

Country \_\_\_\_\_

Competitor# \_\_\_\_\_



## **16<sup>th</sup> International Biology Olympiad**

**Beijing**

**July, 2005**

### **Practical Examination**

#### **Part IV**

Total time available: 90 minutes

## The 16<sup>th</sup> IBO Practical Tests

**First name: Last name Country:**

**Code: Important:**

1. Write your name and code on both task paper and answer paper sheets.
2. Make sure that all the results should be written on the answer paper unless otherwise instructed.
3. There are 4 parts in practical test. Each part has 90 min. You should start your **first** test according to last digit of your competitor code. For example, if you have a code of 221, your first practical test will be part I, if you have a code of 223, your first practical test will be part **III**.
4. Your **second** practical test is as follows: competitors from part I and part II exchange labs; competitors from part III and part IV exchange labs;
5. You go to your **third** practical test according to the following rules:  
  
If the last digit of your competitor code is 1, you go to practical test part III. If the last digit of your competitor code is 2, you go to practical test part IV. If the last digit of your competitor code is 3, you go to practical test part I. If the last digit of your competitor code is 4, you go to practical test part II. You should follow the instructions from your guides when switching labs.

## Practical Test, Part IV

### Plant Biology

#### Task 1. Plant anatomy and physiology (20 points)

##### Materials and tools

You are provided with a set of tools and experimental materials. You will need to use other tools and instruments, including stereoscope, microscope, Petri dishes, forceps, slides, slide covers, and filter paper. You are provided with a Petri dish containing an aquatic plant.

##### Finish the following tasks.

- (1) Observe the plant with stereoscopy first and answer questions 1 through 3.
- (2) Take one plant and put it on a slide, cut some roots off and put them on another slide and cover the slide with a cover slid. Press the cover slightly and observe the slide under microscope. Answer questions 4 and 5.
- (3) Take one plant and put it on a slide, cut a leaf and put it on another slide. Cover it with a slide cover and press it gently. Observe the specimen you made and answer questions 6 through 8.

Questions 1 -3 are about external description of the plant. 1.

The stem of the plant is: (2 points)

- A. Vertical
- B. Horizontal
- C. Rosulate
- D. Acaulescent (no stem)

2. Which of the following description about its root is correct? (2 points)

- A. It contains chlorophyll
- B. It is a adventitious root
- C. It is a rhizoid
- D. It is a spindle-shaped root.

3. Which of the following description on its leaves is/are correct? (2 points)

- (1) The leaves don't have petiolules.
- (2) Their leaves are bipinnate.
- (3) Some leaves don't have chlorophylls
- (4) There are needle-shaped leaves.

- A. 1,2,3,4
- B. 1,2
- C. 1,3
- D. 2,4
- E. 1,2,3

Questions 4-5

4. Which of the following is correct? (2 points)
- A. This plant is a vascular plant
  - B. This plant contains vessels
  - C. This plant is bryophyte based on its root structure.
  - D. None of the above is correct.
5. A researcher grew the plant for many generations and found that no seeds were produced. Which of the following could be true based on your observation? (2 points)
- (1) The researcher could have missed the seeds produced.
  - (2) This plant is a seedless plant.
  - (3) This type of plants does not have sexual reproduction.
- A. 1,2,3
  - B. 1,3
  - C. 1,2
  - D. 2,
  - E. 3

