

Country Code: _____
Country: _____

20th INTERNATIONAL BIOLOGY OLYMPIAD
12th – 19th July, 2009
Tsukuba, JAPAN



Directions :









- You should not open the envelope until the bell rings once to indicate the start of the test.
- After the bell rings, please open the envelope and write your student code on every page of the ANSWER SHEET at the beginning of the test.
- Please make sure that you have received all the materials and equipment listed for each task.

If any of these items are missing, please raise your hand.
- When the bell rings twice to indicate the end of the test, please put down your pencil and stop writing.
- For safety reasons, do not take any food or drink into the laboratory.
- You must wear your coloured laboratory coat together with appropriate clothes and shoes.

- Please properly use the materials (pencils, a pencil sharpener, an eraser, a ruler, a marker pen, a stopwatch, goggles, gloves, a calculator) which were given to you at registration.
- Distilled water (DW) in a bottle, paper towels, cleaning papers and two plastic cups for discarding liquid and solid materials have been provided at your bench. Please use them as needed.
- After the test, please be sure that you have cleaned the bench before you leave.

How to handle a micropipette:

Each micropipette has a fixed range of volumes as indicated on the head of pipette. Please use appropriate types of the micropipettes. Do not cross the limits of this range.

Type (Volume)	Head	Window	Volume
P1000 (200-1000 microlitre)			indicates 850 microlitre
P200 (50-200 microlitre)			indicates 150 microlitre
P20 (2-20 microlitre)			indicates 15 microlitre
P2 (0.2-2 microlitre)			indicates 1 microlitre



Volume adjustment: turn the dial (1) to set the value to the desired volume, which can be seen in the window.

Use: Secure the pipette tip to the tip holder (2). Gently push down the plunger (3) to the first stop, hold, and dip the tip into the solution vertically to a depth of 2 - 4 mm. Release the plunger slowly and make it return to the original position. Remove the pipette from the liquid and transfer the contents to the desired tube. Make sure that the tip is close to the inner wall of the tube. Push the plunger to the first stop and then push further to discharge the solution completely from the tip. Remove the pipette from the tube. Put the used tip into the disposal container by pressing the tip-ejector (4).

Attention: With the 200-1000 microlitre pipette (P1000), it may suck the solution into the pipette cylinder with the rapid release of the plunger. If this happens, please tell the help staff after the test.

Student Code: _____

20th INTERNATIONAL BIOLOGY OLYMPIAD

12th – 19th July, 2009

Tsukuba, JAPAN



PRACTICAL TEST 1

ANIMAL AND PLANT ANATOMY

Total Points: 100

Duration: 90 minutes

Dear Participants,

- In this test, you have been given the following 2 tasks:
 - Task 1: Animal anatomy (50 points)
 - Task 2: Plant anatomy (50 points)
- **You must write down your results and answers in the ANSWER SHEET. Answers written in the Question Paper will not be evaluated.**
- Please make sure that you have received all the materials and equipment listed for each task. If any of these items are missing, please raise your hand.
- At the end of the test, put the Answer Sheet and Question Paper in the envelope. The supervisor will collect this envelope.

Good Luck!!

Task 1 (50 points)

Animal Anatomy

<u>Materials and Equipment</u>	Quantity
1. Vessel containing two caterpillars anesthetized	1
2. Vessel containing one caterpillar non-anesthetized	1
3. Dissecting plate	1
4. Forceps	2
5. Scissors	1
6. Disposable pipette	1
7. Dissecting needle equipped with holder	2
8. Dissecting pins	20
9. Compound binocular microscope (equipped with illuminator)	1
10. Set of color pencils: one “O” (orange), one “B” (blue), and one “G” (green)	1
11. Photo of a dissected caterpillar (included in your envelope)	1
12. A Petri dish for discarding dissected larva	1

Introduction

Even in insects which undergo complete metamorphosis, the body structure of the adult and larva are basically common. After closely observing a non-anesthetized caterpillar and dissecting and closely observing anesthetized caterpillars or moth (*Bombyx mori* Linné) larvae (silk worm), answer the following questions. When you dissect the caterpillars, do it in

the dissecting plate filled with water, using suitable equipments such as forceps, scissors, dissecting needle with holder, dissecting pins.

