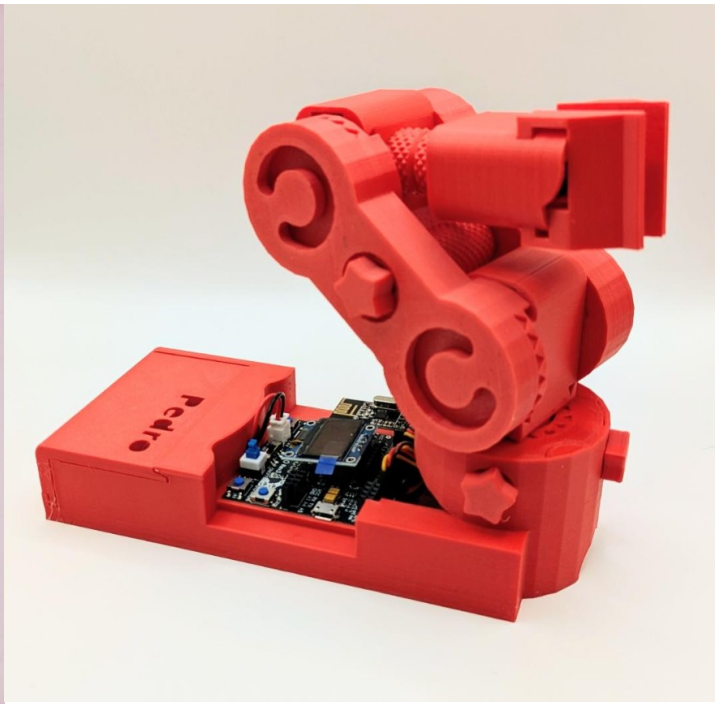
Pedro STEM Lesson n°1
v1.0

« Discover Pedro Robot »



https://pedrobot.com

🎯 Learning Objective

Discover the Pedro robot, understand its basic operation, and explore its different control modes.

Students will learn:

- Basic concepts of robotics (programming, embedded systems, planetary gear systems)
- How a 3D printer works
- How to identify the components of a robot
- How to assemble a robot

🛠️ Required Materials

✅ All Pedro robot parts printed in 3D
✅ 2 ball bearings **8x22x7 mm**
✅ 4 continuous rotation (**360°**) servomotors
✅ 1 micro USB cable
✅ 7.4V battery
✅ Pedro Rev3 Electronic Board
✅ PC (Windows, Linux, or OS X) with Arduino IDE installed

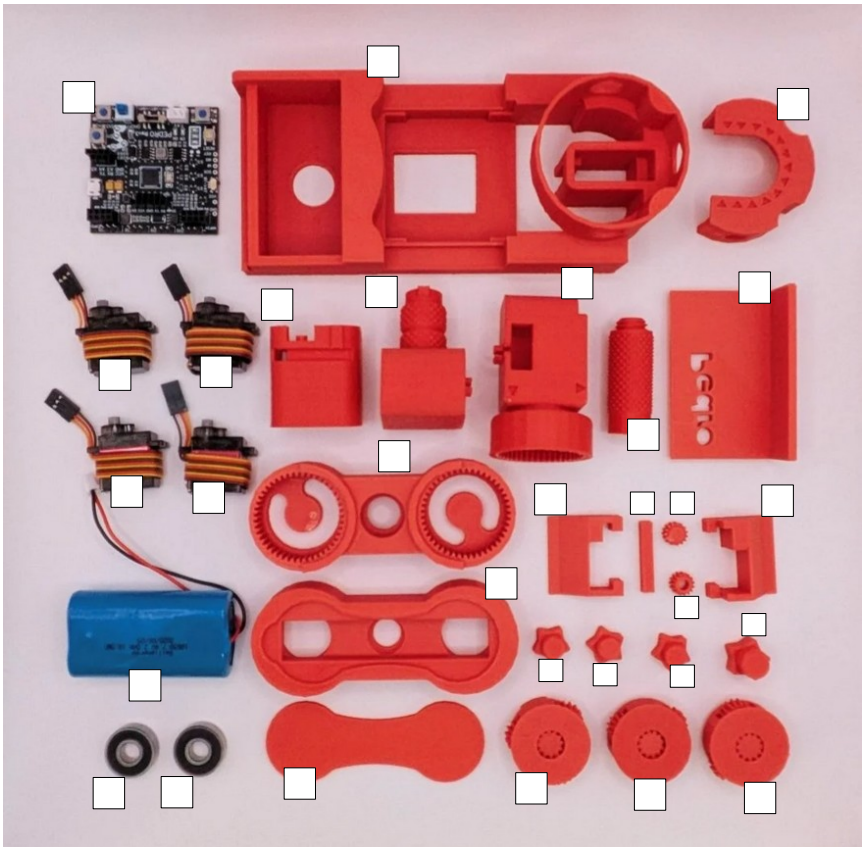
⚙️ Installing and Uploading Pedro Firmware

