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Physics

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Starting Motion

Problems that demonstrate the advantages of a lever are popular among high school students. One of them is the following: Model a situation in which an average person can prevent a car from starting motion.

In most of the passenger cars, the rear wheels are the driving force. The model based on this fact is the following: To take advantage of a lever, one has to mount a long pole on the automobile as shown on Figure 1. The values of the model parameters are the following: The length of the pole equals 100 m, the distance between the athlete and the vehicle is equal to 100 m, the distance between front wheels of the car and the rear ones equals 2 m, and the mass of the automobile equals 1000 kg. Under such circumstances, the person takes the rear wheels of the car off the ground through pulling the rod with the force which magnitude

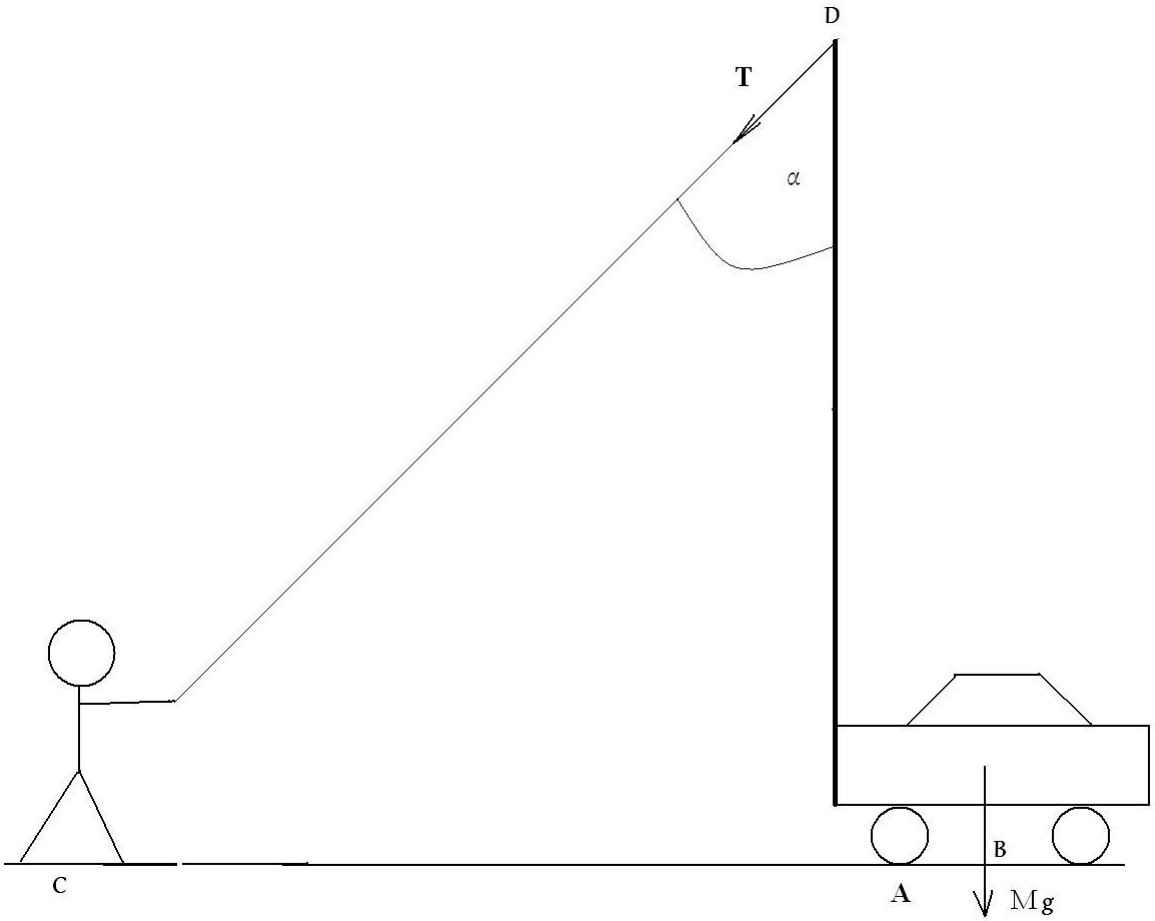

Figure 1

T is such that sum of the torque at the point A equals zero. Hence, one can write the following (see Figure 1):

$$T \cdot DA \sin \alpha = Mg \cdot AB. \quad (1)$$

Since $DA = CA = 100$ m, $\alpha = 45°$. Therefore, from the equation (1), it follows that $T \approx 14.14 \cdot g \approx 138.6$ N because AB=1 m and Mg=9800 N. Actually, performing daily activities people often exert the force which magnitude is equal to the one of $\vec{T}$