UCLouvain

lphys1114

2022

Thermodynamics

5.00 credits	22.5 h + 20.0 h	Q2

Teacher(s)	Fichefet Thierry ;
Language :	French
Place of the course	Louvain-la-Neuve
Main themes	The basic notions of thermodynamics are then introduced. The concepts of thermodynamic state, pressure and temperature are defined. Internal energy and the first principle of thermodynamics as well as entropy and the second principle of thermodynamics are then presented. Equilibrium conditions and applications (including cycles and thermal machines) are studied. Finally, we describe the kinetic theory of gases, the macroscopic properties of perfect gases and the phase changes of pure bodies. In addition, during the semester, a conference on recent physics news in relation to the teaching unit is organized. The participation of students to this conference is mandatory.
Learning outcomes	**At the end of this learning unit, the student is able to :** 1. **Contribution of the teaching unit to the learning outcomes of the programme** 1.1, 1.3, 1.4, 1.5, 1.6, 2.1, 2.2, 2.4, 3.1, 3.2, 3.3, 3.4, 3.5, 3.6, 4.3, 6.4 1. **Specific learning outcomes of the teaching unit** At the end of this teaching unit, the student will be able to : • describe and interpret the concepts and basic laws of thermodynamics, in particular the first and second principles ; • apply the fundamental laws of thermodynamics to simple cases, standard thermal machines and real-life examples ; • interpret transformations involving mass and energy exchanges via the fundamental laws of thermodynamics ; • describe and apply the kinetic theory of gases ; • discuss the main processes associated with changes of state of a pure body ; • relate the concepts developed in thermodynamics to those covered in other teaching units ; • use experimental devices specific to thermodynamics, carry out measurements and make physical interpretations.
Evaluation methods	The entrance test to laboratory and the laboratory report count for 10% of the final mark. This part of the mark will be used for each session and cannot be updated. The exam is written, lasts three hours and counts for 90% of the final mark. The exam includes two problems similar to those solved in the guided exercise sessions, for which full details of the solution are required, and one question that aims to check that the concepts and developments presented during the theoretical course have well been mastered (demonstration or application of laws or formulas). All the subjects addressed during the theoretical lessons and the guided exercise sessions must be known for the exam. No formula book will be made available to students. It is essential to bring a simple scientific calculator to the exam. The modalities mentioned above are valid whatever the exam session. If the sanitary conditions deteriorate, the modalities of teaching and examination will be reassessed according to the situation and the rules in force.

Teaching methods	The teaching activities include (1) the theoretical course (9 sessions of 2 hours each), (2) the guided exercises (8 sessions of 2 hours each), (3) a practical laboratory work (1 sessions of 2 hours), (4) the tutorial and (5) a conference of 2 hours on the importance of thermodynamics in meteorology-climatology. It is essential to have a simple scientific calculator for the guided exercise sessions and the practical laboratory work. The different subjects are presented in the theoretical course via slides and blackboard notes. The fundamental concepts are illustrated using applications from modern life, short films or animations, and experiments. The guided exercises play an essential role in the comprehension of the theoretical course and allow the application of the studied theoretical concepts to real problems. The list of problems to be solved during an exercise session and a list of additional problems are posted on the LPHYS1114 MoodleUCLouvain website approximately one week prior to the exercise session. Preparation of the problems to be solved is crucial. Participation in the practical laboratory session is mandatory. A description of the tasks to be carried out in the laboratory is posted on the LPHYS1114 MoodleUCLouvain website about one week prior to the session. It is essential that this description be read carefully and the online test be performed to access the session. This test is open to participation on the Thursday before the session. Access to the laboratory is not conditional on succeeding this test, but the test must be performed in order to access the session. A laboratory report must be written and submitted at the end of the session. This report is evaluated. A tutorial, during which the students may ask their questions to the teaching team, is held every two weeks. The best approach is to work consistently throughout the semester. In particular, it is essential that students regularly solve the exercises themselves, and do not simply read the solutions.
Content	1. Fundamental notions 2. Work and heat 3. Internal energy and the first law 4. Perfect and real gases: microscopic approach 5. Entropy and the second law 6. Thermodynamic potentials and functions 7. Phase changes of a pure body 8. Thermal machines
Inline resources	The slides and the short films or animations projected during the theoritical course and the conference, the list of exercises to be solved, the supports for practical laboratory work and other useful documents are made available to students on the LPHYS1114 MoodleUCLouvain website.
Faculty or entity in charge	PHYS

Programmes containing this learning unit (UE)				
Program title	Acronym	Credits	Prerequisite	Learning outcomes
Minor in Physics	MINPHYS	5		🔍
Bachelor in Physics	PHYS1BA	5		🔍