The video is about Newton's 3rd law and football. When a tackle is performed correctly it's not just a thing of defensive beauty, it's also an elegant description of Newton's 3rd law of motion. Newton's 3rd law dictates that the total momentum between players must be the same before the collision as it is after the collision. It's very important to have some speed and momentum as you're going in to make that tackle. That is Newton’s 3rd law video and summary.

| Example 1: A boy and girl on roller skates stand facing each other. The girl puts her arms out and pushes away from the boy. | Example 1 Action: When the girl pushes it has a lot of force and action to push away from the boy. |
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| Example 1 Reaction: When the girl pushed herself away she had a lot of force because she was pushing the opposite way and that pushed her that way. |
| Example 2: A golfer swings her club down to hit a golf ball on a tee. | Example 2 Action: When the golfer swings the ball it has a lot of force and action because when the golfer swings the golf club you're using a lot of force to hit the golf ball. |
| Example 2 Reaction: When the golf club hits the ball it has a lot of force because the more you swing harder the farther it goes;. |
| Example 3: A frog sits on a lily pad in the middle of a pond. Suddenly it makes a leap pushing off the pad. | Example 3 Action: When a frog makes a leap pushing off the pad it has a lot of force and action because when the frog goes forward, and the lily pad goes backward it has an equal and opposite reaction. |
| Example 3 Reaction: When the frog makes a leap it has a lot of force because when you jump off the ground you use a lot of force. |
| Example 4: A kid is skateboarding. He is going down a hill and there is giant rock in front of him. The kid pushes away from the rock by reaching his arms out. | Example 4 Action: When the kid is going down the hill he uses a lot of force because when he pushes away to a different direction that requires a lot of force. |
| Example 4 Reaction: When the kid is going down hill and there is a rock he uses a lot of force because if you want to go to a different direction you need a lot of force to go to a different direction. The kid pushes off using his arms and in order to go in a different direction you need to push really hard if you're on a skateboard. |

Newton's Third Law (Action- Reaction) Worksheet

1. Identifying Action and Reaction
   1. An easy way to identify action and reactions forces is to simply say:
      1. Action: Object A exerts a force on Object B.
      2. **Reaction**: When the force Object A and Object B it makes the object go slow or far.
   2. Example: In the case of a falling boulder,
      1. Action: the Earth exerting a force on the boulder.
      2. **Reaction**: When the Earth exerts a force on a boulder it will not go very far but if it is down hill the boulder will go really fast.
   3. Example: In the case of hanging a lamp from ceiling,
      1. Action: the ceiling exerting a force on the lamp.
      2. **Reaction**: When the ceiling exerts a force on the lamp it will swing a little bit back and forth.
   4. Example: In the case of hammering a nail,
      1. Action: the hammer exerting a force on the nail.
      2. **Reaction**: When the hammer exerts a force on the nail since the hammer is very big and strong the nail goes right into the ground very fast.
   5. A diver dives off a raft. What happens to the diver? What happens to the raft?
      1. **Action:** The action force is the diver pushing off of the raft, and the reaction force is the raft pushing back on the diver.
      2. **Reaction:**  When the diver moves forward and dives into the water. The raft moves backwards in the water because of the reaction force.
   6. What action reactions forces are involved when a rocket engine fires? Why doesn't a rocket need air to push on?
      1. **Action:** The action force is the rocket pushing out the hot gasses produced by the engine.
      2. **Reaction:** The reaction force is the hot gas pushing back on the rocket propelling it into space.
   7. A tennis racquet hits a tennis ball. Why doesn't the racquet swing backwards when the ball hits it? (Shouldn't it swing back because of action- reaction forces? The racquet does not swing backwards because the force of your arm keeps it from going back. The action force is the ball hitting the racquet. The reaction force is the racquet pushing back on the ball causing it to go back across the net and by the other player.
   8. What forces are acting on a book sitting on a table? Are action- reaction forces involved in this situation? The force on the book is gravity pulling the book down and the table pushing the book back up. These two forces are equal and opposite so that means there are action forces and reaction forces.
   9. If two people each stand on a skateboard and push off of each other what happens (Newton's 3rd law)? When two people push off of each other they move away from each other and they would fall off the skateboard which would be equal and opposite.
   10. In question "i" how would the distance moved by the skateboard compare if one person had a lot more mass than the other person? The person with less mass would move away faster and would likely move a greater distance than the more mass person.