1. **Download and install** the latest version of the Arduino IDE.
2. **Install the required libraries** from the Library Manager:
    - **PedroRobot**: Tools → Manage Libraries → search **PedroRobot** → Install
    - **U8glib**: Tools → Manage Libraries → search **U8glib** → Install
    - **RF24**: Tools → Manage Libraries → search **RF24** → Install
3. **Connect** your Pedro robot to your computer via USB.
4. **Select the correct port**:
    - Tools → Select the port that appear when you connect Pedro robot
5. **Select the board type**:
    - Tools → Board → Arduino Micro
6. **Open the example sketch**:
    - File → Examples → PedroRobot → Pedro
7. **Compile and upload** the sketch to your Pedro board.

✅ Done! Your Pedro robot is now ready to run with the latest firmware.

1. Materials Check:

Make sure you have all the parts before starting the assembly.
Check all the parts by putting an ✅ next to each part of Pedro robot.



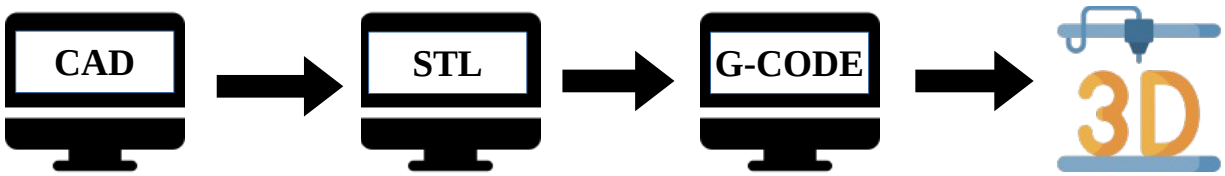
What You Should Know About Pedro

*All the parts of **Pedro** are **3D printed**. As you can see, there are **no screws** in the pieces that make up Pedro. **Which makes Pedro a 100% 3D-printed robot.***

What Is 3D Printing?

3D printing is a technology that allows us to create solid objects by **melting and layering plastic filament**. Before printing a part, several important steps are needed:

1. **Design (CAD):**
   The first step is to design the part using a **CAD (Computer-Aided Design)** software. This program lets us draw the object in **three dimensions** on a computer.
2. **Export to STL:**
   Once the design is finished, it is **converted into an STL file**. This file describes the shape of your object using **a set of precise coordinates and numbers**.
3. **Generate the G-code:**
   The STL file is then converted into a **G-code file**. G-code contains the exact **instructions the 3D printer follows** to create the part **layer by layer**. Usually, the G-code is **saved on a microSD card**, which is then inserted into the 3D printer to start printing.



