









## GAME, SET, MATCH!

finding information about their joint on the internet, and the mapper will create a simple concept map of how the joint works and how energy is transferred as the joint moves.

\*The “mapper” can use online mind mapping sites such as Coggle, Inspiration, and Mindomo. Some of the sites that are not free do have a free trial period that can be used.

### GROUP ACTIVITY—35 MIN

9. When students have finished their concept map, ask them to join a pair that has the joint they do not have (an elbow pair joins with a knee pair) and compare how elbow and knee joints work by looking at their concept maps and discussing what they’ve learned from their research.
10. Next, explain to students that they will now attempt to use what they have learned about joints and construct a simple working robotic knee or elbow using the materials provided. Their goal is to create a robotic joint that is able to raise a tennis ball if it is an elbow or kick a plastic inflatable ball if it is a knee joint. Give student groups time to design and create their robotic joint.
11. Groups should present and test their robotic joints to the class for the last 10-15 minutes of the class period, explaining how their design uses principles from elbow or knee joints and how the energy is transferred through the joint from potential to kinetic to create movement.

#### Take Action!

As an extension to this lesson, students can take a look at how robotic joints can be used in prosthetics for people who have lost limbs and how the technology is advancing to amazing prosthetics that can be controlled by a person’s mind or that can actually feel objects it is being used to pick up!

<https://www.nytimes.com/2015/05/21/technology/a-bionic-approach-to-prosthetics-controlled-by-thought.html>

<https://www.livescience.com/43125-man-gets-first-bionic-hand-that-feels.html>

# GAME, SET, MATCH!

## NATIONAL STANDARDS

Technology Education	<p><a href="#">Next Generation Science Standards</a> and <a href="#">International Technology and Engineering Educators Association</a></p> <p>ITEEA Standards for Technological Literacy Standard 16: Energy and Power Technologies In order to select, use, and understand energy and power technologies, students in Grades 9-12 should learn that</p> <p>J. Energy cannot be created nor destroyed; however, it can be converted from one form to another.</p>
Science	<p><a href="#">Next Generation Science Standards</a></p> <p>HS-PS3-3: Design, build, and refine a device that works within given constraints to convert one form of energy into another form of energy.</p>