33rd
INTERNATIONAL
PHYSICS OLYMPIAD
2002
BALI - INDONESIA

EXPERIMENTAL COMPETITION

Thursday, July 25th, 2002

Please read this first:

1. The time available is 5 hours for the experimental competition
2. Use only the pen provided
3. Use only the front side of the paper
4. Begin each part of the problem on a separate sheet
5. For each question, in addition to the ***answer sheets*** where you may write, there is an ***answer form*** where you *must* summarize the results you have obtained. Numerical results should be written with as many digits as are appropriate to the given data.
6. Write on the blank sheet of paper the results of all your measurements and whatever else you consider is required for the solution of question. Please use ***as little text as possible***; express yourself primarily in equations, numbers, figures, and plots.
7. Fill in the boxes at the top of each sheet of paper used by writing your ***Country***, your student number (***Student No.***), the number of the question (***Question No.***), the progressive number of each sheet (***Page No.***), and the total number of blank sheets used for each question (***Total Pages***). Write the question number and the section letter of the part you are answering at the top of each sheet. If you use some blank sheets of paper for notes that you do not wish to be marked, put a large X across the sheet and do not include it in your numbering.
8. At the end of the exam, arrange all sheets for each problem *in the following order*:
   - Answer form
   - Used sheets in order
   - The sheets you do not wish to be marked
   - Unused sheets and the printed question

   Place the paper inside the envelope and leave everything on your desk. You are not allowed to take any sheets of paper and any material used in experiment out of the room .
9. Note that all scales marked on the graph papers and the apparatus for the experiments (e.g. the test tube) are of the same scale unit, but ***not calibrated*** in milimeter.

10. Beware the time consuming process of electrolytic experiment. You are allowed to perform the two problems (problem I and problem II) in any order, even simultaneously.

Use the following symbols in your answer

acceleration of gravity	g	*absolute temperature*	T
gas pressure	P	*frequency*	f
angular frequency	ω	*periodicity of oscilation*	T_{osc}
Height	h	*velocity of light*	c
wavelength	λ	*refractive index*	n
Mass	m	*gas constant*	R
mechanical work	W	*length*	l
Diameter	d	*electric current*	I
electric charge	q	*electron charge*	e
Boltzmann constant	k_B	*radius*	r
volume of gas	V_g	*voltage*	V