18th INTERNATIONAL BIOLOGY OLYMPIAD
JULY 15 - 22, 2007

PRACTICAL EXAMINATION 1

ANIMAL ANATOMY, SYSTEMATICS AND ECOLOGY

This examination is composed of 3 tasks.

TASK A:	Dissection of two annelids	26 marks
TASK B:	Identification of annelids using a dichotomous key	10 marks
TASK C:	Defining the structures, body plan, life style and classification of 10 “worm-like animals”.	27 marks

TOTAL MARKS = 63

TOTAL TIME AVAILABLE = 90 minutes

GENERAL INSTRUCTIONS

- **Before starting the exam, the invigilator will show you a red card and a green card to test for red-green color blindness. If you are unable to see the difference between the two cards, raise your hand, and you will be provided with assistance immediately.**
- Read the exam paper carefully before commencing the exam.
- It is recommended that you allocate your time according to the mark value of each task and question.

IMPORTANT INFORMATION FOR TASK A

You must commence with Task A. When Task A is completed, raise your hand and a lab assistant will take a photo of your dissections, record the time, sign the pan labels and remove the dissections for marking.

IMPORTANT INFORMATION FOR TASKS B AND C

- All answers for Tasks B and C must be recorded in the answer booklet provided.
- Ensure that your 4-digit student code number is written on **ALL** pages of your answer booklet.
- Use the pencil provided to fill in the appropriate circle for each question in the answer booklet.

Task A. Annelid Dissection (26 marks)

Objective: To locate key features in a marine and a terrestrial annelid.

Materials:

- dissecting tray containing annelid 1 (tray labeled with blue sticker)
- dissecting tray containing annelid 2 (tray labeled with yellow sticker)
- 1 pair of dissecting scissors
- 1 pair of forceps
- 1 scalpel
- 20 steel pins on foam board
- 14 colored pins on foam board (2 red-orange, 2 blue, 2 yellow, 2 black, 2 white, 2 pink, 2 green)
- 1 pair disposable gloves
- 1 dissecting microscope and external lamp
- 2 specimen cards (1 labeled with blue sticker, the other labeled with yellow sticker)
- water bottle for keeping specimens wet
- 15 cm ruler from student pencil case

NOTE: Before beginning your dissection, ensure that you have all of the materials listed above. If you do not, immediately notify a lab assistant by raising your hand. After all materials lists are confirmed, timing will begin.

Procedure:

1. Fill out each of the two specimen cards with your student number and name and set aside. You will sign these cards **upon completion** of your dissections.

2. Put on your gloves and remove the wet paper towel that is covering the specimen. **Throughout the dissection, use the water bottle to regularly wet your specimen and any parts removed. This will ensure that the parts do not dry out.**

3. Note the differences in the external features of each worm, namely the increased number of sensory structures and the presence of multifunctional appendages on annelid 1.

4. **From the mid portion of the body** of annelid 1, detach an entire parapodium. Parapodia function as limbs and gills for the worm. Details of the parapodia allow zoologists to distinguish between different species of this annelid. Each parapodium consists of a ventral division called the **neuropodium** and a bilobed dorsal division called the **notopodium**. Each notopodium is supported by a chitinous and stiff rod called an **aciculum**. A dorsal and a ventral cirrus project

from the notopodium and the neuropodium, respectively. **Setae** extend beyond the parapodia.

5. Use the pins provided to pin the detached parapodium in one corner of the **annelid 1** dissecting pan. Ensure that it is pinned on wet paper towel. Pin as follows:

- **red-orange** pin for the **neuropodium** (2 marks)
- **blue** pin for the **notopodium** (2 marks)

**** Before continuing, use the water bottle to moisten the parapodium & cover it with a wet piece of paper towel ****

6. Stretch out each worm in its dissecting pan, **dorsal side up**. Place one steel pin through the 1st segment of the body and one pin through the last segment of the body to secure it in place.

