Student's ID number.....

PRACTICAL TEST

Lab. No. 1

Total score 44 points

Time 60 minutes

Instruction

In a given land plot with relatively dense trees and shrubs, the soil was rather dark in color, rich in organic matter, and inhabited by diversed species of animals. The soil was randomly sampled to the depth of no more than 15 cm from various areas of the plot, and animals were collected in order to study their diversity in the surface soil. Most abundant species of animals were sorted out and preserved in 70% ethyl alcohol.

Each student is provided with 10 glass vials (labeled #1 through #10). There are two specimens in each vial preserved in 70% ethyl alcohol.

Task I-1 (20 points)

1.1 Fill in the answer code of the phylum for each specimen. (5 points)

Answer code

01 Annelida	04 Mollusca
02 Arthropoda	05 Nemathelminthes
03 Cnidaria (Coelenterata)	06 Platyhelminthes

Answer

Vial	#1	#2	#3	#4	#5	#6	#7	#8	#9	#10
Phylum										

1.2 Fill in the answer code of the taxonomic units or groups for each specimen. (5 points)

Answer code

01 Chelicerata	07 Crustaceae
02 Chilopoda	08 Oligochaeta
03 Diplopoda	09 Diptera
04 Gastropoda	10 Polychaeta
05 Insecta	11 Thysanura
06 Hirudinae	12 Turbellaria

Answer

Vial	#1	#2	#3	#4	#5	#6	#7	#8	#9	#10

1.3 Fill in the answer codes of 2 observed characteristics of the specimen in each vial. (10 points)

Answer code

01 antenna	08 head + thorax + abdomen	15 predatory
03 cephalothorax + abdomen	10 laterally-flattened body	16 setae for locomotion
05 cylindrical body	12 one pair of legs per segment	18 spinneret
06 dorso-ventrally flattened body		20 two pairs of legs
07 four pairs of walking legs	14 pedipalp	per segment

Answer

Vial	#1	#2	#3	#4	#5	#6	#7	#8	#9	#10
Charac-										
teristics										

Task I-2 (10 points)

Based on each pair of characteristics provided, complete the diagrammatic dichotomous key on page 3 by filling in the answer codes of characteristics in the appropriate **spaces** (.....) and specimen numbers (#1 to #10) in the **boxes** ([#])

Answer code

01 Body elongated.

02 Body oval-shaped.

03 Body divided into head, thorax and abdomen.

04 Not as above.

05 Base of abdomen constricted.

06 Base of abdomen broadly joins to thorax.

07 Appendages present.

08 Appendages absent.

09 Antenna elbowed with long first segment.

10 Antenna not elbowed.

11 One pair of prominent pincerlike appendages.

12 Appendages leglike.

13 One or two pairs of legs per body segment.

14 Not as above.

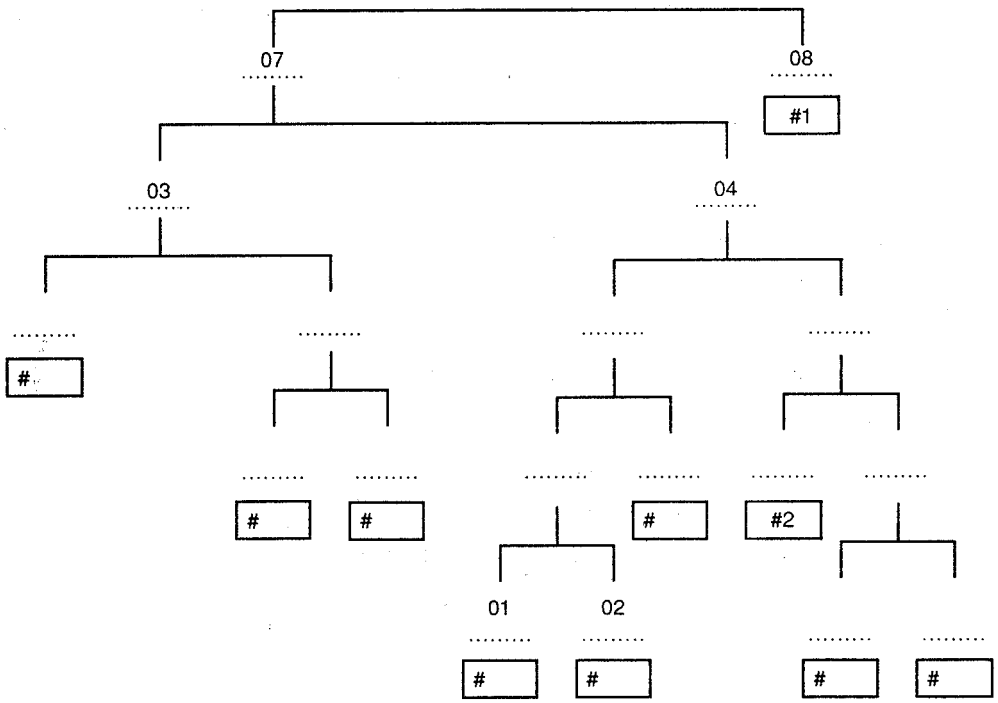
15 One pair of legs per body segment.