2. Robotics Concept:

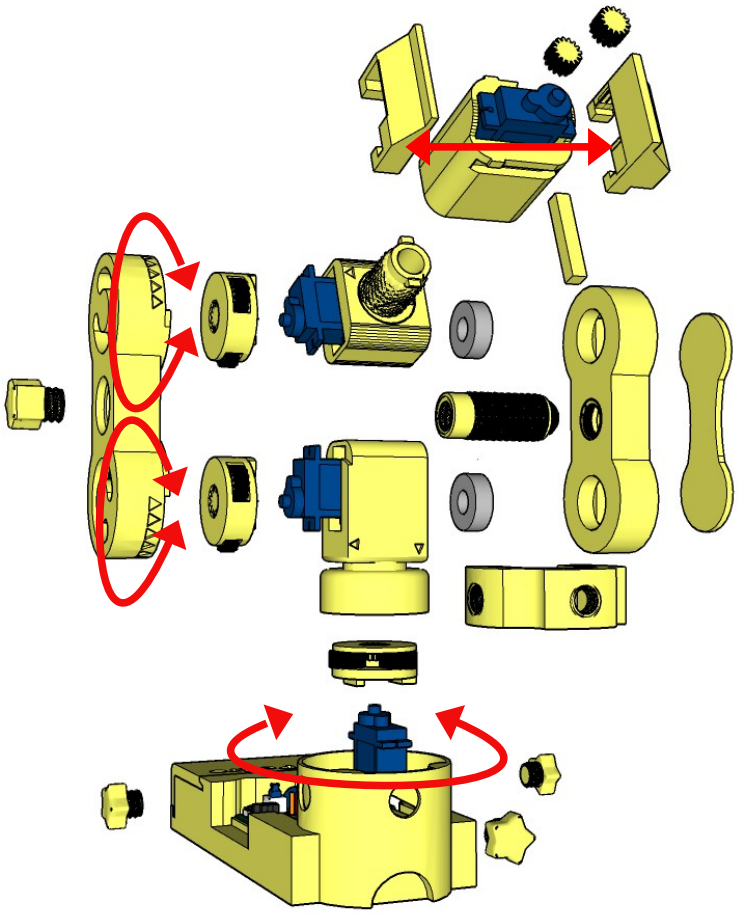
As robotic arm Pedro is equipped with **four servomotors**, each serving a distinct purpose in its movement. Three servomotors control the movement axes, allowing for a **180° rotation** for each axis, while the fourth servomotor is dedicated to the gripper.

- The **first servomotor** controls the base rotation, facilitating horizontal movement translation.
- The **second servomotor** manages the shoulder, enabling vertical rotation.
- The **third servomotor** operates the elbow, facilitating pick-up movements.
- Finally, the **fourth servomotor** controls the gripper, enabling Pedro to grasp objects securely.

Together, these servomotors enable Pedro to perform a wide range of precise and coordinated movements, making it an effective tool for various robotic applications.

Mechanical Components

- **3D Printed Parts**: High-quality PLA or ABS, providing durability and strength.
- **Ball Bearings**: Three precision bearings for enhanced movement accuracy:
    - **Base Bearing**: Ensures stable and precise rotational movement.
    - **Elbow Bearing**: Provides accurate and fluid bending at the first articulation.
    - **Arm Bearing**: Offers smooth motion and stability at the arm joint.



3. Planetary gear system

Pedro features three planetary motion modules, fully 3D-printed. These modules enable smooth and precise movements, powered by a MG30S 360° motor placed at the center of each joint.

What is a planetary gear system in robotics?

A planetary gearbox is a gear mechanism that optimizes motion transmission by reducing speed and increasing torque. It consists of:
⚙️ The sun gear: the central gear (driven by the motor)
⚙️ The planet gears: three gears rotating around the sun
⚙️ The ring gear (here replaced by Pedro's structure), holding everything together

