PHYSICS 12

Newton's Third Law

Whenever an object A exerts force on an object B, then the object B exerts force on the object A of equal magnitude but opposite direction.

In other words, the force of A on B is equal in magnitude and opposite in direction of the force of B on A.

In short: **For every action, there is an equal and opposite reaction.**

$$F_{A \text{ on } B} = - F_{B \text{ on } A}$$

All forces result from interactions = Forces always come in pairs.

There are two types of interactions:

1. Contact Interactions- _____

_____

2. At-a-distance Interactions- _____

Action-Reaction pairs:

Action: the tires on a car push on the road...
Reaction:

Action: while swimming, you push the water backwards...
Reaction:

Action: a rocket pushes exhaust to the left...
Reaction:

Action: the earth pulls down on a ball...
Reaction

Example 1: When a rifle fires a bullet, the force the rifle exerts on the bullet is exactly the same (but in the opposite direction) as the force the bullet exerts on the rifle... so the rifle "kicks back". The bullet has a mass of 15 g and the rifle is 6.0 kg. The bullet leaves the 75 cm long rifle barrel moving at 70 m/s.

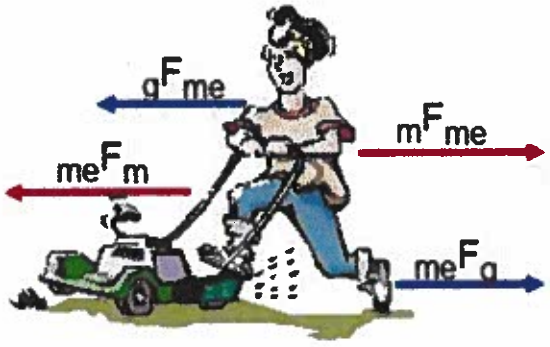
a) **Determine** the acceleration of the bullet.

b) **Determine** the force on the bullet.

c) **Determine** the acceleration of the rifle.

d) **Explain** why the bullet accelerates more than the rifle if the forces are the same.

Example 2: If I push on a lawn mower, it pushes back on me with an equal, but opposite force. **Explain** why we don't both just stay still.



me → me
m → mower
g → ground