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.

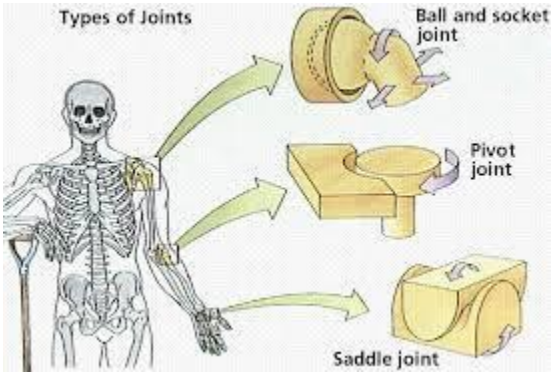
Location	Neck	Knee	Hip	Elbow	Shoulder	Thumb
Type of Joint						
Bones Involved						

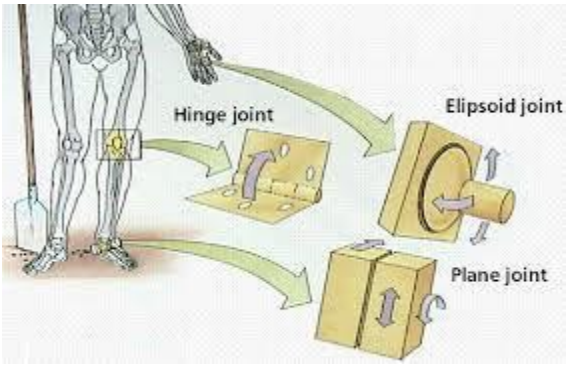
Reference List:
https://opentextbc.ca/biology/chapter/19-3-joints-and-skeletal-movement/
https://opentextbc.ca/biology/wp-content/uploads/sites/96/2015/03/Figure_38_03_04.jpg

Six types of synovial joints: https://www.youtube.com/embed/zWo9-3GJpr8

Student Handouts:
https://www.heart.org/idc/groups/heart-public/@wcm/@fc/documents/downloadable/ucm_306500.pdf
http://vle.brighouse.calderdale.sch.uk/frogweb/Parents%20Information/Physical%20Education/GCSE%20PE/Theory/GCSE%20Theory%20questions%20&%20resources/2.5%20-%20Skeletal%20system/2.5%20-%20All%20worksheets%20-%20homework%20and%20extensions.pdf

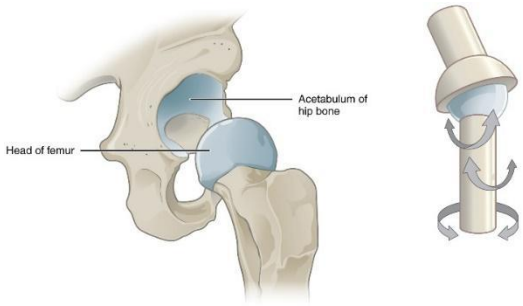
Student Assessments:





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)