DESIGN PROJECTS



KINETIC SCULPTURE

GRADE LEVEL

Grades 9-12

MODELING TIME

8-10 hours

MATERIALS

- PLA Filament – Approximately 117g

DESIGN OBJECTIVES

- 3D Printed
- No fasteners or adhesives
- Fully functional assembly

DESCRIPTION

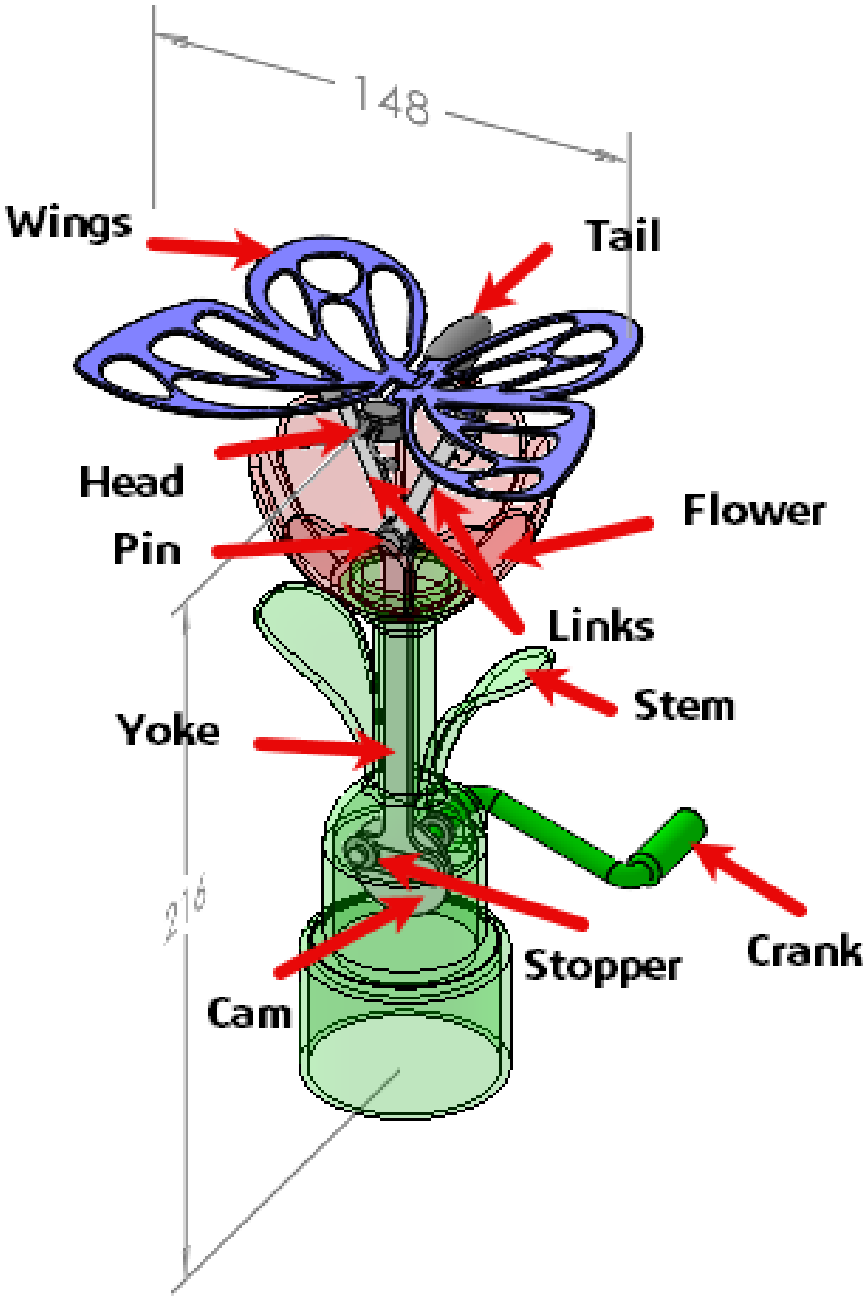
Blending art and engineering, kinetic sculptures showcase motion through cleverly arranged parts and linkages. In this project, students follow a guided design while learning the basics of surface modeling for artistic features and using assemblies to build mechanical motion.

