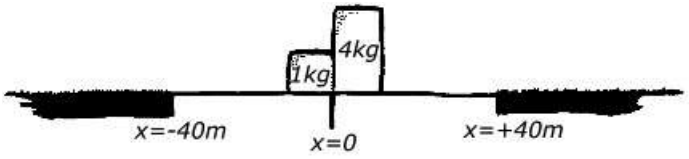
NAME _____ DATE _____

Scenario

Two blocks of mass $1\ \text{kg}$ *and* $4\ \text{kg}$ *are placed in contact at the center point of an* $80\ \text{m}$ *long track that exerts negligible friction on the blocks. At both ends of the track, there are strips of rough surface of equal coefficient of kinetic friction* 0.5*. A small explosive charge between the blocks propels them apart at time* $t = 0$ *so that the* $1\ \text{kg}$ *block moves with a speed of* $40\ \text{m/s}$ *along its section of the frictionless track.*



(This figure is not to scale; the size of the two blocks is significantly smaller than the distance to the location where the frictionless track is connected to a rough surface.)

Quantitative Analysis

PART A: Calculate the time at which the $1\ \text{kg}$ block reaches its rough surface and the time at which the $4\ \text{kg}$ block reaches its rough surface. Verbally explain your calculations.

1-kg Block	4-kg Block

1-kg Block	4-kg Block

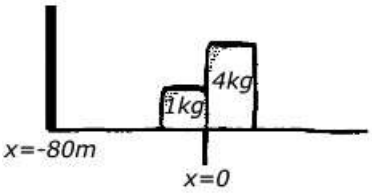
PART B: Both blocks have the same magnitude of acceleration while sliding to rest on their respective rough surfaces. Calculate this acceleration and verbally explain your method.

PART C: Calculate the time at which the 1 kg block comes completely to rest and the time at which the 4 kg block comes completely to rest on their respective rough surfaces.

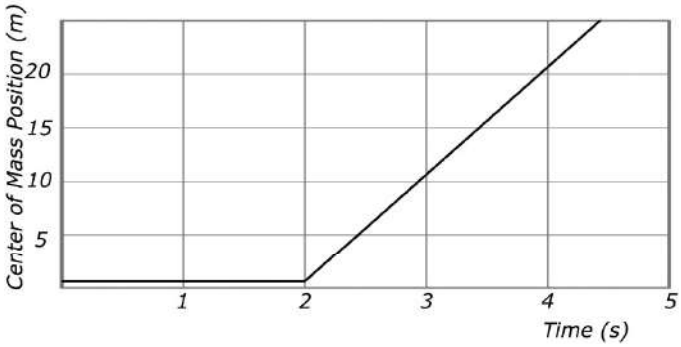
1-kg Block		4-kg Block	

Argumentation

Now, the blocks are exploded apart the same way as before, but this time, friction is negligible everywhere on the track. Instead, there is a wall located at $x = -80$ m. Upon striking the wall, the 1 kg block sticks to the wall. The graph of the center of mass position of the two-block system is shown as a function of time.



PART D: The graph at right shows the position of the center of mass of the two-block system as a function of time. The graph is zero for $0 < t < 2$ s and has a constant positive slope for $t > 2$ s. In a clear, coherent, paragraph-length response, explain why the graph has these features.



Checklist:

- _____ I answered the question directly.
- _____ I stated a law of physics that is always true.
- _____ I connected the law or laws of physics to the specific circumstances of the situation.
- _____ I used physics vocabulary (energy, mass, momentum, force, velocity, center of mass, time).