1. Measuring the Earth's magnetic field in a laboratory

A Cartacci and S Straulino
Dipartimento di Fisica dell'Universit`a di Firenze—Via G Sansone, 1 50019 Sesto Fiorentino,Italy
E-mail: anna.cartacci@fi.infn.it

416 PHYSICS EDUCATION July2008

Abstract
Two methods for measuring the Earth's magnetic field are described. In theformer, according to Gauss, the Earth's magnetic field is compared with thatof a permanent magnet; in the latter, a well-known method, the comparison ismade with the magnetic field generated by a current. As all the usedinstruments are available off the shelf, both methods are cheap. With someattention to the procedure, both methods give accurate results.

2. The coefficient of friction, particularly of ice

Allan Mills
Department of Physics and Astronomy, University of Leicester, Leicester LE1 7RH, UK
E-mail: am41@le.ac.uk

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Abstract
The static and dynamic coefficients of friction are defined, and values from 0.3 to 0.6 are quoted for common materials. These drop to about 0.15 when oil is added as a lubricant. Water ice at temperatures not far below 0 ◦Cis remarkable for low coefficients of around 0.05 for static friction and 0.04–0.02 for dynamic friction, but these figures increase as the temperature diminishes. Reasons for the slipperiness of ice are summarized, but they are still not entirely clear. One hypothesis suggests that it is related to the transient formation of a lubricating film of liquid water produced by frictional heating. If this is the case, some composition melting a little above ambient temperatures might provide a skating rink that did not require expensive refrigeration. Various compositions have been tested, but an entirely satisfactory material has yet to be found

3. The physics of ice sheets

J N Bassis
Scripps Institution of Oceanography, University of California, San Diego, La Jolla, CA, USA and Department of the Geosciences, University of Chicago, Chicago, IL, USA

382 PHYSICS EDUCATION July2008

Abstract
The great ice sheets in Antarctica and Greenland are vast deposits of frozen freshwater that contain enough to raise sea level by approximately 70 m if they were to completely melt. Because of the potentially catastrophic impact that ice sheets can have, it is important that we that we understand how ice sheets have responded to past climate changes and will respond to present climate changes, so can predict the effect global warming will have on sea level rise in the coming centuries. The purpose of this article is to introduce students to some of the basic concepts of glaciology, the physical variables that control the evolution of ice sheets, and how changes in these parameters may affect the long-term evolution of ice sheets.

4. Hands-on force spectroscopy: weird springs and protein folding

Manfred Euler
Leibniz-Institute for Science Education (IPN), Universitat Kiel, Olshausenstraße 62, 24098 Kiel, Fed. Rep. Germany
E-mail: euler@ipn.uni-kiel.de

308 PHYSICS EDUCATION May2008

Abstract
A force spectroscopy model experiment is presented using a low-cost tensile apparatus described earlier. Force–extension measurements of twisted rubber bands are obtained. They exhibit a complex

nonlinear elastic behaviour that resembles atomic force spectroscopy investigations of molecules of titin, a muscle protein. The model experiments open up intriguing possibilities to stimulate insight into entropy-driven self-organization of soft biological matter at the nanometre scale and into protein folding by hands-on experience and analogical transfer.

5. Measurement of g by means of the 'improper' use of sound card software: a multipurpose experiment

SGanci
Museo di Fisica e Meteo-sismologia 'G Sanguineti–G Leonardini', Piazza N S dell'Orto, 8 16043 Chiavari (GE), Italy
300 PHYSICS EDUCATION May2008
Abstract
A well-known experiment for the measurement of the acceleration of gravity is carried out on a personal computer using standard software for a sound card in a non-canonical way, which provides an improved, more accurate, result and is a useful teaching method for a traditional classroom experiment

6. The jumping ring and Lenz's law—an analysis

J M Bostock-Smith
Kesgrave High School, Main Road, Ipswich IP5 7RE, UK
E-mail: bostocksmith@btinternet.com
May2008PHYSICS EDUCATION 269
Abstract
Lenz's law is sometimes invoked to explain the behaviour of the jumping, or levitating, ring. This is shown to be incomplete, and an alternative explanation using Faraday's laws and circuit analysis is offered. This leads to the choice of optimum material and dimensions for the ring.

