

Tractor Pull Olympics

Background:

Many insects are capable of lifting and moving many times their body weight. Observe, for example, ants carrying a large piece of bread at your next picnic. How can they do this? Why can't humans?

In the weightlifting division, Olympic humans manage to lift about 260 pounds. Elephants can lift 600 pounds with their trunk. But for their size, ants are the real champions. They can lift up to 50 times their body weight and carry it around over their heads. And they do this with their mouths!

Objectives:

- To explore the strength of Madagascar Hissing Cockroaches
- To determine how many pounds you could pull if you have the strength equivalent to a cockroach

Materials:

- Hissing Cockroaches
- Washers
- String
- Paper Sleds (4 inches by 5 inches)
- Tape

Methods:

- a. Select a cockroach and weigh the roach
- b. Have the students predict how many washers the cockroach will be able to pull on the paper sled
- c. Cut a piece of string and attach the string to the cockroach with tape. Tape the other end to a sheet of paper (sled)
- d. Mark a starting line with masking tape and place the roach near the starting line
- e. When the roach begins walking add washers to the sled, one at a time, until you find the maximum number the roach can pull
- f. Compute the total weight pulled by the roach. Determine how many pounds you could pull if you had the strength equivalent to a roach.

Calculations:

Pulling power of roach = Number of washers pulled x weight of washers

Pulling power if humans had the strength equivalent to a roach =

Pulling power of roach + weight of roach = x (pulling power of human)

Weight of roach = weight of human

Solve for x (Pulling power of human)

Conclusions:

- Compare the strength of male vs. female roaches
- Conduct the inquiry using different substrates
- List some reasons why cockroaches can pull so much weight

Reasons:

1. Insect's skeleton is on the outside, muscle attachment is very different than humans
2. As the body becomes smaller, the muscles become relatively more powerful
3. The small size of insects gives them a greater surface area to volume ratio which influences wind resistance, physics, and center of gravity factors