



## **Lion Cub – a physics competition for junior high and high school students**

*Piotr Goldstein, Adam Smólski*

The Polish-Ukrainian Physics Competition “Lion Cub” stems from the Kangaroo Competition in mathematics.

Thousands of pupils who enjoyed the math contest encouraged Ukrainian physics teachers from Lvov to organize a similar competition in physics. The first round of the new competition took place in 2001 and it was a great success! Lions are the symbol of Lvov, so the name was born. In Poland a “Lion Cub” started in 2003. More than 21,000 students from 1300 schools took part in it in 2006.

The competition consists of 30 multiple-choice questions, which should be answered in 75 minutes. You have to hurry up: the problems are sometimes hard, often tricky, they rather refer to precise thinking than to acquired knowledge. The topics are not restricted to the typical school syllabus. Nevertheless the participants really enjoy the contest.

Let us look at a few examples

In the building of the Lion Cub Inc. Ltd. all lifts move with the same speed in shafts emptied of air. Sometimes the lifts break off and fall. Just now one of them is overtaking another one. Both of them broke off above, at the same height, either while standing on one of the floors or while uniformly moving between them. It is definitely true that

- A.** the overtaken lift broke off later than the overtaking one,
- B.** at the moment of the break off the overtaking lift was moving upwards,
- C.** at the moment of the break off the overtaking lift was standing at one of the floors,
- D.** at the moment of the break off the overtaking lift was moving downwards,
- E.** at the moment of the break off the overtaken lift was standing on one of the floors.

The correct answer is E, but in order to prove it we need detailed analysis of the answers A – D to decide that they are false.

There are also questions in which the incorrect answers (“distracters”) simulate common student mistakes:

The planets revolve around the Sun. What forces act on them, in an inertial frame of reference?

- A. Centripetal and centrifugal forces.
- B. The gravitational force from the Sun and other celestial bodies only.
- C. The friction force of cosmic ether.
- D. The gravitational force from the Sun and other celestial bodies as well as the centrifugal force.
- E. The gravitational force from the Sun and other celestial bodies and additionally the centripetal force.

And some of them attempt to confuse the student's mind:

A lift moves down with an acceleration  $a$ . A man in the lift drops a coin. What is the acceleration of the coin with respect to the Earth? Air resistance may be neglected.

- A.  $g + a$     B.  $g - a$     C.  $g$     D.  $a$     E. 0.

The competition selects a group of high-level students who understand physics deeply. But I hope that it is great fun also for the others and a low score is no shame. One can really learn a lot from the bare analysis of the problems.