Q.1.1. (1 point × 2 = 2 points) The insect body is composed of three regions, the head, thorax and abdomen. Show the boundary between the head and thorax by drawing an orange line with orange color pencil “O” and the boundary between the thorax and abdomen by drawing a blue line with blue color pencil “B” on the photo of the caterpillar in the Answer Sheet.

Q.1.2. (3 points) On each side of the caterpillar’s head, you will find an eye patch. How many small eyes are in the eye patch of one side of the caterpillar head in front of you? Answer using numerals.

Q.1.3. (3 points) Insects breathe by means of a tracheal system, with external openings called spiracles. How many pairs of spiracles do the caterpillars in front of you have? Answer using numerals.

Q.1.4. (6 points + [2+2] × 3 points = 18 points) The photo in your envelope shows a dorsal view of a dissected caterpillar. Dissect an anesthetized caterpillar by yourself **exactly as shown in photo**. (You may use the second caterpillar if required) When you have finished the dissection, call your assistant by raising your hand. Your assistant will take a photograph of your specimen for evaluation (**6 points**). *You should check the photograph of your dissected specimen after it has been taken.*

Closely observe the internal structures of the caterpillar, focusing on where the tubular structures A, B and C arise. Answer the name and function of each of the tubular structures A, B and C by choosing the appropriate answer for the name from numerals 1-10 and function from the alphabet a-j.

Names 1: salivary gland; 2: oviduct; 3: malpighian tubule; 4: appendix;
 5: trachea; 6: prothoracic gland; 7: silk gland; 8: corpora allata;
 9: fat body; 10: seminal duct

Functions a: secretion of juvenile hormone; b: support of digestion;
 c: respiration; d: secretion of silk; e: secretion of prothoracic hormone;
 f: restoration of fat; g: excretion; h: transport of egg;
 i: transport of sperm; j: secretion of saliva

Q.1.5. (2 points × 3 = 6 points) The insect body contains different kinds of internal organ systems. Closely observing non-anesthetized and dissected caterpillars, show the positions of the central nervous system, digestive system (gut) and circulatory system (heart), by drawing them into the image of the caterpillar prepared in the Answer Sheet using the colors as indicated below.

Central nervous system - orange color pencil “O”

Digestive system - blue one “B”

Circulatory system - green one “G”.

Notice: If you can show the positions of the systems in the image of the caterpillar, there is no need to copy their exact shapes: however, in drawing the digestive systems, you should clearly show both ends.

Q.1.6. (4 points) The central nervous system of insects is composed of the aggregations of cell bodies or the ganglia and the bundles of nerve fibers or the nerve cords connecting ganglia. How many ganglia does the dissected caterpillar have? Answer using numerals.

Q.1.7. (4 points × 3 = 12 points) Show the positions of the anteriormost, anterior-second and posteriormost ganglia by drawing arrows and labeling with “A” for anteriormost, “2” for anterior – second and “P” for posteriormost with black pencil in the image of the caterpillar used in **Q.1.5**.

Q.1.8. (2 points) How many nerve cords are there between each pair of ganglia? Answer using numerals, choosing the correct number from 1 to 4.

Task 2 (50 points)

Plant Anatomy

In this task, fruit and flower morphology are examined and the developmental process is studied.

Part A Seed morphology and reserve substances

<u>Materials and equipment</u>	Quantity
1. Petri dishes containing seeds labeled I to IV	4
2. Compound binocular microscope (used in Task 1)	1
3. Forceps (used in Task 1)	2
4. Knife	1
5. Scalpel	1
6. Bottles of staining and rinsing solutions (IKI, IKI-R, CBB, CBB-R, OR, OR-R)	6
7. Small Petri dishes for staining	12

Introduction

Morphology and reserve substances vary across plant species. Reserve substances can be distinguished by staining.

Q.2.A.1. (27 points)

There are 4 kinds of seed (I to IV) in Petri dishes. The seeds labeled IV are *Vigna angularis*, a kind of legume which are given as an example. The seeds have been soaked for 24 hours. From some seeds, the seed coat was removed. Dissect the seeds using scalpel or knife, and stain each of them and their sections separately using all three staining solutions. Then, observe the stained seed samples including the sections of tissues under the stereomicroscope, and examine the degree of staining. Look at the samples carefully and fill the degree of staining in the Box of Q.2.A.1. in the answer sheet using the following symbols: “±” for weak staining, “+” for medium staining, “++” for strong staining. Use “-” for samples not stained, and “N” for seeds which do not have the indicated tissue..

