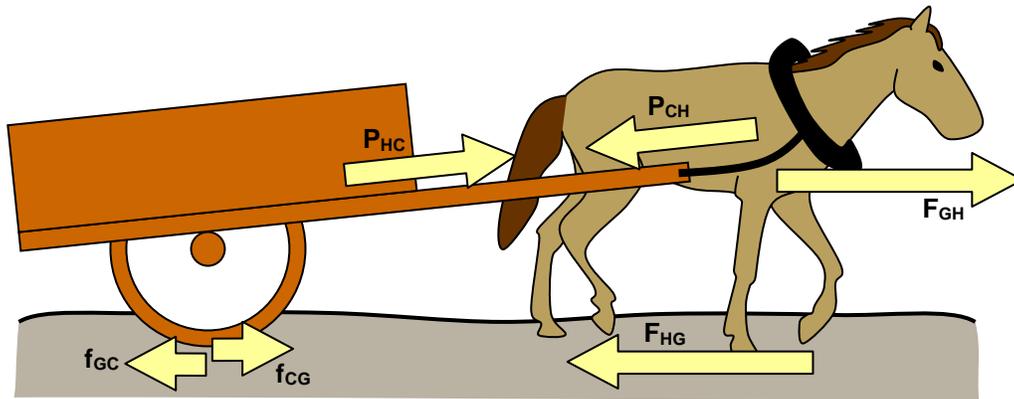


The Horse and Cart Problem

The horse and cart problem is an application of Newton's Third Law, which says: For every action, there is an equal and opposite reaction. If A exerts a force on B, then B will exert an equal and opposite force on A.



When the horse walks forward and pulls on the cart, the following forces are present:

	Action		Reaction
F_{HG}	The horse pushes against the ground.	F_{GH}	The ground pushes back on the horse.
P_{HC}	The horse's body pulls on the cart.	P_{CH}	The cart resists movement and pulls back on the horse's body.
f_{CG}	The cart wheel pushes against the ground.	f_{GC}	The friction with the ground resists the cart's movement.

Note that the action-reaction pairs of forces affect the motions of different objects. With this in mind, the net force...

- a) on the cart is $P_{HC} - f_{GC}$ since the cart moves when the horse's pull overcomes friction ($P_{HC} > f_{GC}$)
- b) on the horse is $F_{GH} - P_{CH}$ since the horse moves when he pushes the ground enough to pull the cart ($F_{GH} > P_{CH}$)
- c) on the ground is $F_{HG} - f_{CG}$ since the horse-cart system moves when the horse overcomes friction ($F_{GH} > P > f_{GC}$).

In summary, although the action-reaction forces may cancel, the net force resulting from different interactions of forces allows for movement, relative to the ground.

