Physics Problems:– March-2011

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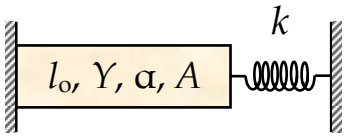
By Sanjeet Singh Adarsh (sadarsh@iitbombay.org, 9822793601)

Q1. Two identical rods of length $2a$ and linear charge denstiy λ each are kept on a line such that their centres are at a separation of b ($> 2a$). Find the force of electrical interaction between them.

Q2. A cubical box-type vessel of side $2l$ has some amount of a liquid of relative density 3. A solid cube of side l floats half submerged in this liquid. Find the volume of water to be poured in the vessel so that the block gets fully submerged. Also find the change in the mercury level.

Q3. A rod has its length, Young's Modulus, coefficient of linear expansion and cross-section area as l_o, Y, α and A respectively. It is fixed at one end to a rigid wall as shown in the figure. The other end is connected to a spring of force constant k, which is initially undeformed and the spring's other end is fixed to another rigid wall. If the temperature of the rod is now increased by an amount ΔT then find the stress induced in the rod.



Q4. A solid wire of radius R carries a current with linearly varying current density with zero value at the centre to maximum at the periphery. If the conductor carries a total current I_o, find the magnetic induction $B(r)$.