16 Two pairs of legs per body segment.

17 Abdomen with a forked appendage near posterior end.

18 Abdomen without the above appendage.

Answer



Student's ID number.....

Task I-3 (8 points)

3.1 Prepare a whole-mount slide of **one** specimen. The slide should clearly show antennae and mandibles. Use provided materials and Hoyer's mounting medium as mountant.

3.2 Label the slide indicating the number of the chosen specimen (#1 to #10) and the student's ID number.

3.3 Draw the **whole** specimen from the prepared slide and label the antenna and the mandible by using answer code.

Answer code	01 antenna	02 mandible

Answer **Drawing of specimen # .....**

Scoring	Correctness of spec. selection	Completeness of specimen	Ant.& mandible demonstration	Quality of slide	Drawing & labeling
Points	1	2	1	1	3
Points received					

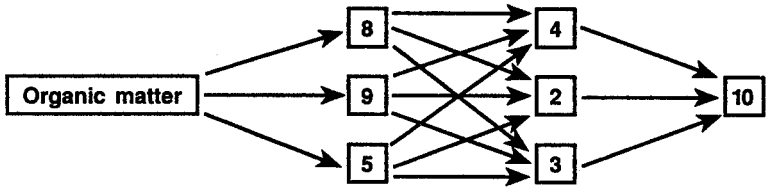
Task I-4 (6 points)

Complete two possible food chains below by filling in the numbers (#1 to #10) of appropriate animals in the boxes provided.

Given that

4.1 organic matter is a food source for primary consumer,

4.2 No specimen can be used twice for the same trophic level in the two different food chains.



Answer

First food chain

Organic matter -------> # -------> # -------> #

Primary consumer Secondary consumer Top consumer

Second Food Chain

Organic matter -------> # -------> # -------> #

Primary consumer Secondary consumer Top consumer

Student's ID number.....

PRACTICAL TEST

Lab. No. II

Total score 45 points

Time 60 minutes

A man-made mini-ecosystem is set up in front of the examination room. Twelve sample of plants with tagged-number from that artificial habitat are placed in trays on each competitor's desk. Using samples and tools provided, solving and answering the problems in each task.

Task II-1 : Plant Sample No.1 (3 points)

Study plant no.1, then choose the answer codes to label the appropriate parts in Fig.1.

Answer codes II-1

Code	Term	Code	Term	Code	Term
01	ovary	04	receptacle	06	stigma
02	ovule	05	stamen	07	style
03	peduncle				

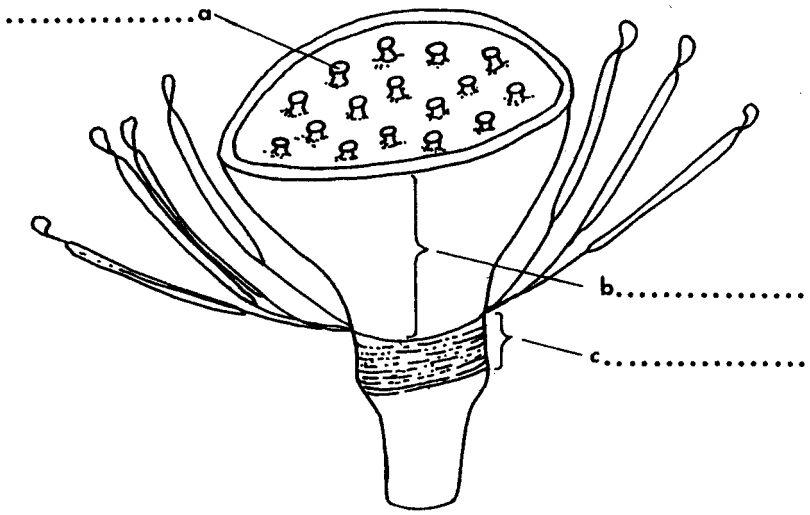


Fig. 1

Student's ID number.....

