Title: "What Moves You?"

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## Abstract:

Using various bone segments to create joints that will explain planar movement and then develop a mechanical model of different joint type that will allow certain movement in a robotic unit.

# Subject, Grade, Level:

7th Grade Science and Robotics/Coding

# **Learning Objective(s)**:

- 1. To identify and classify the different types of articulation (planar, hinge, pivot, condyloid, saddle, and ball-and-socket) based on its shape and structure as it relates to movement and function
- 2. To compare and identify similar joints on whole specimen skeletal structure
- 3. To explain the role of joints in skeletal movement Science:
- 4. Compare joint movement to function across species as it relates to planar movement Robotics:
- 5. To create similar joint types using prefabricated metal parts
- 6. Design and assemble joint as it relates to one component of movement in the robotic game criteria.

## Timeframe:

Science 2-3 Days; Robotics 5-10 days

## **List of Materials:**

- oVERT 3D printed bones of various species unassembled (ideally 3 sets of 6 articulations)
- oVERT 3D whole models of a bat and alternate species (min of two reference models)
- Various metal nuts, bolts, washers, square, and angled pieces
- Cut/flat pieces of rubber bands with tooth-picked size wholes (represents cartilage and tendons)

## **Procedure and general instructions (for instructors):**

• Introduce skeletal system as it relates to movement

## **Procedure and general instructions (for students):**

• Activate students' prior learning of skeletal functions by discussing answers to the question "What kinds of movements do your bones help you make?"

- Identify six types of moveable joints in the human skeleton; discuss where they are located in the body and what types of planar movements they allow.
- Divide students into teams of 4 to 6 and distribute 3 to 6 sets of joints disassembled.
- Give students a set amount of time to assemble the joints given and draw out the unit and describe which plans this articulation will allow.
- Students will draw out joint
- Students can then rotate to next set of joints to match and identify

Use Morphosource.org to examine various bones and joints:

https://www.morphosource.org/Detail/SpecimenDetail/Show/specimen id/8069

https://www.morphosource.org/Detail/MediaDetail/Show/media id/14693

https://www.morphosource.org/Search/Index

Use YouTube video to draw a representation of each type of joint mentioned.

Location	Neck	Knee	Hip	Elbow	Shoulder	Thumb
Type of						
Joint						
Bones						
Involved						

## Reference List:

https://opentextbc.ca/biology/chapter/19-3-joints-and-skeletal-movement/https://opentextbc.ca/biology/wp-

content/uploads/sites/96/2015/03/Figure 38 03 04.jpg

Six types of synovial joints: <a href="https://www.youtube.com/embed/zWo9-3GJpr8">https://www.youtube.com/embed/zWo9-3GJpr8</a>

## **Student Handouts:**

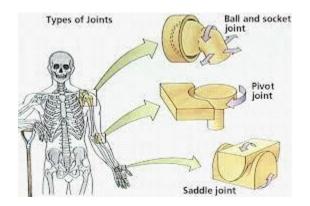
https://www.heart.org/idc/groups/heart-

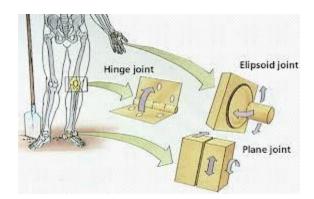
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%20homework%20and%20extensions.pdf

# Student Assessments:





# **Vocabulary**:

An articulation, or joint, is usually formed of fibrous connective tissue and cartilage. Joints are grouped according to their motion:

ball and socket joint; hinge joint; condyloid joint (a joint that permits all forms of angular movement except axial rotation); pivot joint; gliding joint; and saddle joint.



## articulation

joint of the body

# biaxial joint

type of diarthrosis; a joint that allows for movements within two planes (two axes)

## diarthrosis

freely mobile joint

# fibrous joint

joint where the articulating areas of the adjacent bones are connected by fibrous connective tissue

## joint

site at which two or more bones or bone and cartilage come together (articulate)

# joint cavity

space enclosed by the articular capsule of a synovial joint that is filled with synovial fluid and contains the articulating surfaces of the adjacent bones

## multiaxial joint

type of diarthrosis; a joint that allows for movements within three planes (three axes)

## synarthrosis

immobile or nearly immobile joint

# synovial joint

joint at which the articulating surfaces of the bones are located within a joint cavity formed by an articular capsule

# uniaxial joint

type of diarthrosis; joint that allows for motion within only one plane (one axis)