Caution

- Some seeds are potential allergens. Wear gloves and do not touch them with your bare hands.
- Do not allow the staining solutions to contact your skin. If they touch your skin, rinse the area thoroughly with distilled water.

Staining and rinsing solutions:

Staining solution	Rinsing solution	Stain for	Color	Property
IKI	IKI-R	Starch	Purple	Aqueous solution
CBB	CBB-R	Protein	Blue	Contain ethanol and acetic acid
OR	OR-R	Lipid	Red	Contain ethanol

Staining method:

- Use small Petri dishes for staining and rinsing.
- Stain for 5 to 10 minutes in staining solution.
- Then, rinse the specimens well with rinsing solution.

Part B Development of fruits

Materials and equipment

1. Tomato fruits labeled (A)	3
2. An apple fruit labeled (B)	1
3. Drawings of flowers labeled (I and II) and strawberry fruits (included in your envelope)	1
4. Forceps (used in Task 1)	2
5. Knife	1
6. Colored pencils (orange (O), blue (B), green (G)) (used in Task 1)	3
7. White tray	1

Introduction

A fruit may develop from some part of a single flower. Therefore, the morphological features of a fruit are closely related to those of its flower.

Q.2.B.1. (4 points)

There are fruits of tomato (A) and apple (B). Cut the fruits transversely and vertically on a paper towel in the white tray. Compare the fruits and flower drawings (I and II).

Enter the number of the flower (I or II) that corresponds to each fruits (A, B) in the Box of Q.2.B.1. in the Answer Sheet.

Q.2.B.2. (11 points)

Using a black pencil, draw and indicate ovules (or seeds), carpels (and/or tissue derived from carpel), and sepals on the vertical illustrations of the fruits (A1 and B1) of Q.2.B.2. in the

Answer Sheet. Then, color the following tissues on the same fruit drawings (A1 and B1) in the colors designated. Refer to the strawberry drawings.

Ovule (or seeds): color pencil O (orange)

Carpels (and/or tissue derived from carpel): color pencil G (green)

Sepals: color pencil B (blue)

Q.2.B.3. (8 points)

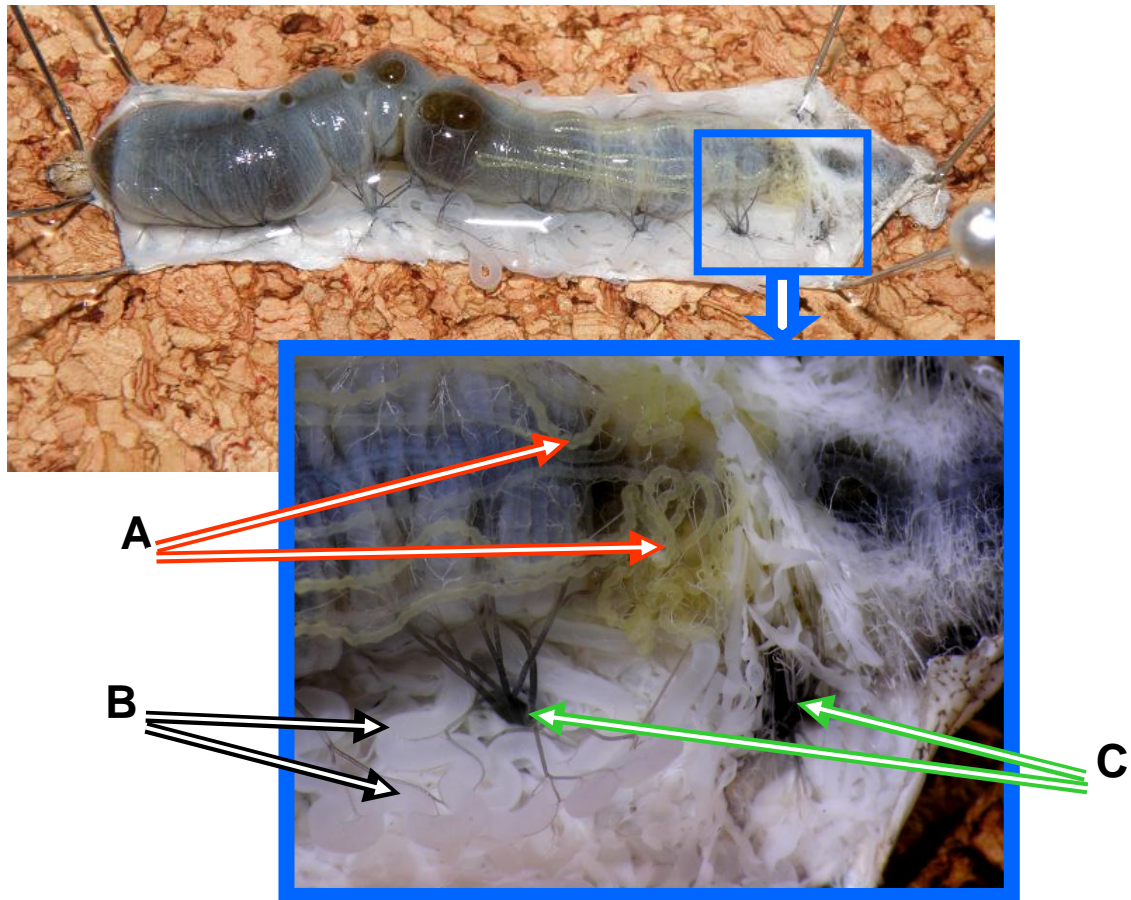
Complete the drawings of the transverse illustrations of the fruits (A2 and B2) of Q.2.B.3. in the Answer Sheet. Draw additional lines and color the ovules (or seeds) and carpels (and/or tissue derived from carpel) in the colors designated.

