Dynamics II

1. What is the weight of ballast to be dropped from a uniformly descending balloon to enable it to rise with the same velocity? The balloon with the ballast weighs $Q = 1600kG$, and its lifting capacity (assumed to be constant) is $W = 1200kG$. The air resistance is the same during ascent and descent.

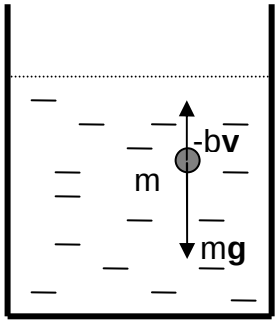
2. A load of mass $m = 1kg$ is suspended on a thread. Find the tension of the thread with the load if: a) it is lifted with an acceleration of $a = 5m/s^2$, b) it is lowered with the same acceleration $a = 5m/s^2$.

3. An automobile weighing $Q = 10^4 N$ is braked and stops after time $t_0 = 5s$, covering a distance $s = 25m$ in uniformly retarded motion. Find the initial speed of the automobile and the braking force.

4. A mass of $0.5kg$ undergoes a rectilinear motion. The relation between the distance *s* travelled by the mass and the time *t* is given as $s(t) = A - Bt + Ct^2 - Dt^3$, where $C = 5m/s^2$, and $D = 1m/s^3$. Determine the force which acts on the mass after the first second of its motion.

5. A body of mass *m* is subject to a constant force $\vec{F}_0$. Write down and solve the equations of motion.

6. Consider a sphere of mass *m* released from rest in a viscous liquid, as in fig.1. Assuming that the only forces acting on the body are the resistive force $-b\vec{v}$, and the weight $m\vec{g}$, describe the body's motion. Write the equation of motion and solve it.



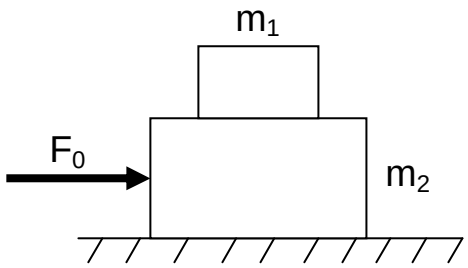
7. A braking force proportional to the velocity $F = -b\vec{v}$ is exerted on a body of mass *m*. Find the dependence of the velocity of the body as a function of time. What is the distance travelled by the mass until it stops?

8. A resultant force acting on a car of mass *m* changes in time according to the equation $F(t) = C \cdot t^2$, where *C* is a constant. How the velocity of the car will change in time?

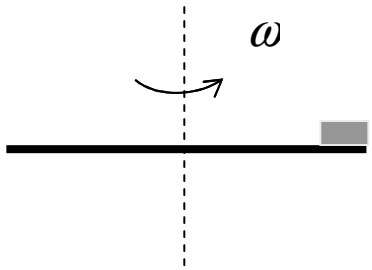
9. A body slides down along an inclined plane forming an angle α with the horizontal direction. The coefficient of friction μ depends on the distance s travelled by the body, $\mu(s) = b \cdot s$, where *b* is a positive constant. Find the way s_1 the body has moved until it comes to a rest. What is the maximal speed of the mass?

Dynamics II

10. A block of mass $m_1 = 2kg$ is placed on a block of mass $m_2 = 4kg$. The lower block is on a frictionless horizontal surface and is subject to a force $F_0 = 30N$ as shown in fig.2. Find the minimum value of the coefficient of friction such that m_1 does not slide on m_2.



11. .A small coin is placed at the rim of a turntable of radius 15 cm which rotates at 30 *rev/min (revolutions per minute).* Find the minimum coefficient of friction for the coin to stay on (fig.3.)



12. The rods of a centrifugal governor (fig.4) are 12.5 cm long. What number of revolutions per second does the governor make if during rotation the weights have deviated from the vertical direction through the angle $\alpha = 30^o$?