This activity offers a wide range of possibilities for instructors. The individual components are simple enough for beginners to learn foundational CAD skills, while also introducing key concepts in motion planning. The result is a functional model that encourages students to explore how different mechanisms can produce a variety of movements. By the end, students will be equipped with the essential tools to one day design their own kinetic sculptures — and let their ideas take flight.

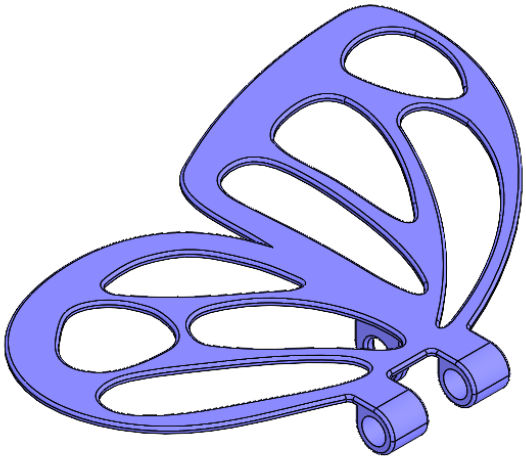
HISTORY

Kinetic sculptures have existed for centuries, blending motion with storytelling and mechanical ingenuity. In ancient Greece, inventors like Hero of Alexandria built automata powered by falling weights, water, or air to create lifelike movement in temples and theaters.
During the Islamic Golden Age, engineer Al-Jazari designed intricate water-powered machines—musical automatons, mechanical peacocks, and programmable servants—that showcased early robotics and advanced control systems.
By the 18th and 19th centuries in Europe, automata flourished—delicate, hand-cranked figures like musicians and dancers used cams, gears, and linkages to animate complex scenes. In the 20th century, artists like Jean Tinguely brought kinetic sculpture into modern art, using motion itself as a creative medium.

