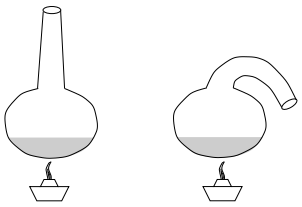
Eötvös 1999

1) A fighter plane flies horizontally above us at a height of 0.9 km. It is at a distance of 1 km from us when we first hear its sound. From what direction do we hear its sound when it is at a distance of 2 km from us?
2) The neck of one of two otherwise identical flasks is straight, that of the other one bends downwards. Identical quantities of

   a) water and
   b) ether

   are poured into the flasks, making sure that the temperature of the liquid is 100 ℃ in case a) and 34.6 C in case b). From which flask is the liquid first off in case a) and in case b)?



3) A long, thin, vertical glass tube is surrounded by a much thicker, coaxial glass tube of diameter D. There are closely spaced, short-circuited one-turn coils of resistance R each at distance h of each other on the thick tube.

   A small rod magnet of mass m and dipole momentum d is dropped into the thin tube; it reaches a constant speed V_0 after a relatively short time interval. How many times the original would the speed of the magnet be if

   a) the mass of the magnet,
   b) the dipole momentum of the magnet,
   c) the distance between the turns,
   d) the resistance of the turns,
   e) the diameter of the turns

   were changed to twice the original value without changing the other data? Mechanical friction, air resistance, the self- and mutual induction of the turns can be neglected.