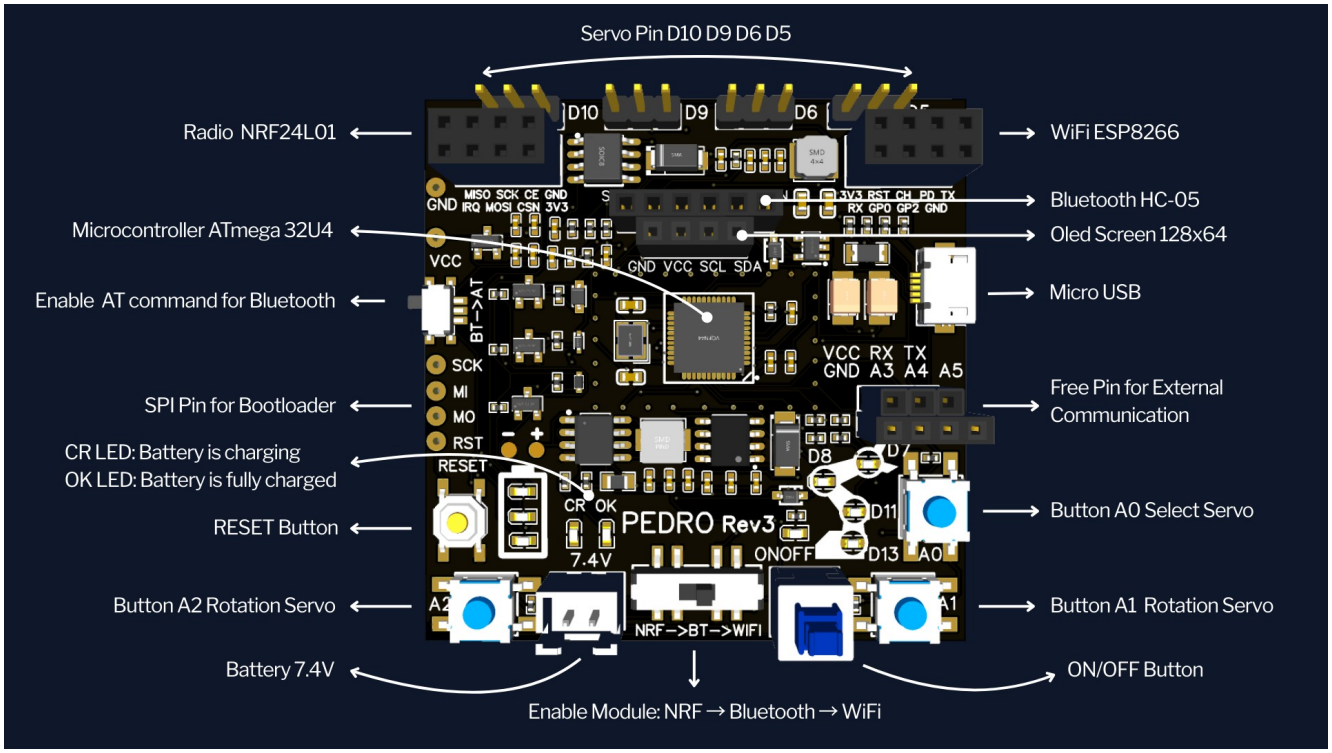
Why use a planetary system on Pedro?

✅ Increased power and precision
✅ Compact and robust design
✅ Fully 3D-printable with no complex parts

This system allows Pedro to execute smooth and precise movements in its three main joints: the base, shoulder, and elbow. No screws, no glue just 100% 3D printed

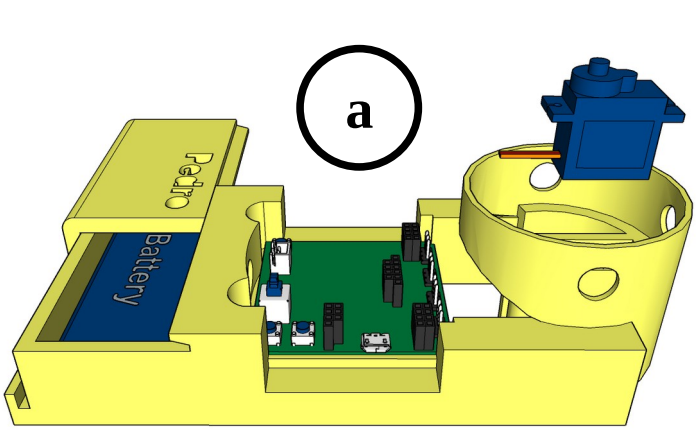
4. The Pedro Board

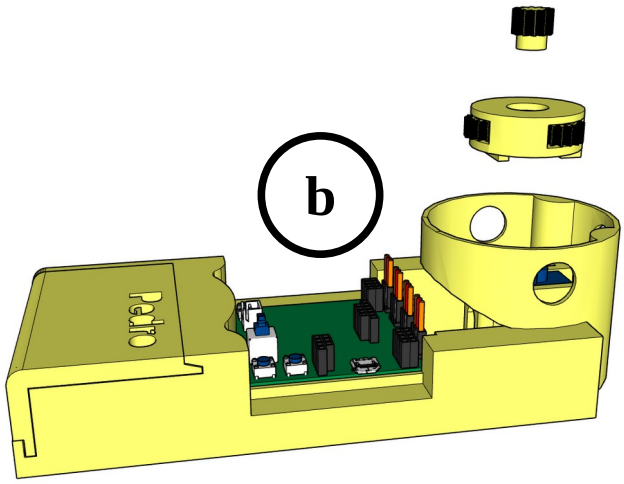
- **OLED Screen (128x64)**: Visualize data, debug in real-time, or create interactive menus.
- **NRF24L01**: Enable long-range wireless communication between Pedro or devices.
- **ESP8266-01 WiFi Module**: Bring your Pedro online with ease. (**Rev3 only**)
- **HC-05 Bluetooth Module**: Connect wirelessly to smartphones or other devices. (**Rev3 only**)

