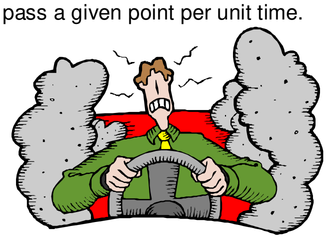
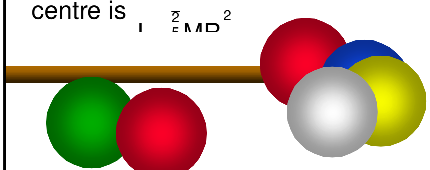
Problems Class 7

In an effort to reduce congestion in the Mersey Tunnel, the authorities are trying to determine the speed at which the largest number of cars can travel through the tunnel per unit time. They have asked for your help. Assuming that the maximum deceleration a car can achieve when braking is 6.4 m s^{-2}, that an average car is 3 m long and that the average driver's reaction time is $^{2}/_{3}$ s, determine the minimum safe distance between two cars, as a function of their speed. Use this to determine the maximum safe number of cars per unit distance, and hence the speed at which most cars pass a given point per unit time.



Problems Class 7

Steve Davis has retired and now runs a snooker school. One of the pieces of advice he gives his pupils is, "If you want to make the cue ball move without slipping when you strike it with the cue, you've got to hit it at a height of three quarters of the diameter of the ball with the cue held horizontally". Explain why Steve is nearly right and determine the exact height at which the cue ball should be struck. The moment of inertia of a sphere of radius R about an axis through its centre is $I = \frac{2}{5}MR^2$



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Demonstrate why a moving bicycle is less likely to fall over than a stationary bicycle if subjected to a sideways push. Consider the angular momentum of the (free) front wheel and the effect on the direction of the axis of the wheel of a force applied at height h tending to push it over. (Difficult problem!)