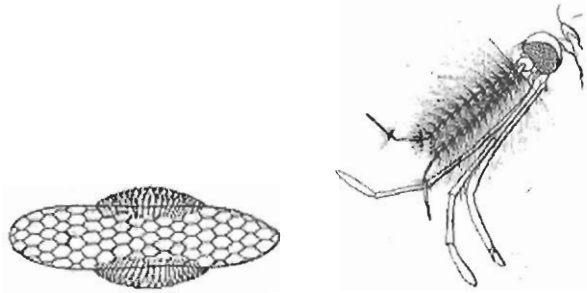
## QUESTION 3

- a. A housefly and a tsetsefly bear close similarities mainly because they belong to the same Order and Suborder yet one is a mechanical transmitter of disease while the other is a biological vector.
- i. What is the difference between a mechanical vector and a biological vector? (4)
  - ii. Explain why a housefly is an efficient mechanical vector. (4)
  - iii. Name one disease transmitted by the tsetsefly to humans and how transmission of the disease occurs. (3)
  - iv. Name the Order and Suborder to which houseflies and tsetseflies belong. (2)
  - v. Describe two methods you may use to structurally differentiate a housefly from a tsetsefly. (4)
- b. Outline a strategic plan for the control of housefly populations in a rural homestead in order to reduce mechanical transmission of pathogenic elements of disease into human food. (8)

[25 marks]

#### QUESTION 4

- a. Study the mosquito egg and adult mouthparts shown below:



- i. Write down the mosquito Genus of the egg. (1)
  - ii. Describe the habitat from which these eggs are likely to be recovered. (3)
  - iii. Are the mouthparts of a male or female mosquito? Give reasons for your answer. (3)
  - iv. Are the mouthparts of an *Anopheles* or Culicine mosquito. Give reasons for your answer. (3)
- b. *Anopheles arabiensis* remain the predominant species responsible for transmission of malaria in Swaziland yet *An. gambiae* and *An. funestus* used to be also involved. Explain why *An. arabiensis* have persisted as the predominant species transmitting malaria in Swaziland. (4)
- c. Indoor residual spray exercises have largely succeed because of consistency and appropriate application of the chemicals on wall surfaces of human dwellings.
- i. Name the chemicals used, appropriate nozzle size and the corresponding surfaces where they are used during indoor residual spray exercises. (6)
  - ii. What distance should the sprayer maintain between the nozzle and the spray surface in order for the exercise to be effective? (1)
  - iii. An indoor sprayer collects the following information prior to travelling to a community where he has to perform indoor residual spraying:  
Number of houses to be sprayed = 150  
Average indoor surface to be sprayed in each house = 20m<sup>2</sup>  
Concentration of DDT in wettable powder = 50%  
Concentration of DDT to be deposited on the surface = 2 g/m<sup>2</sup>  
What is the total amount of DDT required for the indoor residual sprayer to carry the exercise? (4)

[25 marks]

#### QUESTION 5

- a. A household complains of rodent infestation in their house to the office of the Municipal Council where you are employed as an Environmental Health Officer. The office delegates you to go and assist the family. Outline the steps you would take to assist the family remove the nuisance and eventually prevent future infestation of their house with rodents. (25)

[25 marks]

## QUESTION 6

- a. Two pesticides, A and B, are reported to have LD<sub>50</sub> values of 0.025 and 0.15 respectively. Which of the two pesticides is more toxic? Give reasons for your answer. (3)
- b. Define LC<sub>50</sub>. (2)
- c. Cabaryl is a carbamate that is manufactured through thin-layer chromatography, spectrophotometry, gas chromatography, high pressure liquid chromatography, and chemical ionisation mass spectrometry and has been used for more than 30 years to control a range of pests including head lice. Best and Murray (1962), published their survey on the occupational exposure of plant workers during the production of cabaryl. They reported exposure values of 0.23 to 31 mg/m<sup>3</sup>, which were well above occupational exposure limit (OEL) values.
- Explain what OEL is and what the reported findings mean to the health of the plant workers. (4)
  - How would you use this evidence to normalise the situation at the production plant and prevent illness or death of the plant workers? (4)
  - Other than during manufacture, describe how humans are likely to become exposed to cabaryl. (2)
- d. Another carbamate, propoxur, is a moderate hazardous insecticide often used in households to reduce populations of insects.
- Explain the mode of functioning of propoxur. (2)
  - Why is propoxur often added in insecticidal formulations containing pyrethroids in commercial sprays used to control household crawling insects? (3)
  - For how long does propoxur remain effective in the environment? (1)
  - Propoxur is used as a 50% water dispersible powder or as a 20% emulsifiable concentrate. What is the difference between the two types of formulations? (4)

[25 marks]