Task II-2 : Plant Sample No.2 (7 points)

Study plant no.2, draw the floral diagram and label the diagram using the following answer codes.

Answer codes II-2

Code	Term	Code	Term	Code	Term	Code	Term
01	anther	03	calyx	05	perianth	07	stamen
02	bract	04	corolla	06	pistil	08	stigma

Space for drawing

Task II-3 : Plant Sample No.3 (6 points)

Study plant no.3, then choose the answer codes to label Fig.3.

Answer codes II-3

Code	Term	Code	Term	Code	Term
01	anther	05	corolla	09	stamen
02	bract	06	filament	010	staminal column
03	bulbil	07	fruit	011	stigma
04	calyx	08	ovary	012	style

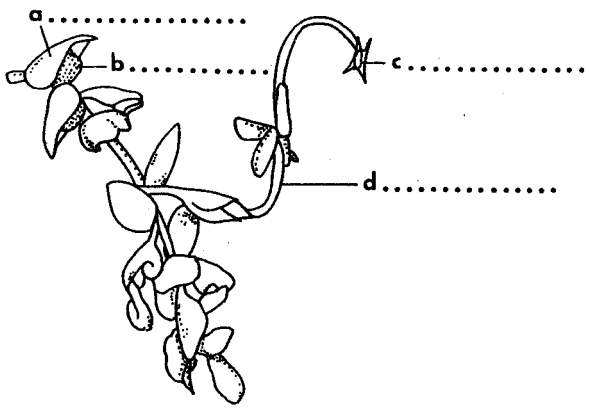


Fig. 3

Task II-4 : Plant Sample No.4 (14 points)

Prepare the cross-section of the stem of plant sample no.4.

4.1 Choose the answer codes to label Fig.4. (5 points)

Answer Code II-4 : 4.1, 4.2

Code	Term	Code	Term	Code	Term
01	bundle sheath	010	lateral meristem	019	secondary cell wall
02	cambium	011	lignified wall	020	secondary xylem
03	collenchyma	012	middle lamella	021	sieve tube
04	cortex	013	parenchyma	022	tracheid
05	crystals	014	phloem fiber	023	vascular bundle
06	cytoplasm	015	primary cell wall	024	vessel (trachea)
07	fiber	016	vacuole	025	xylem
08	hypodermis	017	sclerenchyma	026	xylem fiber
09	intercellular space	018	sclereid		

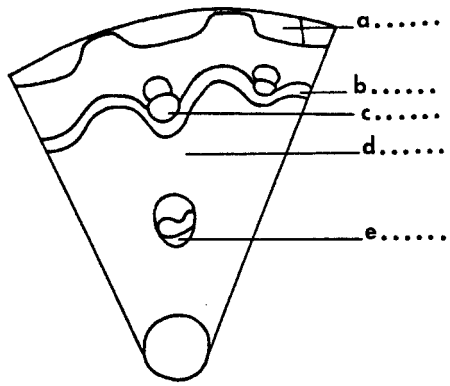


Fig.4

4.2 Draw 5 cells of the area "d" in Fig.4 and choose the answer codes to label the structure of those cells. (5 points)

Space for drawing

4.3 Study Fig.4, put X in the appropriate boxes a to e to indicate the tissue which has lignified cell wall. (3 points)

☐ a. ☐ b. ☐ c. ☐ d. ☐ e.

4.4 Put X in the box to indicate status of cell in position "a" in Fig.4 (1 point)

☐ living cells ☐ dead cells

Task II-5 : Plant Sample No.5 (3 points)

Study plant sample no.5 and choose the appropriate answer codes to indicate the 3 major structures of the plant.

Answer codes II-5

Code	Term	Code	Term
01	corm	06	micropyle
02	cotyledon	07	pericarp
03	embryo	08	rhizome
04	endosperm	09	seed coat
05	integument	010	tuber

5.1 .....

5.2 .....

5.3 .....

Task II-6 : Plant Samples No.1-12 (12 points)

Classify the plant samples no.1-12 b y putting the sample number(s) in front of the Division(s) that it (they) should belong to.

Sample numbers	Divisions
.....	Ascomycota
.....	Basidiomycota
.....	Bryophyta
.....	Cyanophyta
.....	Chlorophyta/Charophyta
.....	Equisetophyta (Sphenophyta)
.....	Lycopodiophyta
.....	Magnoliophyta
.....	Pinophyta
.....	Polypodiophyta (Pterophyta/Filicophyta)
.....	Zygomycota

Student's ID number.....

