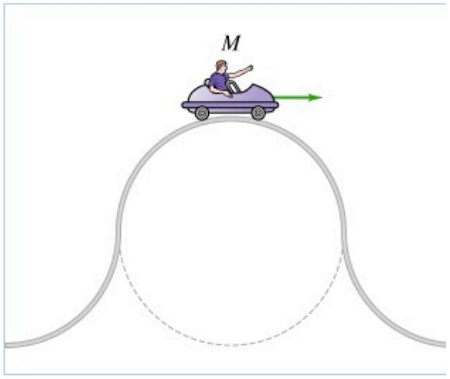
PHYSQ 124 – Particules et ondes **Mastering Physics**
Quiz 3 – 2 octobre 2014

Velocity of a Roller Coaster Ranking Task

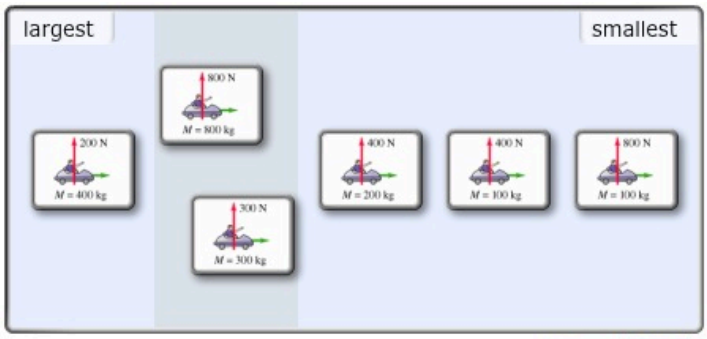
Description: Conceptual question on the velocity of different roller-coaster carts going over a semi-circular hill. (ranking task)

Six roller-coaster carts pass over the same semicircular "bump." The mass M of each cart (including passenger) and the normal force n of the track on the cart at the top of each bump are given in the figures.



Part A

Rank the speeds of the different carts as each passes over the top of the bump.



☐ The correct ranking cannot be determined.

reset ? help

Taking the expressions for the net force on the cart and the centripetal acceleration of the cart and substituting into Newton's 2nd law,

$$\sum \vec{F} = m\vec{a},$$

results in

$$F_{\text{gravity}} - n = m\frac{v^2}{R}.$$

Since the radius is the same for every cart, we can ignore R and write

$$v^2 \propto \frac{F_{\text{gravity}} - n}{m}.$$

But F_{gravity} is simply mg so

$$v^2 \propto \frac{mg - n}{m},$$

or

$$v^2 \propto g - \frac{n}{m}.$$

Therefore, larger n/m implies smaller v.