I think his third law is that for every force in nature there is an equal and opposite reaction.

**Results:**

| **Instructions** | **Action** | **Reaction** | **Equal and Opposite?** |
| --- | --- | --- | --- |
| *Set one marble halfway down the track (at 50 cm). Drop another marble from the lower drop point. Watch the marbles collide.* | **When the marble drops down it has a lot of force and action to push the other marble.** | **When the marble collided with the other marble it barely moved the other marble because it had not a lot of force.** | **Both marbles started moving but the opposite force slowed the first marble.**  **Opposite** |
| *Set one marble halfway down the track (at 50 cm). Drop another marble from the upper drop point. Watch the marbles collide.* | **When the marble dropped at the upper point it had more speed to bump into the other marble.** | **When the marble collided with the other marble it made it go farther than the first time we did the first experiment.** | **When the first marble came in contact with the other one it slowed the first marble (opposite force). But it made the other marble go faster.** |
| *Set two marbles, side-by-side and touching, halfway down the track (at 50 cm). Drop a marble from the lower drop point. Watch the marbles collide.* | **When the Marble rolled down, it made an impact, and slowed to a halt.** | **The middle marble was stationary. Last marble was impacted, sped up, and rolled away** | **It was opposite, not equal.** |
| *Set two marbles, side-by-side and touching, halfway down the track (at 50 cm). Drop a marble from the upper drop point. Watch the marbles collide.* | **When the two marble were hit by the marble rolling down it didn’t move the marble very far.** | **The middle marble only moved a little bit and the last marble moved very far.** | **It was opposite** |
| *Set three marbles, side-by-side and touching, halfway down the track (at 50 cm). Drop a marble from the lower drop point. Watch the marbles collide.* | **When the first marble came down it made the middle marble push the other marble which pushed the last marble andmade go not very far.** | **The middle marble moved fast, the third marble made the fourth marble move a little bit.** | **It was equal and opposite** |
| *Set three marbles, side-by-side and touching, halfway down the track (at 50 cm). Drop a marble from the upper drop point. Watch the marbles collide.* | **When the first marble came down it made the second marble a lot, the third marble a little and the fourth marble made it move a lot.** | **The middle marble went very fast, the third marble slowed down and the fourth marble sped up.** | **It was equal and opposite.** |
| *Set four marbles, side-by-side and touching, halfway down the track (at 50 cm). Drop a marble from the lower drop point. Watch the marbles collide.* | **When the first marble came down it knocked the second marble into the third marble very fastly then the fourth marble going slower and finally knocking in the fifth marble making it barely go any far.** | **The middle marble made it go very fast, the third marble went slower, the fourth marble went even slower and the fifth marble went the slowest.** | **It was equal and opposite.** |
| *Set four marbles, side-by-side and touching, halfway down the track (at 50 cm). Drop a marble from the upper drop point. Watch the marbles collide.* |  |  |  |

**Post-Lab Conclusions:**

1. What is Newton’s First Law of Motion? Newton's First law of motion states that, if a body is at rest or moving at a constant speed in a straight line, it will remain at rest or keep moving in a straight line at constant speed unless it is acted upon by a force.
2. What is Newton’s Second Law of Motion? Newton's Second law of motion states that acceleration is produced when a force acts on a mass. The greater the mass of the object to be accelerated the greater the amount of force needed to accelerate the object.
3. What is Newton’s Third Law of Motion? Newton's Third law is that for every force in nature there is an equal and opposite reaction.
4. In today’s lab, which of the trials contained an “equal and opposite” reaction? The third marble experiment and the fourth one.
5. Explain how, even though the marbles were always rolling in the same direction, the actions/reactions were still equal and opposite forces. It is because for every action force there is a reaction force. After the collisions, why wasn’t the last marble rolling quite as fast as the first marble? It is because the more marbles it hits, the slower the impact makes the marble slower.
6. Explain how today’s lab actually displayed all three of Newton’s Laws.
   1. When you drop the marble into the other marble it begins moving, when you are exerting a force on it demonstrates Newton's 1st Law of motion
   2. When your marble has little mass and doesn't require a lot of force to start moving it through the ruler it hits the marbles causing them to hit into other marbles that demonstrates Newton's 2nd law of motion.
   3. When the marble hits the walls of your rulers, it bounces off the walls it demonstrates Newton's 3rd law of motion.