

## Newton's 3rd Law

A block of mass  $4M$  collides head on with a block of mass  $M$ . Let  $F_{4M}$  be the force exerted on the  $4M$  mass during the collision, and let  $F_M$  be the force exerted on the  $M$  mass during the collision. How do the magnitudes of the forces exerted on each block during the collision and magnitudes of the accelerations ( $a_{4M}$  and  $a_M$ ) of the blocks during the collision compare?

<u>Force exerted on blocks</u>	<u>Accelerations of blocks</u>
(A) $F_M > F_{4M}$	$a_M > a_{4M}$
(B) $F_M = F_{4M}$	$a_M = a_{4M}$
(C) $F_M < F_{4M}$	$a_M < a_{4M}$
(D) $F_M = F_{4M}$	$a_M > a_{4M}$

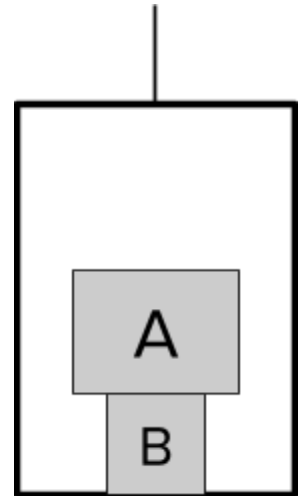
Answer:

A block of mass  $2M$  sits on top of a block of mass  $M$  which is sitting on the floor of an elevator. The elevator is moving **downward and slowing down**. How do the following forces compare: the force of gravity on the mass A ( $F_{gA}$ ) exerted by Earth, the force of gravity on the mass B ( $F_{gB}$ ) exerted by Earth, the force exerted on box A by box B ( $F_A$ ), and the force exerted on box B by box A ( $F_B$ )?

- (A)  $F_A > F_B > F_{gA} = F_{gB}$
- (B)  $F_B > F_{gA} > F_A > F_{gB}$
- (C)  $F_A = F_B > F_{gA} > F_{gB}$
- (D)  $F_A = F_B = F_{gA} > F_{gB}$

Answer:

(What would the answer be if the elevator were not accelerating?)

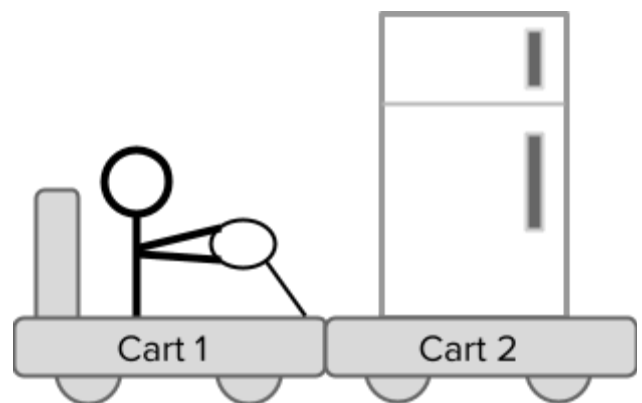


A person drives a cart (Cart 1) to the right while pushing another cart (Cart 2) that has a massive refrigerator on it. The total mass of cart 2 (cart plus fridge) is three times the total mass of cart 1 (cart plus person). If the person is driving with enough force that the two carts accelerate to the right, what can be said for sure about the magnitudes of the forces on the carts?

- (A) The force exerted on cart 2 by cart 1 is larger than the force exerted on cart 1 by cart 2
- (B) The force exerted on cart 2 by cart 1 is smaller than the force exerted on cart 1 by cart 2
- (C) The force exerted on cart 2 by cart 1 is the same as the force exerted on cart 1 by cart 2
- (D) The force exerted on cart 2 by cart 1 could be larger or smaller depending on the size of the acceleration

Answer:

(What if the carts were moving at constant speed?)



A driver pushes down on the gas pedal and accelerates forward along a horizontal road. The tires are rolling without slipping. Which of the following forces are responsible for each result?

**Force that propels the car forward**

- (A) Frictional force on tires from ground
- (B) Frictional force on ground from tires
- (C) Normal force on tires from ground
- (D) Normal force on ground from tires

**Force that prevents the car from falling**

- Normal force on tires from ground
- Normal force on tires from ground
- Frictional force on tires from ground
- Frictional force on tires from ground

Answer: