CBS - STATISTICAL MECHANICS (P703)

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**Jan - April 2017**   **SET I**

1. One does not need persuasion to be convinced that an ability, mathematical or otherwise to handle interactions among a large number of particles is essential to understanding the physical world. Why then do we not address this issue directly in pre-college physics ? Or rephrasing, how do we subsume this issue in high and higher secondary school physics ? Discuss.

    Consider now the following "many-body" problems at pre-college level.

2. **Traffic Shock Wave**
    An abrupt slowdown in concentrated traffic can travel as a pulse, termed a *shock wave*, along the line of cars, either downstream (in traffic direction) or upstream, or it can be stationary. The figure shows a uniformly spaced line of cars moving at speed $V = 25.0 m/s$ towards a uniformly spaced line of cars moving at speed $v = 5.00 m/s$. Assume that each faster cars adds length $l = 12.0m$ (car length plus buffer zone) to the line of slow cars when it joins the line, and assume it slows abruptly at the last instant.

    (a) For what seperation distance d between the faster cars does the shock wave remain stationary?

    (b) If the separation is twice that amount what are then

        i. the speed and
        ii. the direction (upstream or downstream) of shock wave?
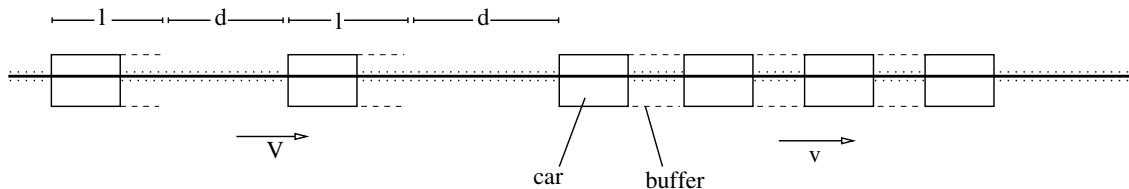
3. **Beads on a string**
    Five identical balls each of mass m and radius r are strung like beads at random and at rest along a smooth, rigid horizontal thin rod of length L, mounted between immovable supports (see Fig.). Assume $10r < L$ and that the collision between balls or between balls and supports are elastic. If one ball is struck horizontally so as to acquire a speed v, find the average force felt by the support.