## Bell Ringer

1. A 20 kg box is sliding down a ramp angled at 57 degrees at an acceleration of $1.4 \mathrm{~m} / \mathrm{s} / \mathrm{s}$. What is the coefficient of friction between the box and the ramp?


## Newton's Third Law



## Newton's Third Law

All Forces come in EQUAL and OPPOSITE pairs!
What does that mean?


## Newton's Third Law



## Paired Forces

- Forces are paired if they are:
- Equal
- Opposite directions
- Same type of force
-Act on different objects


## Practice

I pull on the rope the rope pulls on me

I kick the wall the wall kicks me

My head hits the The soccer ball soccer ball hits my head

## Practice

1. If a gun shoots a bullet forward, then the bullet will also shoot the gun $\qquad$ .
2. If the Earth pulls a skydiver DOWN with its gravity then
$\qquad$ .
3. If Jimmy's foot pushes a soccer ball forward with 20 N of forces, the soccer ball $\qquad$ .
4. If a tow truck pulls a car forward with 1200 N of force then the car $\qquad$ .
5. If a magnet pulls a paper clip up with 2 N of force, then the paperclip $\qquad$ .
6. If Bob's teeth pushes in on a metal nail with 50 N of force, then the nail $\qquad$ .
7. Bob is trying to do a pull up on a bar. If Bob pulls down on the bar with 700 N of force, then $\qquad$ .
8. Bob is trying to do a push up. If Bob pushes down on the floor with 400 N of force, then $\qquad$ .

## Perspective



I did not provoke the fight, so I do not feel bad for what I was forced to do. We were arguing, and since I was right and he was wrong, he decided to fight to cover up his stupidity. He swung at me first, but because I was in top physical condition, I was able to act quickly and block the punch neatly with my head. Then, I jumped to the ground, knocking him down on top of me. I placed my ear in his mouth and between his teeth and then I poked his finger several times with my eye. His teeth hurt so much from the strength of my ear that he became irate and tried to kick me, but I cleverly blocked the onslaught of his attack with my ribs and face. I scrambled to my feet and ran to my car in hopes I would get away and save this man from my deadly hands. Before I could start the car he pulled me from the open door. I proceeded to swing at him, but only managed to hit myself in the head. To this I said, "What's this two against one?" That was the final straw-I lost all control. There will be no mercy!! Taking him in my death grip, I pounded him in the knee with my stomach-then I hit him two or three times in the fist with my teeth! He had had it! I could tell. After that he didn't even try to pick me up off the ground. He was too chicken!!

The Force of Gravity pulls an apple to the Earth

The force of Gravity pulls the Earth to the apple!!!!!!!!!


The Earth pulls on the apple just as hard as the apple pulls on the Earth!!!!!!
So why does apple move and Earth stand still?

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## How can the Horse pull the Cart?



We always look at the forces acting $\underline{\mathbf{O N}}$ an object!


## Newton's Third Law in Action

 How much force is acting between the blocks?

To solve this we first start by looking at the problem in a different light, This is same as....


All the blocks move together so they have the same acceleration and can be treated as the same object!!

With the situation looking like this, we can easily apply Newton's second Law


## Practice

Jimmy is moving across town and is pushing his belongings down the frictionless street with a force of 125 N . What is the force acting between each of the objects and the acceleration?


