T3_40 DAMPING OF THE OSCILLATIONS AND EQUILIBRIUM OF SPRING-MASS SYSTEMS DUE TO DIFFERENT FRICTIONAL FORCES

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Friction phenomena are everywhere around us and allow life as we know it. However in standard high-school physics courses not enough attention is devolved to friction phenomena both from a qualitative and a quantitative point of view. In this talk we discuss how different kind of friction can have significant effects on the periodic motion of a spring mass system both in air and on a plan. Usually damped oscillations are presented with resistance proportional to velocity which yields an exponential decay in amplitude. Sometimes dynamic friction force is taken into account resulting in linear amplitude decay. Rarely the contribution of static friction force and its role in determining the final position of the system is considered. Here we discuss at first how students can explore experimentally physical situations where the frictional force and periodical motions are involved. Some experiments about sliding and others about viscous friction are proposed to motivate students obtain quantitative relations in the form of phenomenological laws. The experiments require real-time microcomputer-based laboratory tools readily available in a well-equipped teaching laboratory and are focused both on the damping of the oscillations and on the final positions. A teaching learning sequence based on these experiments has been tested with high school students and teachers following a course of specialization. A second purpose of the present work is to report an accurate theoretical and numerical study of damped harmonic oscillations (i.e. a common spring-mass system out of its equilibrium in the presence of both static and sliding friction). Care will be reserved in evaluating the role of static friction to determine the final mass position. Finally theoretical, numerical and experimental results comparison is reported and discussed.