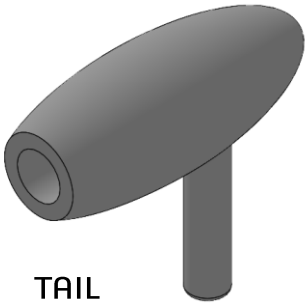
KINETIC SCULPTURE COMPONENTS



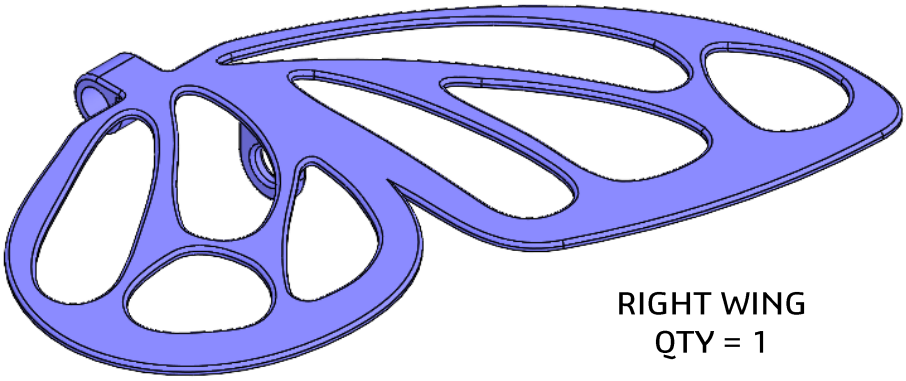
KINETIC SCULPTURE COMPONENTS



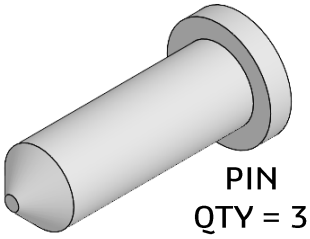
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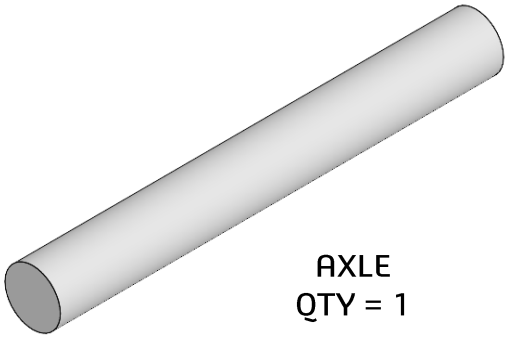
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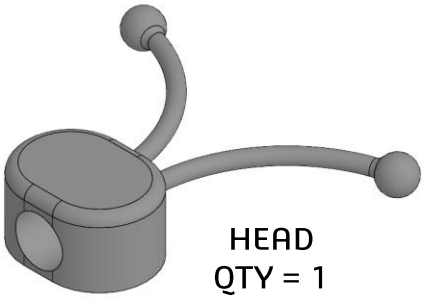
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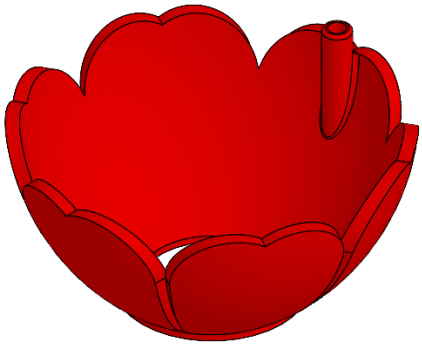


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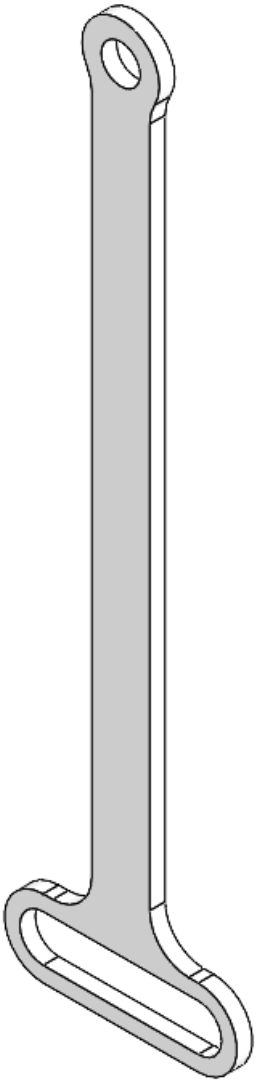


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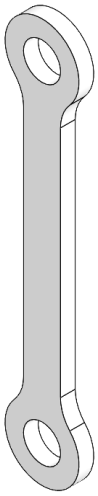
KINETIC SCULPTURE COMPONENTS



