Stepping Stone:

You need to know ...

- The uses of gears and how they are used in motion.
- The uses of gears and how they are used in motion.
- Basic information about gears (Driver, Follower or Driven, Gear train) and gear ratio.

You will be able to...

- Utilize Pascal's Principle to enhance the force application in hydraulic robotic arms.
- Apply Bernoulli's Principle in the design and operation of pneumatic robotic arms.
- Prevent or mitigate resonance effects that could impair the robotic arm's performance.

let's Think

What type of pressure works best for your robotic arm?

How can you design your robotic arm to stay stable and avoid unwanted movements?

Explore

Attach small weights to the end of a flexible ruler or rod. Strike the tuning fork and hold it near the ruler to observe the vibration.

Observation Questions:

- **What happens to the ruler when the tuning fork vibrates at different frequencies?**

- **How does the amount of weight on the ruler affect its vibration?**

- **What does this suggest about how a robotic arm might react to different forces during operation?**

Use the hairdryer to blow air over the top of a ping pong ball. Observe how the ball behaves in the airflow. Then, create and fly paper planes with different designs.

Observation Questions:

- **What happens to the ping pong ball when air blows over it? Why does it stay in the air?**

- **How does the design of the paper plane affect its flight? Which design flies the furthest or stays in the air the longest?**

- **How can controlling airflow in a robotic arm's pneumatic system make it move more smoothly?**

Connect two syringes of different sizes with tubing and fill them with water. Push on the smaller syringe and observe the movement of the larger one.

Observation Questions:

- **What happens to the larger syringe when you push the smaller one? How does the force change?**

- **How does changing the size of the syringes affect the force and movement?**

- **How could this principle be used to design a robotic arm that can lift heavy objects with minimal effort?**

Watch it..

To understand how the robotic arm will work, let's watch this video.

Scan Here!

https://www.youtube.com/watch?v=MylCSqKC6SE

Read about it

To learn more about the parts of the robotic arm, let's watch this video.

https://rozum.com/servos-as-robot-components/

Scan Here!

Resonance:

- **Definition:** When an object vibrates strongly at its natural frequency due to matching external vibrations.
- **Rule:** Avoid matching the natural frequency of parts to prevent damage.

Bernoulli's Principle:

- **Definition:** As fluid speed increases, its pressure decreases.
- **Rule:** Use faster airflow to reduce pressure and control movement in systems.

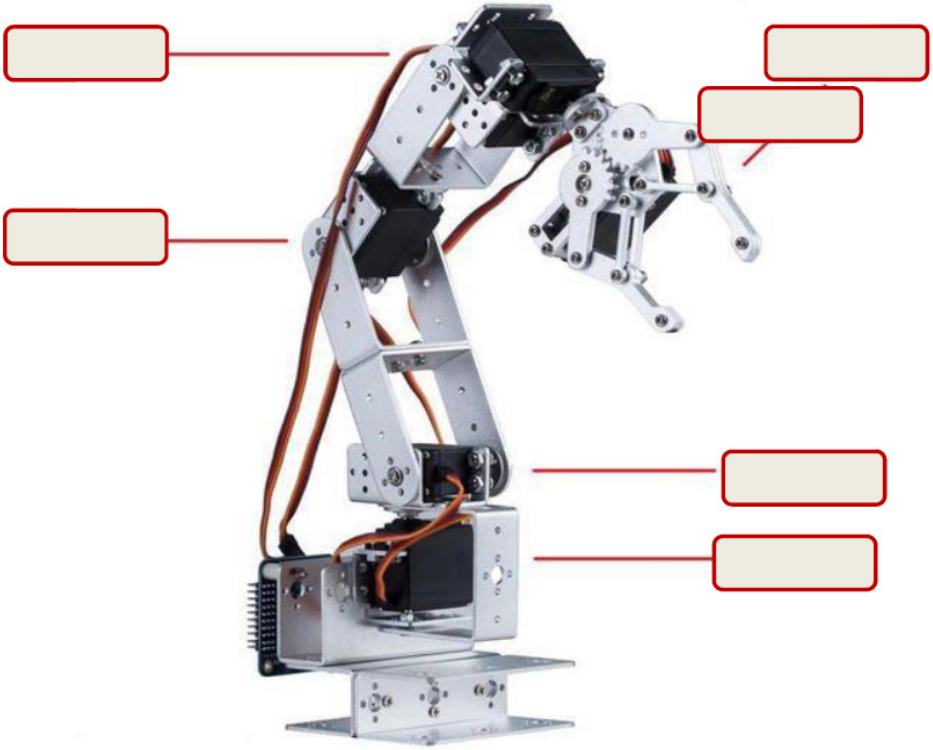
Pascal's Principle:

- **Definition:** Pressure applied to a fluid is transmitted equally in all directions.
- **Rule:** Use it to amplify force in hydraulic systems for lifting.

Assessment

Focus

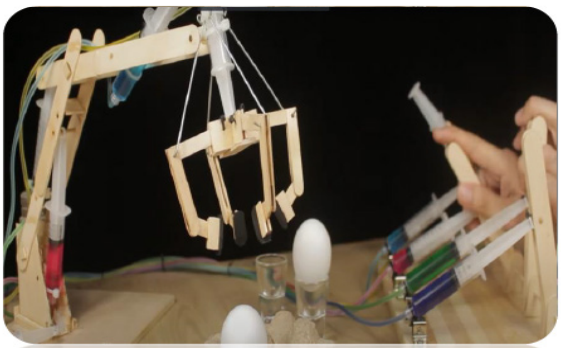
Fill in the gaps to complete the robotic arm parts.



Practice

Construct a robotic arm using appropriate materials, powered by syringes for movement.

Make it move right, left, up and down and grip things.



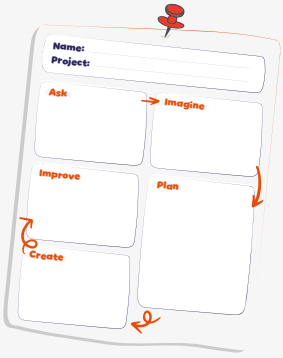
Challenge

Your robotic gripper is effective at holding various objects, but it struggles with metallic items.

How could you modify the gripper's design to enhance its ability to attract and hold onto metals?

Consider what materials or components you could add to improve its functionality.

After we learned what are the parts we need for our robotic arm and how to make it work better let's go back to our EDP paper and add these parts to the planning part..



Now I can...

- **Prevent or mitigate resonance effects that could impair the robotic arm's performance.**
- **Apply Bernoulli's Principle in the design and operation of pneumatic robotic arms.**
- **Utilize Pascal's Principle to enhance the force application in hydraulic robotic arms.**