7. Cut open the body wall of annelid 1 from the anterior tip down the body 3-5 cm. Separate the body wall from the internal structures and pin the body wall to the dissecting tray by using the steel pins.

8. Cut open the body wall of annelid 2 from the anterior tip, and continue the cut posteriorly approximately 5 cm. Separate the body wall from the internal structures. To open up the worm, pin the body wall to the dissecting tray by using the steel pins.

9. Starting at the anterior end of each worm, locate the muscular **pharynx**. In annelid 1 the pharynx also contains jaws that are useful in its predatory lifestyle. **In both specimens**, pin the following structure:

- **yellow** pin for the **pharynx** on **annelid 1** (2 marks)
- **yellow** pin for the **pharynx** on **annelid 2** (2 marks)

10. Moving posteriorly in both specimens, locate the long and tubular intestine used in digestion. In **both specimens**, pin the following:

- **black** pin for the **intestine** on **annelid 1** (2 marks)
- **black** pin for the **intestine** on **annelid 2** (2 marks)

11. Other major features of the annelid digestive system can be seen in annelid 2. Immediately posterior to the reproductive organs in annelid 2 lie the soft **crop** and the tougher-walled **gizzard**. **In annelid 2**, pin the following:

- **pink** pin for the **crop** on **annelid 2** (2 marks)
- **green** pin for the **gizzard** on **annelid 2** (2 marks)

12. Both annelids possess a closed circulatory system with tubular hearts and a dorsal and ventral blood vessel. **In both specimens**, pin the following:

    - **white** pin for the **dorsal blood vessel** on **annelid 1** (2 marks)
    - **white** pin for the **dorsal blood vessel** on **annelid 2** (2 marks)

13. Although both specimens are annelids, annelid 1 is sexually dioecious, whereas annelid 2 is hermaphroditic. Hermaphroditism is an advantage for this slow-moving organism. Examine the anterior internal structures in annelid 2, and any external features found on the body wall. **In annelid 2 only,** pin the following:

    - **plain steel pin** for **clitellum** (2 marks)
    - **red- orange** pin for **seminal vesicle** (2 marks)
    - **blue** pin for **seminal receptacle** (2 marks)

14. **After finishing the task, place a wet paper towel over the dissected specimens. Raise your hand. A lab assistant will take a photo of your dissection. Both the lab assistant and yourself will sign your dissection pan labels and record the time. Your dissection will then be taken in and graded as you move onto the next section of the practicum.**

Task B. Identification of annelids using a dichotomous key (10 marks)

Objective: To use a dichotomous key to identify ten annelids to the genus-level.

Materials:

- line drawings of 10 annelids (labeled as 1 to 10). **ALL** of the organisms are drawn in the **SAME** orientation

Procedure:
Use the dichotomous key below to identify the genus to which each annelid belongs. Indicate your selections in the answer booklet by filling in the **most** appropriate circle for each annelid.

Dichotomous Key

1a.	Has a prominent posterior sucker	go to 2
1b.	Lacks a posterior sucker	go to 3
2a.	Posterior half of body much wider than the anterior end	*Glossiphonia*
2b.	Body more ribbon like, anterior part tapered	*Eropobdella*
3a.	Has a prominent clitellum	*Lumbricus*
3b.	Clitellum absent	go to 4
4a.	Each segment has a pair of lateral appendages (parapodia)	go to 5
4b.	Parapodia are reduced, modified and/or not present on each segment	go to 8
5a.	Worm bears dorsal scales (elytra)	*Lepidontus*
5b.	Worm lacks dorsal scales	to 6
6a.	More than 15 body segments.....	go to 7
6b.	Less than 15 body segments; prostomium with a pair of club-shaped palps....	*Nerillidopsis*
7a.	Segment 2 bears a pair of long parapodial cirri	*Tomopteris*
7b.	Lacks long parapodial cirri on segment 2	*Nereis*
8a.	Possesses numerous tentacles	*Neoamphitrite*
8b.	Lacks tentacles	go to 9
9a.	Parapodia of the mid-body region modified as tufted branchia (gills)	*Arenicola*
9b.	Body divided into distinct regions; anterior end modified for filter-feeding....	*Chaetopterus*

