Quiz 2

Solutions

Choose the best answer.

1. You are riding an elevator down from the 50th floor of a high building. For the first two floors the elevator accelerates downward, reaching a rapid speed. For the next 46 floors it descends at constant speed. For the last two floors it accelerates upward, to come to a stop at the ground floor. Your weight (as perhaps measured by standing on a bathroom scale):

   A. Is lowest when the elevator is between floors 48 and 2.

   ☛B. Is lowest when the elevator is between floors 50 and 48. [**g** and **a** are both down, so $g_{eff} < g$.]

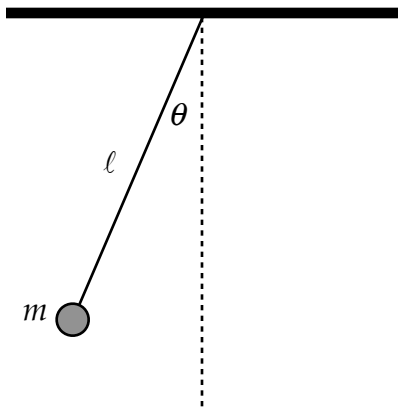
   C. Is lowest when the elevator is between floor 2 and the ground floor.

   D. Is the same throughout the descent.

Choose T or F depending on whether the statement is true or false.

2. Sharp curves on a highway are banked so the normal force helps provide the needed radial force to allow a car to make the curve without sliding. **T**

3. Shown is a pendulum at the top of its swing, momentarily at rest, about to swing back downward. The string is massless. Give answers in terms of g and the quantities shown.



   a. What is the tension in the string?

   b. What is the acceleration of the mass?

   c. At the bottom of the swing when the string is vertical, we will soon be able to show that the mass has speed given by $v^2 = 2\ell g(1-\cos\theta)$. What is the tension in the string at that instant?

   [Draw good free-body diagrams in both situations. For parts a and b, choose a coordinate system with one axis along the string.]

a. Free-body digram below left. In the y-direction: $T - mg\cos\theta = 0$. So $T = mg\cos\theta$.

b. In the x-direction: $mg\sin\theta = ma$. So $a = g\sin\theta$.

c. Free-body diagram below right. The radial force is $T - mg = mv^2 / \ell = 2mg(1-\cos\theta)$, so $T = mg(3-2\cos\theta)$. [Consistency check: if $\theta = 0$ (the pendulum is not swinging at all) then $T = mg$ as expected.]