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## NYU Physics I—Term Exam 5

**Problem 1:** When you weigh yourself on a scale, you weigh less than your gravitational force, because there is a buoyant-force correction. What fraction of your weight is this correction? That is, what is the buoyant force divided by the gravitational force, roughly? (from Problem Set 9)

**Problem 2:** A figure skater spins in place on frictionless ice at angular speed  $\omega_i$  with hands outstretched. The skater has a total moment of inertia  $I_i$ . As the skater draws his hands into his body, his moment of inertia decreases to  $I_f = I_i/2$ . Does the kinetic energy  $K$  increase, decrease, or stay the same? Assume that there are no torques acting. (from Problem Set 10)

**Problem 3:** Immediately after being hit by the cue, a cue ball slides along the felt in the  $x$  direction at speed  $v$ . Draw a free-body diagram for the cue ball, showing the forces acting, and clearly label the  $x$  direction. (from Problem Set 10)

**Problem 4:** What would be the length of an Earth year if the Earth was orbiting on a circular orbit of radius 0.25 AU (instead of 1 AU)? Give your answer in units of days. (from worksheet on orbits)

**Problem 5:** What is the relationship between linear acceleration  $a$  and angular acceleration  $\alpha$  when a ball of radius  $R$  is rolling without slipping down a plane? (from lecture 2018-11-08)

**Problem 6:** How is it that the astronauts in the Space Station are weightless? Write a grammatically correct answer in one sentence, in fewer than 20 words. Box your sentence! (from lecture 2018-11-15)