

Name: _____

Social Security #: _____

34PTS

TA (circle one): Beesley Bird Denholm Harrison Johnston Roberts Wilcox

A. (10PTS) You are trapped inside a railroad freight car sitting at rest on a horizontal track at the edge of a long downslope. Inside the car are equal masses of lead bricks and gold bricks on opposite sides of the freight car. The track rails and freight car wheels are frictionless. You can escape if somehow the car can be moved so that the right wheels slide over the edge of the downslope. You have no outside help. Is there anything you can do inside the freight car that would allow you to escape, i.e., get the freight car over the edge of the downslope? If there is, what is it you can do? On what principle(s) of physics will your action be based?



downslope
YES, MOVE LEAD BRICKS FROM THE LEAD BRICK PILE TO THE GOLD BRICK PILE.

LAT SYSTEM = PR CAR + PERSON + ALL BRICKS

+ Pb BRICKS.
SINCE $P_{sys}^{TOT} = 0$ AND SINCE $F_{net} = 0$, NOTHING THE RIDER CAN DO WILL CHANGE CM OF SYSTEM. IF RIDER MOVES Pb BRICKS FROM Pb BRICK PILE TO Au PILE CHANGING THE CM OF THE 2 BRICK PILES THE PR CAR WILL HAVE TO MOVE TO THE RIGHT TO KEEP POSITION OR CM_{sys} UNCHANGED. WHEELS THEN SLIP OVER RIGHT EDGE.

B. (10PTS) Gymnasts use padded mats to protect themselves from injury. Give a brief explanation using one or more physics principles on how such injury protection is provided.

WHEN A GYMNAST HITS A MAT HER MOMENTUM UNDERGOES A CHANGE $\Delta p = F_{impact} \Delta t$. THE MAT EXTENDS Δt THUS REDUCING FIMPACT FOR A GIVEN Δp . SINCE INJURIES ARE CAUSED BY FIMPACT THE SMALLER FIMPACT IS THE LESS SERIOUS OR LESS FREQUENT IS INJURY.