

APPENDIX II

Basic Skills for the Practical Part of the IBO

The IBO practical examination should concentrate on the evaluation of competitors for their ability to solve given biological problems using the following skills.

In the IBO tasks the names of organisms will be the national names (no description) together with the scientific names (Latin) in brackets. Any description instead of name is prohibited. The organizers should construct the questions so that the name of the organism is not a key element for answering; otherwise they should use very well known organisms (general representatives of a group) mentioned in the list for biosystematics.

I Science Process skills

- 1 Observation
- 2 Measurement
- 3 Grouping or classification
- 4 Relationship finding
- 5 Calculation
- 6 Data organization and presentation: graphs, tables, charts, diagrams, photographs
- 7 Prediction / projection
- 8 Hypothesis formulation
- 9 Operational definition: scope, condition, assumption
- 10 Variable identification and control
- 11 Experimentation: experimental design, experimenting, result/data recording, result interpretation and drawing conclusions.
- 12 Representing numerical results with appropriate accuracy (correct number of digits)

II Basic biological skills

- 1 Observation of biological objects using magnifying glasses
- 2 Work with a microscope (objective max. 45 x)
- 3 Work with a stereomicroscope
- 4 Drawing of preparations (from a microscope, etc.)
- 5 Exact description of a biological drawing using tables of biological terms marked with a numerical code

III Biological methods

Competitors in the IBO should know the following methods and be able to use them. If any method requires extra specific information concerning procedures that depend on special technical equipment, instruction will have to be provided.

A Cytological methods

- 1 Maceration and squash technique
- 2 Smear method
- 3 Staining of cells and slide preparation

B Methods to study plant anatomy and physiology

- 1 Dissection of plant flower and deduction of flower formula
- 2 Dissection of other plant parts: roots, stems, leaves, fruits
- 3 Free - hand sectioning of stems, leaves, roots
- 4 Staining (for example lignin) and slide preparation of plant tissues
- 5 Elementary measurement of photosynthesis
- 6 Measurement of transpiration

C Methods to study animal anatomy and physiology

- 1 Dissection of invertebrates.
Dissection of fish or parts or organs from vertebrates bred for the consumption is allowed, too.
Animals being used, as dissection material should be dead before being submitted to the students.
- 2 Whole - mount slide preparation of small invertebrates
- 3 Elementary measurement of respiration

D Ethological methods

- 1 Determination and interpretation of animal behaviour

E Ecological and environmental methods

- 1 Estimation of population density
- 2 Estimation of biomass
- 3 Elementary estimation of water quality
- 4 Elementary estimation of air quality

F Taxonomic methods

- 1 Use of dichotomous keys
- 2 Construction of simple dichotomous keys
- 3 Identification of the most common flowering-plant families
- 4 Identification of insect orders
- 5 Identification of phyla and classes of other organisms

IV Physical and chemical methods

- 1 Separation techniques: chromatography, filtration, centrifugation
- 2 Standard tests for monosaccharides, polysaccharides, lipids, protein (Fehling, I_2 in $KI(aq)$, biuret)
- 3 Titration
- 4 Measuring quantities by drip and strip methods
- 5 Dilution methods
- 6 Pipetting, including use of micropipettes
- 7 Microscopy, including use of counting chambers
- 8 Determination of absorption of light
- 9 Gel electrophoresis

V Microbiological methods

- 1 Preparing nutrient media
- 2 Aseptic techniques (flaming and heating glass material)
- 3 Inoculation techniques

VI Statistical methods

- 1 Probability and probability distributions
- 2 Application of mean, median, percentage, variance, standard deviation, standard error, T test, chi-square test

VII Handling equipment

Due to differences in the equipment between IBO member countries, these skills can only be evaluated if the competitors have been informed beforehand about the algorithm, how to use the equipment, how to proceed with a particular experiment...