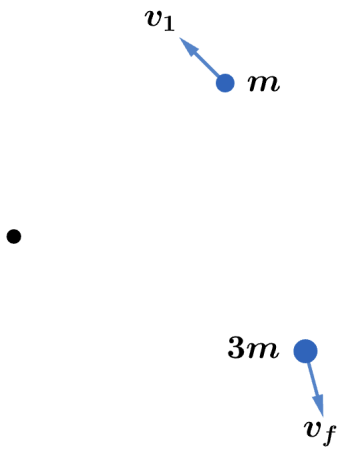
2007 F=ma Exam: Problem 38

Kevin S. Huang



The initial kinetic energy of the system is

$$K_i = \frac{1}{2}mv_0^2$$

The final kinetic energy after the elastic collision and the cord breaking is

$$K_f = \frac{1}{2}mv_1^2 + \frac{1}{2}(3m)v_f^2$$

but since an elastic collision conserves energy, the final kinetic energy is also equal to

$$K_f = K_i - U$$

where U is the energy cost to break the spring. From the previous problem, we found

$$U = \frac{1}{8}mv_0^2$$

Thus,

$$\frac{K_f}{K_i} = 1 - \frac{U}{K_i} = 1 - \frac{1/8}{1/2} = \frac{3}{4}$$

so the answer is $\boxed{\text{D}}$.