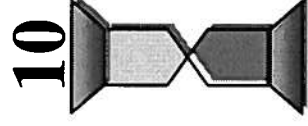
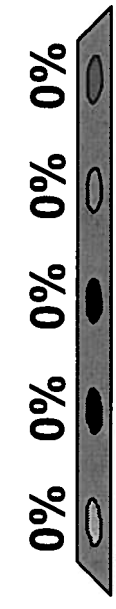


10/24/07 (9)

An observer on the sidewalk and an observer in a van moving with constant velocity will measure for a given object



- a) The same velocity.
- b) The same momentum.
- c) The same kinetic energy.
- d) The same gravitational acceleration, g .
- e) None of the above.



10/24/07

The correct answer is d): the two observers will measure the same acceleration due to gravity; as follows.

- Observer, S (on sidewalk), observes velocity, \mathbf{v} , to be $\mathbf{v} = \mathbf{v}' + \mathbf{V}$, when S' in van measures the velocity of the same object to be \mathbf{v}' , and the van is moving with constant velocity, \mathbf{V} .
- It follows immediately that a), b) and c), all of which depend on \mathbf{v} for S (or on \mathbf{v}' for S'), can **NOT** be the same.
- But $\mathbf{a} = \Delta\mathbf{v}/\Delta t$ and $\mathbf{a}' = \Delta\mathbf{v}'/\Delta t$ are the same, (since \mathbf{V} is constant) whatever the value of the acceleration.
- Thus, the acceleration due to gravity, g , is the same for S and S'.
- **Shorter solution:** All the Laws of physics, including the law of gravity, are the same in every inertial frame, including S and S'.
- Therefore the gravity force (near earth), $\mathbf{F}_G = m\mathbf{g}$, is the same for both frames.