Ovule (or seeds): color pencil O (orange)

Carpels (and/or tissue derived from carpel): color pencil G (green)

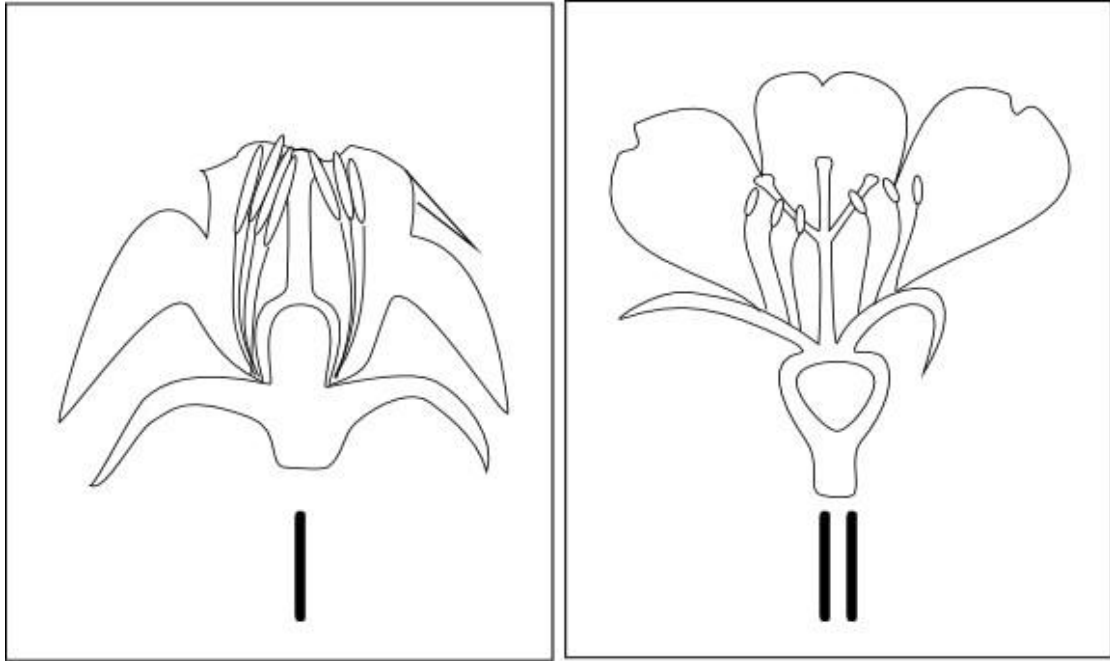
Task 1

Photo of dissected caterpillar, dorsal view



Task 2

Flowers I and II



Sample drawings of a strawberry

