Physical Chemistry Laboratory II

Description of contents

1. Study of an oscillating reaction: the Belousov-Zhabotinskii reaction.
2. **Potentiometric and Voltammetric Study of the Ferricyanide/Ferrocyanide Redox Couple in Aqueous Solution of Potassium Chloride.**
3. **Fluorescence spectroscopy. A study on the effect of the molecular structure on the fluorescent capacity of dyes, and the energy transfer of excited riboflavin molecules.**
4. **Determination of the Surface Tension of Hydroethanolic Mixtures by the Du Nouy Method.**
5. **Kinetic Study of the Photochemical Oxidation of Triphenylphosphine.**
6. **Kinetic theory of gases. Part I. Gas viscosity: Estimation of molecular diameter. Part II. Determination of molecular mass using the ideal gas law.**
7. **Quantum-Chemical calculations. I. Geometric and electronic structure. II. Electronic spectra.**
8. Study of electronic systems with the Hückel method.
9. Molecular modeling: structure and reactivity.
10. The Parker actinometer.

General objectives and working model

Note: The general objectives and the evaluation method of the subject “Physical chemistry laboratory II” of the Chemistry degree can be found in the course guide available in the AV (virtual classroom).

General objectives: The objective of the course is to provide the student with training in:

- The use of instruments and equipment found in a Physical Chemistry laboratory.
- The carrying out of experiments in some of the most important areas of Physical Chemistry.
- The analysis of the results obtained with the deduction of logical conclusions based on the concepts acquired.
- The elaboration of a laboratory notebook, as well as the writing of laboratory reports.

Operational model and calendar: Student attendance to all sessions is mandatory.

General warnings and cleaning in the laboratory:

- Both at the beginning and at the end of the laboratory session, each student must verify that they have all the necessary material to carry out the practical. If this is not the case, they should inform the corresponding teacher.
- The teacher should be informed immediately of the breakage of any type of laboratory material for him/her to replace it.
- It is strictly forbidden to remove material from the laboratory.
- Laboratory work requires scrupulous cleaning of both the material used and the workbench. The material must be cleaned before use and immediately after each operation.
- At the end of each laboratory session, the student has to clean their workbench. The rubber pipette bulbs must be left full of air and never connected to the pipette. The burettes, after cleaning, should be left in the burette stand placed face down and with the key open. The student must check that all devices are disconnected. In the case of thermostatic baths used in practicals that need overnight incubation, the student should verify that the water level in the bath is adequate. The baths are always filled with deionized water.
- The scales, after each weighing, have to be cleaned and tared to zero.
- Concentrated acids must always be handled in the fume hood. If they spill, the teacher responsible must be notified immediately.
- Water is a scarce asset, unnecessary waste must be avoided.
- Mobile phones must be disconnected in the laboratory.

Material needed: The student has to go to the laboratory with a laboratory coat, gloves, safety glasses, glass marker, and a notebook (never loose sheets) which will be used as a laboratory diary. Preferably, the notebook should have 80+ sheets of A4 size squared paper.

Laboratory diary

Each student must keep a diary in which they write down all the work done during the laboratory session. This notebook will be the basis, together with the outline of the practical, for the preparation of the practical report. Therefore, it is important to make detailed and organized notes.

For each of the practicals carried out, the laboratory diary must include:

1. Title and date of completion.

2. Objectives of the practical.

3. Brief theoretical introduction.

4. Scheme of the experimental procedure.

5. Preliminary questions.

6. Experimental procedure. The procedure followed should be explained in detail, in such a way that someone else could repeat the experiment.

7. Results:

a. Experimental laboratory conditions.
b. Experimental data. They should be presented in an orderly manner and, whenever possible, in numbered and titled tables indicating the quantities they contain and their units. The figures should have a footnote indicating what they represent and their units.
c. Incidents that have occurred in the practical.
d. Calculations necessary to achieve the objectives of the practical that will be briefly explained.

8. At the end of each practical you must indicate the data obtained (objective of the practice) expressed correctly with units, errors (when possible) and a brief discussion.

9. Post-laboratory questions.

The notebook will be available to the teacher for periodic review and evaluation. Therefore, it is important that the student keep the notebook up to date in chronological order.

Laboratory reports

Each student must prepare a report of the practicals indicated by the teacher responsible. The structure of the report is detailed in the attached PDF file.

Course Evaluation

The overall evaluation will be carried out according to the following criteria:

1. Continuous evaluation of each student, based on classroom activities, participation and degree of involvement in the teaching-learning process during the laboratory sessions: attitude, skills acquired, and laboratory notebook: 30% of the overall mark.

2. Theoretical-practical tests consisting of oral and/or written examinations which shall include both theoretical and practical questions and problems: 40% of the overall mark.

3. Presentation of the results: reports, and/or oral communication: 30% of the overall mark.

To pass the course the student must obtain a minimum of 5.0 for the overall mark; in addition, the student must achieve a minimum mark of 4.0 out of 10 in each part.