Task C. Form and function of "worm-like" animals (27 marks)

Introduction

The following 10 animals all resemble "worms" in habit or appearance based on their general tubular or "worm-like" body plans. Most people without scientific training would initially use the term "worms" to describe these ten animals but with our zoological knowledge we know that these animals actually belong to several very different phyla and are only related superficially by their "worm-like" body plan. These 10 animals have structural characteristics that are adapted to their particular environments and life styles.

Objective: Using the pictures provided, determine which adaptations (form) these animals have that helps them in their environment and life styles (function)

Materials:

- laminated, colour photographs of 10 animals (labeled A to J). Note: there are two photographs of each animal.

Procedure:

There are two parts to this task. Fill in the tables in your answer booklet.

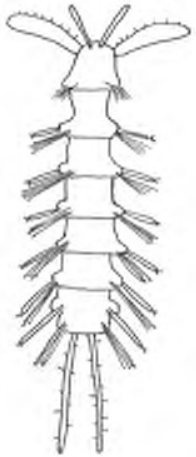
1. In Part I, select the best response for each of 6 characteristics (body shape; structures used in locomotion or for attachment to a host; structures used in feeding; type of digestive tract; body segmentation; type of sensory structures) from the choices provided.

2. In Part 2, use your observations from Part 1 to select the best response from the choices provided for the life style of each animal, the phylum to which it belongs and its body plan. For each part, indicate your choices by filling in the circles in the appropriate section of the answer booklet.

- THE END –

Images for Task B

1



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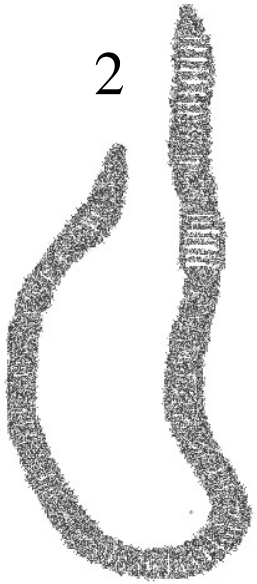

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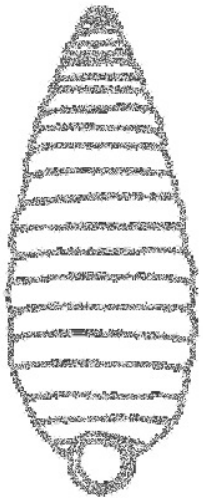

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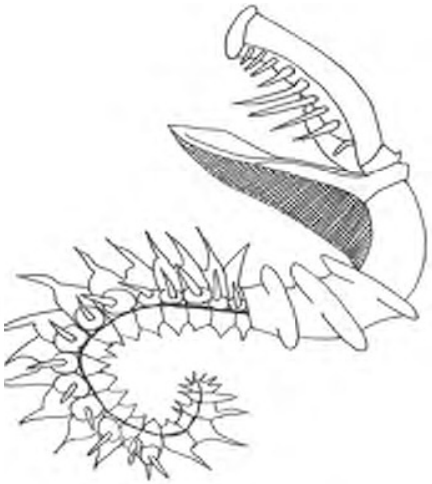

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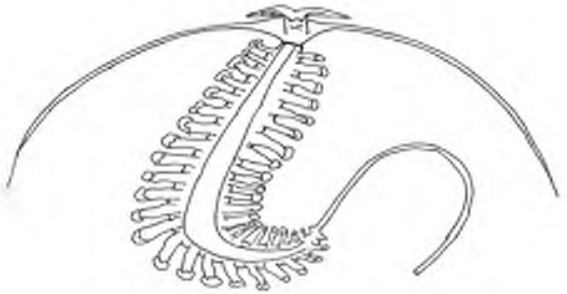

