Physics

Solutions

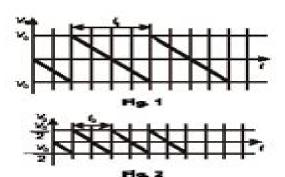
1. MECHANICS

1. Since the balls move along the vertical, we direct the coordinate exis vertically upwards. We plot the time dependence of the projections of the velocities of the balls on this exis. Figures 1 and 2 show the dependences V, (f) and V_s (f) respectively (the moments of the baginning of motion are not matched so far). These graphs present infinite sets of straight line segments with equal slopes (along the exceleration is the

some). These segments are equidistant on the time exis, their separations tesing $f_1 = 2\sqrt{\frac{2h_1}{g}}$ for the first test

and $t_2 = 2\sqrt{\frac{2h_2}{g}}$ for the second ball. Since $h_1 = 4h_2$ by hypothesis, $t_1 = 2t_2$, i.e. the frequency of motion of

the second ball is twice as high as that of the first ball. It follows from the ratio of the initial heights that the maximum valocities attained by the balls will also differ by a factor of two (see Figs. 1 and 2):



There are two possibilities for the coincidence of the velocities of the balls in magnitude and direction. The velocities of the balls may coincide for the first time $\tau = \eta t_1$ a after the baginning of motion (where $\eta = 0$, 1,

2, ...) during the time interval $\frac{t_1}{4}$ then they coincide $\frac{3t_1}{4}$ a efter the beginning of motion during the time

Interval $\frac{t_i}{2}$. Subsequently, the velocities will coincide with a period t_i during the time interval $\frac{t_i}{2}$. The other

possibility consists in that the second ball starts moving $x = \frac{\xi_1}{2} + \kappa \xi_1 = \text{ (where } \mu = 0, 1, 2, ...)$ efter the first

Chapter 21 Physics Solutions Manual

Paul A. Tipler, Gene Mosca

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