7. Balancing beams—for a few moments

Bob Kibble
School of Education, University of Edinburgh, Holyrood Road, Edinburgh EH8 8AQ, UK
E-mail: bobk@education.ed.ac.uk
May2008 PHYSICS EDUCATION 283
Abstract
A 2 m long wooden beam provides an ideal demonstration tool for exploring moments. A class set is cheap and can be used at introductory and advanced levels. This article explores how such beams can be used to support learning about moments, equilibrium, vectors, and simultaneous equations.

8. Acceleration in one, two, and three dimensions in launched roller coasters

Ann-Marie Pendrill
Department of Physics, G¨oteborg University, SE 412 96 G¨oteborg, Sweden
E-mail: Ann-Marie.Pendrill@physics.gu.se
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Abstract
During a roller coaster ride, the body experiences acceleration in three dimensions. An accelerometer can measure and provide a graph of the forces on the body during different parts of a ride. To couple the experience of the body to pictures of the ride and an analysis of data can contribute to a deeper understanding of Newton's laws. This article considers the physics of launched roller coasters. Measurements were performed with a three-dimensional co-moving accelerometer. An analysis is presented of the forces in the different ride elements of the Kanonen in G¨oteborg and the Speed Monster in Oslo, which both include loops and offer rich examples of force and acceleration in all dimensions.

9. The most dangerous point in a climb may be just after you start

Michael J O'Shea
Department of Physics, Kansas State University, Manhattan, KS 66506-2601, USA

E-mail: mjoshea@phys.ksu.edu
September 2008 PHYSICS EDUCATION 499
Abstract
If a climber who is on an overhead belay (attached to a climbing rope from above) slips and falls, the belay rope stretches as the fall is arrested. If this fall occurs from a point close to the ground it is possible that the belay rope may stretch sufficiently that the climber impacts the ground at the base of a climb. A simple model of the landing is used to determine the average force F exerted on the climber by the ground during the impact. The value of F exhibits a maximum as a function of climber fall height, and this maximum value can be large. For all reasonable climber masses m, the maximum value of F is proportional to m2. Slack or tension in the belay rope can change F, and we discuss these possibilities.

10. The physics of winning— engineering the world of sport

David James
Centre for Sport and Exercise Science, Sheffield Hallam University, Collegiate Crescent Campus, Sheffield S10 2BP, UK
September2008 PHYSICS EDUCATION 505
Abstract
Physics, engineering and technology increasingly play a critical role in many sports, enabling athletes to go the extra proverbial mile and surpass their own limits. However, it is not only the competitive elite who benefit from advances in equipment design; many sports have been made safer and more accessible through science and innovation. Clearly, discussion of such ideas will interest a number of students directly. In addition, the numbers given here could readily be used by students to test their understanding of basic physics using simple estimates.

11. Observation of planetary motion using a digital camera

Jan-Peter Meyn
Friedrich-Alexander-Universit¨at Erlangen-N¨urnberg, Physikalisches Institut, Didaktik der Physik, Staudtstraße 7, 91058 Erlangen, Germany
E-mail: jan-peter.meyn@physik.uni-erlangen.de
Abstract
A digital SLR camera with a standard lens (50 mm focal length, f/1.4) on a fixed tripod is used to obtain photographs of the sky which contain stars up to 8m apparent magnitude. The angle of view is large enough to ensure visual identification of the photograph with a large sky region in a stellar map. The resolution is sufficient to observe the motion of Saturn, and of the satellites of Jupiter, within 24 h.
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12. Leidenfrost point and estimate of the vapour layer thickness

Concetto Gianino
Istituto di Istruzione Secondaria ‘Q Cataudella’, Scicli (RG), Italy
November2008 PHYSICS EDUCATION 631
Abstract
In this article I describe an experiment involving the Leidenfrost phenomenon, which is the long lifetime of a water drop when it is deposited on a metal that is much hotter than the boiling point of water. The experiment was carried out with high-school students. The Leidenfrost point is measured and the heat laws are used to estimate the thickness of the vapour layer, d ≈0.06 mm, which prevents the drop from touching the hotplate.