



UNIVERSITY OF SWAZILAND
Faculty of Health Sciences
Department of Environmental Health Science

DEGREE IN BACHELOR OF SCIENCE IN ENVIRONMENTAL
HEALTH SCIENCES

MAIN EXAMINATION PAPER MAY 2017

- TITLE OF PAPER : VECTOR CONTROL
- COURSE CODE : EHSS 104
- DURATION : 2 HOURS
- MARKS : 100
- INSTRUCTIONS :
- : READ THE QUESTIONS & INSTRUCTIONS CAREFULLY
 - : **QUESTION ONE IS COMPULSORY, THEN ANSWER ANY OTHER THREE QUESTIONS**
 - : EACH QUESTION **CARRIES 25** MARKS.
 - : WRITE NEATLY & CLEARLY
 - : NO PAPER SHOULD BE BROUGHT INTO THE EXAMINATION ROOM.
 - : BEGIN EACH QUESTION ON A SEPARATE SHEET OF PAPER.

DO NOT OPEN THIS QUESTION PAPER UNTIL PERMISSION IS GRANTED BY THE INVIGILATOR.

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. Cockroach populations should be maintained low inside households for all of the following reasons **EXCEPT** that they:
 - A. cause destruction of household materials due to the urine deposit
 - B. are unpleasant pests
 - C. are involved in mechanical transmission of pathogenic agents of disease
 - D. are sometimes involved in biological transmission of pathogenic agents of disease to humans
 - E. may cause bites in young children during their sleep

 - ii. The part of the insect abdomen that contains spiracles is called the:
 - A. sternum
 - B. notum
 - C. tergum
 - D. pleurum
 - E. cercus

 - iii. Which one of the following statements is **NOT TRUE** about the characteristics of members of the Class insecta.
 - A. Some insects consist of two compound eyes with each having up to 30 000 eyespots called ommatidia
 - B. Insects are able to change the focus of their eyes in order to see objects at different distances
 - C. The inner organs of an insect are protected by a layer of chitin called a cuticle
 - D. The antennae of insects are used as tactile organs and may be used for smelling or smelling
 - E. The type of mouthparts possessed by the adult insect does not necessarily indicate the type possessed by the young of the same species

 - iv. Bees and wasps cause disease in humans through:
 - A. urtication
 - B. envenomation
 - C. allergic reactions
 - D. tissue invasion
 - E. sensitisation

- v. An entomologist student collects a fly and removes its antennae for further characterisation and identification of the fly. He draws the following antennae as observed from under the microscope.



From the diagram, the student entomologist is likely to conclude that the fly is a:

- A. sandfly
 - B. horsefly
 - C. housefly
 - D. tsetsefly
 - E. mosquito
- vi. The following mouthparts were obtained from a mosquito.



The mosquito is likely to be:

- A. a male *Anopheles gambiae*
 - B. a female *Anopheles funestus*
 - C. a male *Aedes aegypti*
 - D. a female *Culex quinquefasciatus*
 - E. a female *Mansonia spp.*
- vii. A student entomologist identifies the following stage of an arthropod following an exercise during which he collected arthropods from the side of a dam.



The student is likely to conclude that the arthropod is a:

- A. housefly
- B. sandfly
- C. blackfly
- D. flea
- E. tsetsefly

- viii. Which one of the following IS NOT one of the methods bedbugs may be transmitted from an infested house to another one?
- A. Bedbugs may be brought on the bodies of infested humans
 - B. Bedbugs are also transmitted with movements of furniture or clothing from one house unit to another.
 - C. Bedbugs usually occurs from a few bugs that are picked up with luggage during travel to places like hotels, bed and breakfasts (B&Bs), motels, hostels and may be brought in with the luggage into a house
 - D. Bedbugs may crawl between units of a multi-unit housing such as exists in many rural homesteads or enter through cracks and crevices in the wall
 - E. Bedbugs may also drop from bodies of infested animals such as household pets and birds to un-infested areas and house units
- ix. A student entomologist collects arthropods and attempts to identify them using their wings. Which one of the following is likely to be the wing of a sandfly among those he has collected?
- A. The wings are nearly clear and the venation is distinctive with the fourth longitudinal vein (M_{1+2}) bent sharply upwards near the end of the wing so as to nearly meet the R_{4+5} vein in front of it, enclosing a characteristic R_5 cell
 - B. The wing has a characteristic pattern formed by the branching of the M_{1+2} vein which encloses a characteristic hatchet shaped or cleaver-shaped discal cell
 - C. Wings are colourless or almost so and membranous
 - D. Wings are lanceolate in outline, very hairy with scales on the margins and vein 2 branches twice
 - E. The wings have two sub-marginal and five posterior cells and a completely closed discal cell in approximately the centre of the wing
- x. The Onchocerciasis Control Programme in West Africa was a global effort to reduce:
- A. mosquito populations and reduce incidence of malaria
 - B. blackfly populations and reduce river blindness
 - C. louse infestations in humans and the incidence of trench fever
 - D. bedbug infestations in humans and reduce mechanical transmission of typhoid fever
 - E. tsetsefly populations and reduce death of cattle through nagana infections
- b. Write **T** (for true) or **F** (for false) on each of the statements below: (5)
- i. All insects have eyes and live in both terrestrial and aquatic environments, some arachnids have no eyes and they all live in terrestrial environments
 - ii. Houseflies are commonly involved in the biological transmission of pathogenic agents such as those responsible for gastrointestinal diseases
 - iii. Some caterpillars introduce venoms into the skin of their hosts through urticating hairs
 - iv. Insect diapause may occur due to changes in temperature, moisture, availability of food, length of photoperiod and may be imposed by internal factors such as heredity, enzymes or hormones

