



Academic Activity Chapter 11

Mechanizing a Hinge Joint

Biomechanical engineers use biology, technology, and engineering concepts. One of the many things they do is research and model human anatomy to better understand it and help in the development of prosthetics, implants, or other biomechanical devices. This is a modeling and presentation activity covering the hinge joint that forms the human elbow and knee.

Materials:

Notebook (for recording research)
3x5 note cards (for presentation notes)
One 3' long piece of $\frac{3}{4}$ " dowel rod
Ten #10 eye screws
A box of 100 rubber bands

This project requires some research before you get started. Go online and investigate the elbow.

1. Investigate the ratio of forearm length to upper arm length.
2. Determine which muscle groups move the arm.
3. Where do the muscles attach?
4. How do the muscles cause movement in the joint?
5. Document your research in a notebook. Make sure to include the websites used for presentation and citation purposes. Transfer this research to note cards for presentation purposes.

When you understand how the arm works, lay out a design in your notebook for modeling the arm with a dowel rod, some eye screws to form the attachment points, and rubber bands to model the muscle bundles. Keep in mind that muscle bundles are thicker in the middle than at the attachment points.

6. When you have a completed design, create your model. Be careful to measure lengths and determine appropriate attachment points before cutting the dowel rod and setting the eye screws.
7. Test your model for movement against a friend or family member's arm. Record your results in your notebook.
 - How close are your model's movements to the real movements?
 - What are the model's limitations?
 - What improvements could you make?
8. Use the note cards to create a presentation that includes the project assignment, research and sources, the design process and a drawing (posterboard or graphic presentation software), your model, its limitations, and proposed improvements.