PRACTICAL TEST

Lab No. III

Total score 37 points

Time 60 minutes

Task III-1

Population Ecology (22 points)

1.1 Sampling of cowpea weevil population

Cowpea weevil, *Callosobruchus maculatus* Fabricius (Coleoptera: Bruchidae), is one of the major pests of several beans, peas, and pulses. The larvae cause damage by feeding inside the seeds. Each adult makes one emerging hole in the seed. Damaged seeds are lighter in weight and float in water.

Question

Each student will be given a sealed bag of beans, some of which are infested with cowpea weevil. Devise an appropriate procedure for:

(1) estimating damaged seeds per 100 seeds and standard deviation (SD).

(2) estimating population density of cowpea weevil per 100 seeds and standard deviation (SD);

The materials for taking samples are provided. However, some materials may not necessarily be needed. Write down your data from sampling and show your calculation. (18 points)

Answer

Data from each sample should be in the following

Total no. of holes .....

Total no. of damaged seeds .....

Total no. of sampling seeds .....

Formula given : $SD = \sqrt{\frac{\Sigma(x-\bar{x})^2}{(n-1)}}$

SD - standard deviation

1.2 Estimation of the cowpea weevil population growth

Cowpea weevil has discrete generations. Each generation takes 24-26 days at 30-32°C, 70-80% RH (relative humidity). Under unlimited resources, the population growth of cowpea weevil females could be calculated from the following growth equation:

$$N_t = N_0 R^t$$

where

N_0 = initial population size of females,

N_t = population size of females at generation t,

R = net reproductive rate, or number of female offspring produced per female per generation (for cowpea weevil R = 2.6),

t = generation number.

Question

If a bag contains 36,000 beans, and the sex ratio of cowpea weevil is 1:1, predict the population of females in the third generation. Use your population density derived in Question 1.1 to calculate the initial female population. Show all procedures. (4 points)

Answer

Task III-2

Structure and Function of Insects (15 points)

Study the given insect specimens (A-H) and answer the following questions on the provided answer sheet on page 12, by entering the codes given in Answer Codes III-a, III-b, III-c and III-d.

1. What kind of food do the insects A, B and F eat? (see Answer Code III-a)
2. What are the special functions of the first pair of legs of the insects A, B, C, F and the third pair of legs of the insect H? (see Answer Code III-b)
3. Identify the body parts labelled with color or tied with thread in the insects A, C, D and E. (see Answer Code III-c)
4. What is the mode of living of the insects C and H? (see Answer Code III-d)

   What is the habitat of the insect G? (see Answer Code III-d)

Answer code

Answer Code III-a	
Code	**Term**
11	liquid
12	solid
13	solid and liquid

Answer Code III-b	
Code	**Term**
22	clinging
23	digging
24	grasping
25	jumping
26	swimming
27	walking

Answer Code III-c		
Code	**Term**	**Explanation**
31	coxa	the basal segment of the leg.
32	femur	the third leg segment located between the trochanter and the tibia.
33	haltere	a small knobbed structure on each side of the metathorax, representing a hind wing.
34	hamuli	minute hooks, a series of minute hooks on the anterior margin of the hind wing, with which the front and hind wings are attached together.
35	mesonotum	the dorsal sclerite of the mesothorax.
36	pronotum	the dorsal sclerite of the prothorax.
37	scutellum	a sclerite of the thoracic notum; the mesoscutellum, appearing as a more or less triangular sclerite behind the pronotum.
38	scutum	the middle division of a thoracic notum, just anterior to scutellum

Student's ID number.....

Answer Code III-d	
Code	**Term**
41	aquatic
42	ectoparasite
43	endoparasite
44	free living
45	predator
46	terrestial

Answer sheet

Task III-2 : Structure and Function of Insects (15 points)

Insect specimen	1. Type of food use Answer code III-a	2. Special function of legs use Answer Code III-b	3. Name the insect part that is colored or tied use Answer Code III-c	4. Mode of living or type of habitat use Answer Code III-d
A.	1.1_____	2.1_____	3.1_____	
B.	1.2_____	2.2_____		
C.		2.3_____	3.2_____	4.1_____
D.			3.3_____	
E.			3.4_____	
F.	1.3_____	2.4_____		
G.				4.2_____
H.		2.5_____		4.3_____

Student's ID number.....