- v. Both male and female mosquitoes feed on the blood of mammalian hosts but only the female mosquitoes are able to support development of parasites and facilitate their transmission to the next host during blood-feeding

QUESTION 2

- a. Write down one disease that is transmitted to humans by the following flies:
- i. Sandflies (1)
 - ii. Blackflies (1)
 - iii. Tsetseflies (1)
- b. In certain areas, sandflies are the cause of "harara" and hence their populations must be controlled. Explain what is meant by "harara". (2)
- c. Briefly describe the breeding habitats preferred by each of the flies below for larvae or egg-laying:
- i. Sandflies (2)
 - ii. Horseflies (2)
 - iii. Blackflies (2)
 - iv. Tsetseflies (2)
- d. People living in sandfly infested areas may prevent bites through personal protective measures. Describe THREE measures these people may use to protect themselves from bites of sandflies. (6)
- e. Large populations of *Simulium damnosum* resulted in epidemics of one of the diseases transmitted following the bite of infected blackflies among seven West African countries. A major control programme involving three interventions was initiated and it resulted in reduced populations of blackfly and incidence of disease. Discuss the THREE methods of intervention used in the control programme in West Africa to reduce blackfly populations and also to reduce disease incidence. (6)

[25 marks]

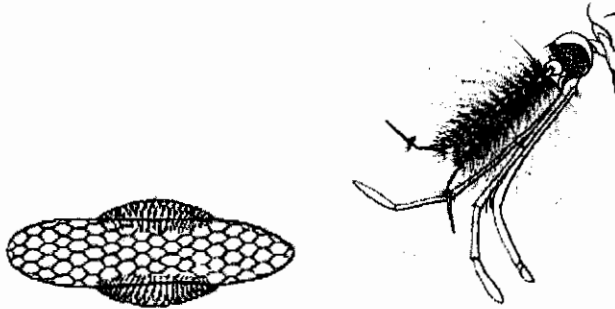
QUESTION 3

- a. Houseflies belong to the Class Insecta which bear significant differences with members of the Class Arachnida. List TWO major differences between members of the Class Insecta and the Class Arachnida. (2)
- b. Houseflies are considered worse mechanical transmitters of disease compared to cockroaches. Explain this observation. (6)
- c. Outline FIVE changes you may recommend to a family with heavy infestation in the kitchen to reduce or remove the housefly infestation. (10)
- d. Housefly breeding occurs in manure of domestic animals including human faecal matter. How can you use this information to reduce population of houseflies in a rural homestead? (7)

[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 = 20m²
 Concentration of DDT in wettable powder = 50%
 Concentration of DDT to be deposited on the surface = 2 g/m²
 What is the total amount of DDT required for the indoor residual sprayer to carry the exercise? (4)

[25 marks]

QUESTION 5

- a. Explain why it is important for entomologists to know the resting places for pests of medical importance. (4)
- b. How does the life cycle of *Tungapenetrans* become a problem to domestic animals including humans? (4)
- c. Describe the life cycle of the flea in the larva and pupa stages. (4)

- d. Fleas are involved in the transmission of the agent of bubonic plague to humans. Name the causative agent of bubonic plague and the species of flea involved in the transmission. (2)
- e. Discuss how flea infestation may be controlled or managed among domestic animals and within nesting areas. (6)
- f. Fleas often cause significant problems inside human dwellings. Discuss how flea infestation may be reduced in houses, particularly where the floor is carpeted. (5)

[25 marks]

QUESTION 6

- a. Write down the genera of snails involved in the transmission of the following flukes: (4)
 - i. *Schistosoma mansoni*
 - ii. *Schistosoma haematobium*
 - iii. *Schistosoma japonicum*
 - iv. *Fasciola hepatica*
- b. Control of snails may involve prevention of human-water contact, reduction and prevention of breeding, mollusciciding and use of biological agents. Discuss snail control under each of these headings:
 - i. Prevention of human-water contact (6)
 - ii. Reduction and prevention of breeding of snails (3)
 - iii. Mollusciciding (2)
 - iv. Use of biological agents (3)
- c. Suppose you want to treat a volume of 40m^3 of water every second with 70% molluscicide in the form of wettable powder at 1mg/l (active ingredient) applied for 8 hours using drums that discharge at
 - i. What is the total weight of molluscicide (in grams) that must be added into the drum dispensers? (3)
 - ii. Calculate the amount of solution (in grams) that has to be added to the dispenser, given that the rate of discharge of the molluscicide from the dispenser is 0.04 litres/second. (4)

[25 marks]