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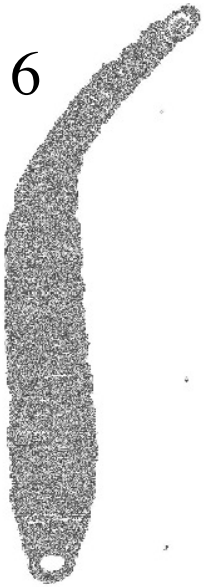
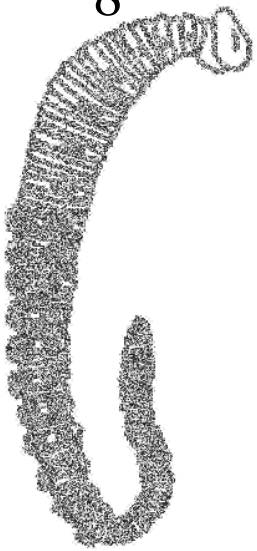


7

8



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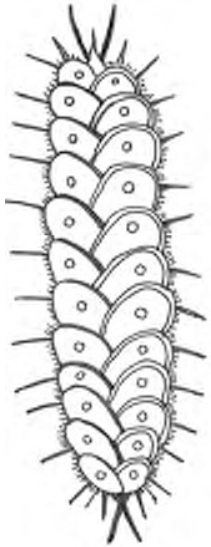

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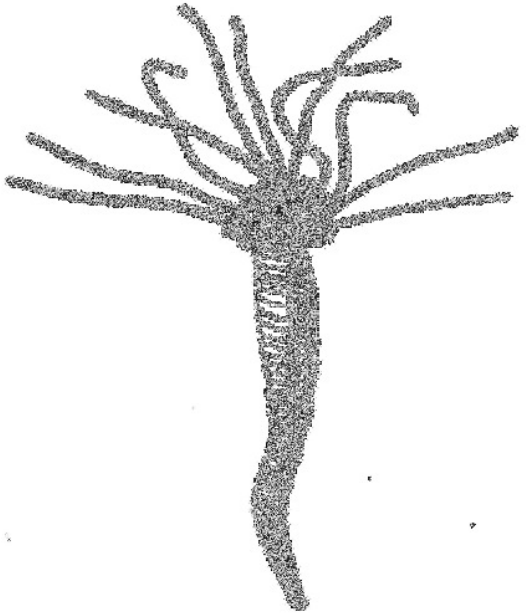

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ANSWER BOOKLET FOR PART 1: TASKS B & C

Important

Ensure that your **4** digit code number is written on all of the following pages of this document

STUDENT CODE NUMBER: _____

STUDENT NAME (printed): _____

Do not write in the box below. For examiners use only.

Task/Part	Marks
B	
C-I	
C-2	
Total	

STUDENT NUMBER: _____

Task B (Dichotomous key to annelid worms)

Indicate the genus for each of the ten specimens (labeled 1-10) by filing in the **most** appropriate circle

	Specimen number:									
	1	2	3	4	5	6	7	8	9	10
Glossiphonia	O	O	O	O	O	O	O	O	O	O
Eropobdella	O	O	O	O	O	O	O	O	O	O
Lumbricus	O	O	O	O	O	O	O	O	O	O
Lepidontus	O	O	O	O	O	O	O	O	O	O
Nerillidopsis	O	O	O	O	O	O	O	O	O	O
Tomopteris	O	O	O	O	O	O	O	O	O	O
Nereis	O	O	O	O	O	O	O	O	O	O
Neoamphitrite	O	O	O	O	O	O	O	O	O	O
Arenicola	O	O	O	O	O	O	O	O	O	O
Chaetopterus	O	O	O	O	O	O	O	O	O	O

Do not write in this box. *For examiners use only. Total Score (10)*	

STUDENT NUMBER: _____

Task C PART 1 (Characteristics of "worm-like organisms; A to J)