PRACTICAL TEST

Lab IV

Total score 45 points

Time 60 minutes

Task IV-1 Permeability of Ions Across the Membrane of Yeast (25 points)

A living cell is surrounded by membrane barrier which is selective for various types of substances which are allowed to enter the cell. The following experiment is designed to demonstrate the permeability of the yeast cells to various ions.

Instruction for Student's Experiment

1. Dissolve 4 g of dry yeast into 50 ml of 0.5% Na_2CO_3 and swirl thoroughly.
2. Label 5 test tubes (no.1 to no.5). Add 5 ml of yeast suspension into each tube, and then add 1 ml of 0.02% neutral red and mix thoroughly.
3. Bring tube no.2 to a laboratory personnel who will put it in the water bath for 5 min for you.
4. Bring tubes no.1 and no.2 to a laboratory personnel who will centrifuge the tubes for you for 5 min. After that, observe the colour of supernatant and pellet.
5. Add 1 ml of 0.02 M NaOH to tube no.4 and 1 ml of 0.02 M NH_4OH to tube no.5, mix thoroughly and observe the colour of yeast suspension.
6. Record the results in the table and answer the following questions.

Table

Tube no.	Yeast (ml)	Neutral red (ml)	NaOH (ml)	NH_4OH (ml)	Colour
1	5	1	----------> Centrifuge		.....
2	5	1	---------->boil---------> Centrifuge		.....
3	5	1	0	0	.....
4	5	1	1	0	.....
5	5	1	0	1	.....

Task IV-2 Determination of Yeast Growth and Glucose Consumption (20 points)

Microorganisms, such as yeast, *Saccharomyces cerevisiae*, can grow in the presence of the nutrient source glucose. The following two experiments were done by a microbiologist to demonstrate the relationship between yeast growth, glucose consumption and pH of yeast cultures.

Study experiments I and II and use their results to answer two questions.

Experiment I

1. Yeast, *Saccharomyces cerevisiae* was grown in liquid medium containing glucose as carbon source. The initial pH of the culture was 5.5. At different time intervals residual glucose and growth were determined. Growth is measured by the increase of turbidity by measuring absorbance of light at 660 nm. According to data obtained, a graph showing time of growth and residual sugar was plotted in figure 1.
2. The yeast biomass contained 85% moisture.
3. A standard curve in figure 2 shows correlation between biomass dry weight and optical density.

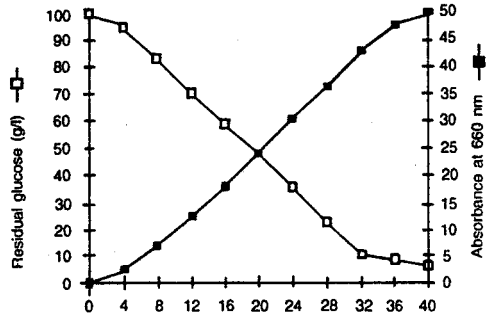


Figure 1. Glucose consumption and relative growth of yeast culture from the beginning to the end of the experiment.

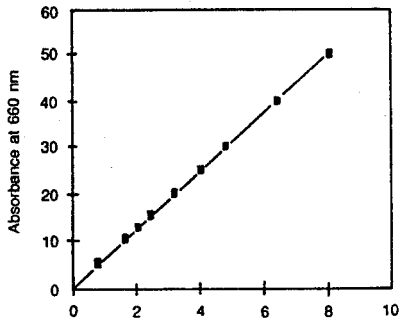


Figure 2. Correlation of yeast cultures between absorbance and biomass dry weight.

Experiment II

The experiment was repeated using the same microorganism, nutrient and growth conditions as those used in experiment I. Five samples (culture 1, 2, 3, 4, 5) were taken at five different times, absorbancy and pH of those five cultures were determined as shown in the following table.

Culture	Absorbance at 660 nm	pH
1	2.5	5.4
2	12.5	5.0
3	30.0	4.2
4	42.0	3.7
5	50.0	3.7

Questions.

1. Using information available from experiment I, fill in the table the culture age, biomass fresh weight and glucose consumed for the five culture samples described in experiment II. (15 points)

Culture	Culture age (hours)	Biomass fresh weight (g/l)	Glucose consumed (%)
1	.....	.....	.....
2	.....	.....	.....
3	.....	.....	.....
4	.....	.....	.....
5	.....	.....	.....

2. Plot a curve of time dependence of pH in experiment II. (5 points)