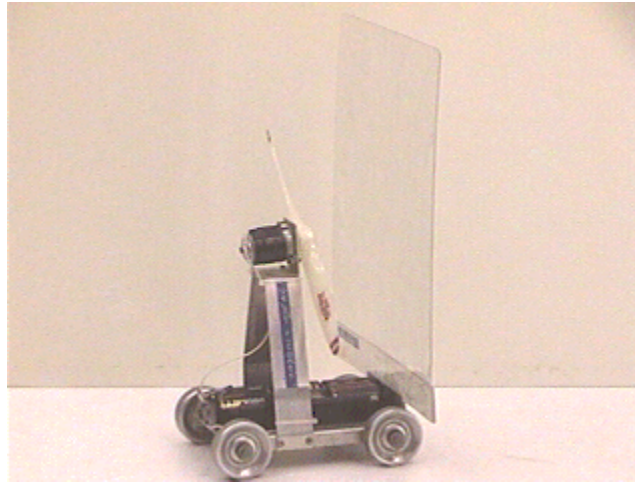


Answer #46

The answer is (c): the cart will remain motionless.



Air from the surrounding area initially at rest is caught up and accelerated by the fan, causing a reaction force that would propel the cart to the left. However, that same air strikes the sail such that its motion from left to right is changed to motion outward, parallel to the sail. Thus the sail experiences a force to the right that is equal in magnitude to the leftward reaction force on the fan. Because the fan is attached to the cart, these two forces, being equal and opposite, produce a zero net force and create no motion of the cart. This is seen in an mpeg video by clicking our mouse on the photograph above.

Another way of viewing this situation is that, because left-to-right motion of the air is started and stopped within the fan cart system, this pair of forces only acts internally within the fan cart system. This constitutes an "internal forces," but only an external force can cause motion of the cart.

Actually, this problem is fairly simple, but can be made much more complex by changing the shape of the sail. If the sail is large and cup-shaped, it might redirect the air so that it exits the cart to the left, and the cart will then move to the right. On the other hand, a sail so small that it fails to catch all of the air from the fan will not cancel *allof* the force on the propeller, so the cart will move to the left.

The PSSC fan cart shown in the picture was designed to illustrate equal and opposite forces and result in no motion.

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