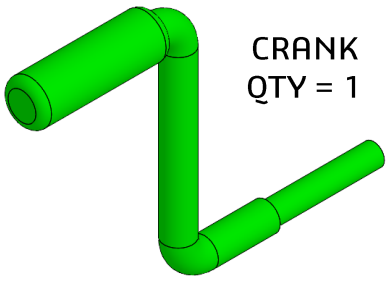
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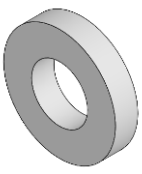
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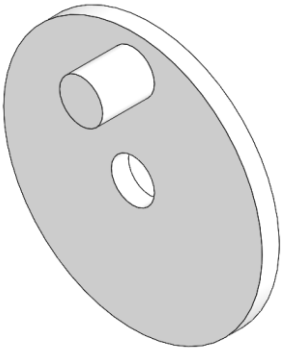
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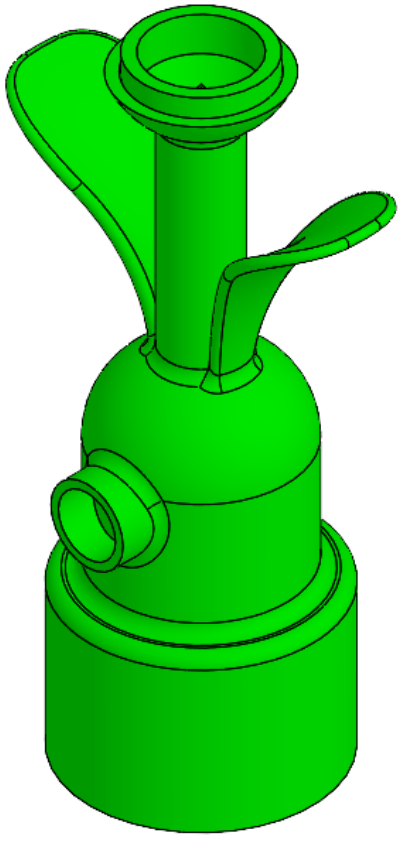
CRANK
QTY = 1



STOPPER
QTY = 5



CAM
QTY = 1



STEM
QTY = 1

EDUCATIONAL CONCEPTS

A kinetic sculpture design and construction project is an excellent way to blend art and engineering while integrating multiple STEM concepts. Here are some potential teaching approaches:

SCIENCE

- Examine kinematics by analyzing position, velocity, and acceleration of moving parts over time.
- Investigate torque, friction, and rotational dynamics and how they impact motion.

TECHNOLOGY

- Teach students to use 3D modeling software to design components with both artistic and mechanical functions.
- Demonstrate how 3D printers work, from slicing software to the actual printing process.
- Discuss additive manufacturing principles and how they differ from traditional methods.
- Emphasize the importance of DFAM, Designing for Additive Manufacturing, by minimizing waste through smart design

ENGINEERING

- Explore how cams, gears, and linkages translate crank input into controlled mechanical motion.
- Challenge students to incorporate different types of movement using a variety of mechanisms.
- Introduce collision detection and failure analysis to identify and resolve weak points in assemblies.
- Encourage iterative design and creative problem-solving to improve motion efficiency and alignment.

MATHEMATICS

- Apply geometric principles in designing effective linkages and motion paths.
- Calculate angles, lengths, and proportions for accurate CAD modeling and proper assembly fit.
- Analyze rotational speed, distances, and motion output to compare design performance.

OPTIONAL CHALLENGES

- Assign roles (e.g., design engineer, materials specialist) to mimic real-world engineering teams.
- Challenge students to power sculpture using another source (e.g., Wind powered, weight powered, water powered)

DISCUSSION STARTERS

- What types of linkages could be used to turn the spinning motion into different movements?
- How does friction in the moving parts affect the overall efficiency and smoothness of the sculptures motion?
- What are some other ideas for a hand-cranked kinetic sculpture? (e.g., walking animals, flapping birds, blooming flowers, bouncing figures, jumping frogs, swimming fish, orbiting planets)
- How might material choices or part tolerances impact the performance of a hand-powered mechanism?

ASSESSMENT CRITERIA

- **SUSTAINABILITY –** How much waste is generated in the manufacturing process?
- **ASSEMBLY –** With no adhesives or fasteners, does the model hold together on its own?
- **MANUFACTURABILITY –** Do the components fit within the parameters of the 3D printer?
- **PERFORMANCE –** How well does it showcase motion considering factors like smoothness, consistency, and responsiveness to rotation?

ADDITIONAL RESOURCES

LINK TO DOCUMENTS

LINK TO YOUTUBE VIDEO

LINK TO STEP-BY-STEP