Select the best response for each characteristic. **Total marks = 12 (0.2** marks/specimen/characteristic)

Specimen	*characteristic 1* **Body Shape:**		*characteristic 2* **Structures used in locomotion or for attachment to a host:**			
	flattened	not flattened	muscular foot	jointed appendages	sucker, scolex and/or "teeth"	none of the other choices
A	O	O	O	O	O	O
B	O	O	O	O	O	O
C	O	O	O	O	O	O
D	O	O	O	O	O	O
E	O	O	O	O	O	O
F	O	O	O	O	O	O
G	O	O	O	O	O	O
H	O	O	O	O	O	O
I	O	O	O	O	O	O
J	O	O	O	O	O	O

Specimen	*characteristic 3* **Structures used in feeding:**				none	*characteristic 4* **Digestive tract:**	
	mandibles or teeth	sucker	radula	none of the other choices		incomplete (single opening for mouth and anus)	complete (separate openings for mouth and anus)
A	O	O	O	O	O	O	O
B	O	O	O	O	O	O	O
C	O	O	O	O	O	O	O
D	O	O	O	O	O	O	O
E	O	O	O	O	O	O	O
F	O	O	O	O	O	O	O
G	O	O	O	O	O	O	O
H	O	O	O	O	O	O	O
I	O	O	O	O	O	O	O
J	O	O	O	O	O	O	O

STUDENT NUMBER: _____

Task C PART 1 continued

Specimen	*characteristic 5* **Body segmented:** yes	no	*characteristic 6* **Sensory structures:** eye spots	simple or compound eyes	none of the other choices
A	O	O	O	O	O
B	O	O	O	O	O
C	O	O	O	O	O
D	O	O	O	O	O
E	O	O	O	O	O
F	O	O	O	O	O
G	O	O	O	O	O
H	O	O	O	O	O
I	O	O	O	O	O
J	O	O	O	O	O

Do not write in the boxes below. For examiners use only.

Question	No. correct
1	
2	
3	
4	
5	
6	
Total	

X 0.2 = /12

STUDENT NUMBER _____

Task C PART 2 (Characteristics of "worm-like organisms; A to J)

Select the best response for each characteristic. **Total marks = 15** (**0.5** marks/specimen/characteristic)

Specimen	*characteristic 7* **Lifestyle:**		*characteristic 8* **Specimen belongs to the phylum**					
	parasitic	non-parasitic	Arthropoda	Nematoda	Mollusca	Annelida	Platyhelminthes	Other
A	O	O	O	O	O	O	O	O
B	O	O	O	O	O	O	O	O
C	O	O	O	O	O	O	O	O
D	O	O	O	O	O	O	O	O
E	O	O	O	O	O	O	O	O
F	O	O	O	O	O	O	O	O
G	O	O	O	O	O	O	O	O
H	O	O	O	O	O	O	O	O
I	O	O	O	O	O	O	O	O
J	O	O	O	O	O	O	O	O

Specimen	*characteristic 9* **Body plan:**		
	acoelomate	pseudocoelomate	coelomate
A	O	O	O
B	O	O	O
C	O	O	O
D	O	O	O
E	O	O	O
F	O	O	O
G	O	O	O
H	O	O	O
I	O	O	O
J	O	O	O

Do not write in the boxes below. For examiners use only.

Question	*No. correct*
7	
8	
9	
Total	

X 0.5 =

/15

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Annelid 1 (Nereis)	Correct
Orange (nephridium)	
Blue (nephridium)	
Yellow (pharynx)	
Black (intestine)	
White (dorsal b.v.)	

sub-total = ☐

Annelid 2 (Lumbricus)	Correct
Yellow (pharynx)	
Black (intestine)	
White (dorsal blood v.)	
Pink (crop)	
Purple (gizzard)	
Steel (clitellum)	
Orange (seminal vesicle)	
Blue (seminal receptacle)	

sub-total = ☐

*each correct pinned structure = 2 marks

Total = ☐
(26)