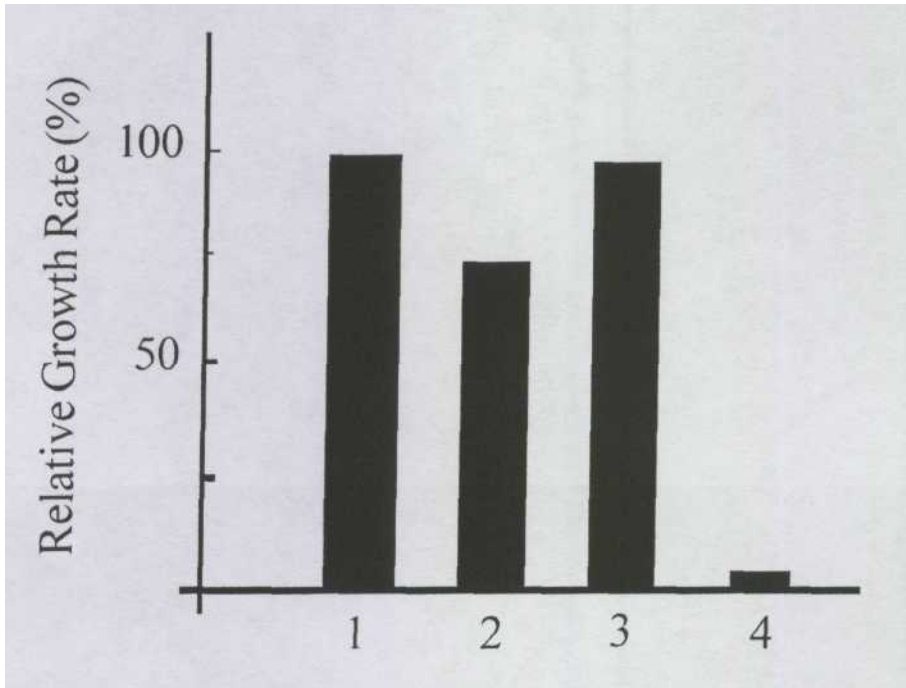
Questions 6-8.

6. Besides the plant tissues and cells, you should be able to observe some other immobile cells. Which of the following descriptions is/are correct about these cells? (2 points)

- (1) They are unicellular.
- (2) They are mostly short non-branched filaments.
- (3) Some of them are branched.
- (4) Their nuclei are easily observed.

- A. 1,
- B. 1,2,3,4
- C. 2,3
- D. 2,3,4
- E. 2

7. A researcher grew the plants under different conditions and obtained results shown in the figure below.



Condition 1, grown with medium A containing combined nitrogen (nitrate).

The growth rate under this condition was used as 100% growth.

Condition 2, grown with medium A without combined nitrogen. Condition 3, grown with medium A containing combined nitrogen.

Ampicillin was added to a concentration of 5  $\mu$ M.

Condition 4, grown with medium A without combined nitrogen. Ampicillin was added to a concentration of 5  $\mu$ M.

**Note, medium A is the standard medium for this plant.**

Which of the following statements is/are correct? (4 points)

- (1) Ampicillin is inhibitory to plant growth only under nitrogen limiting condition.

- (2) The plant can grow without combined nitrogen.
- (3) The root system of this plant could fix nitrogen.
- (4) There are at least some microorganisms associated with the plant and they can fix nitrogen.
- (5) Nitrogenase activity is directly inhibited by Ampicillin.

- A. 1,3,5
- B. 1,5
- C. 2,
- D. 4
- E. 4,5

8. If you would like to obtain a culture of the plant that does not contain any associated organisms, what is the condition to achieve it? (4 points)

- A. Grow it with combined nitrogen plus some ampicillin.
- B. Grow it with combined nitrogen.
- C. Grow it without combined nitrogen.
- D. Grow it without combined nitrogen plus ampicillin.



## **Task 2 Plant pigment characterization (20 points)**

### **Materials and tools**

You are provided with 6 tubes of pigments, labeled pigment I through pigment VI.

You are also provided with a colorless solution in another tube labeled as control. You

will need to use the following instruments: Adjustable Spectrophotometer; Cuvette

cells; Adjustable pippetes; Filter paper;

Perform the following tasks:

- a. Exam the absorption spectra shown in the figure below. The five absorption spectra are obtained from different organisms and the pigment names are given in the figure. The major absorptions of these spectra are given. Among the five pigments in the figure, phycocyanin and phycoerythrin are water-soluble; chlorophyll and carotene are soluble in organic solvents; chlorophyll-protein complexes are soluble in aqueous solution when treated with detergent, b. Use the adjustable pippete to transfer 1 ml of each pigment solution to cuvette cells.

Measure the absorptions at the wavelengths in the table below. Record the results of your measurements in the table.

