

Conservation of energy with springs (21 pts)

5. $\frac{1}{2}kd^2 = mgh$ - 1 pt

6. $k = 2mgh / d^2$ - 1 pt

Graph of $2mgh$ vs. d^2 - 4 pts

Axes labels and units - 1 pt

Regression line - 1 pt

Slope with units (N/m or equivalent) - 2 pts

8a. spring potential energy - 1 pt

8b. kinetic and some gravitational potential energy - 1 pt

8c. gravitational potential energy- 1 pt

d. A stronger spring would create a higher slope as there would be a greater height per compression, d - 2pts

e. The slope would be the same. The cart will reach the same height regardless of the incline angle. Also the slope is the spring constant which is a property of the spring and is independent of the incline angle - 2 pts

f. The slope would remain the same. g would be lesser, but h would be greater, with the two factors offsetting. Also, the slope is the spring constant which is a property of the spring and doesn't vary with what planet you are on - 2 pts

g. Friction makes the spring constant estimate too low. Friction causes a lesser height, creating a slope less than it should be. - 2 pts