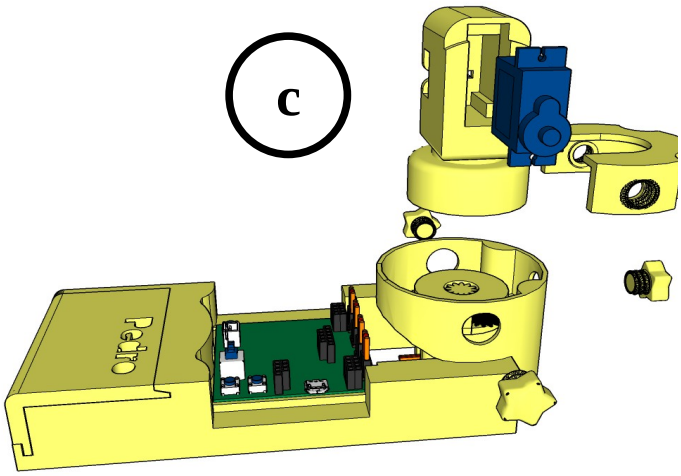


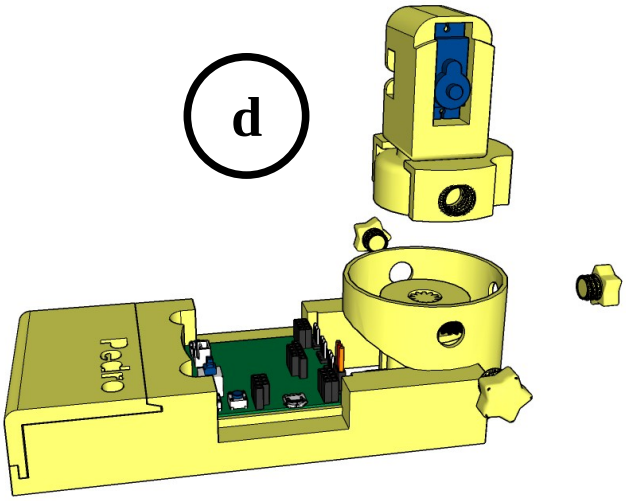
3. Assembling:

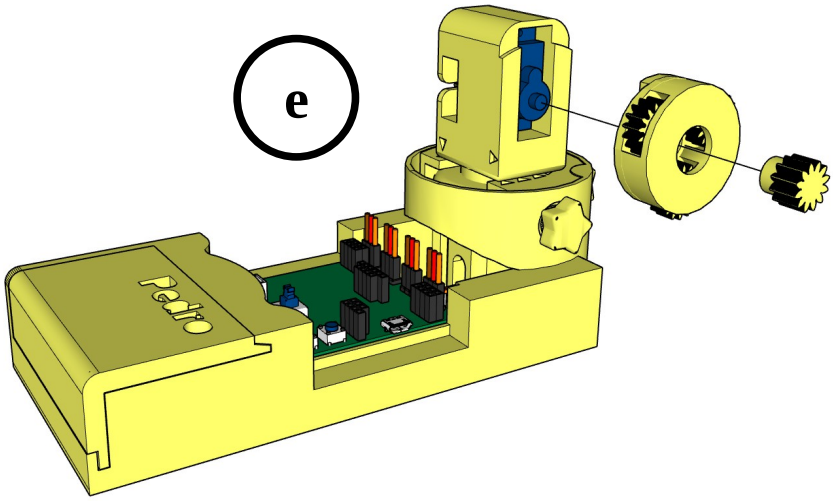
Step 1:

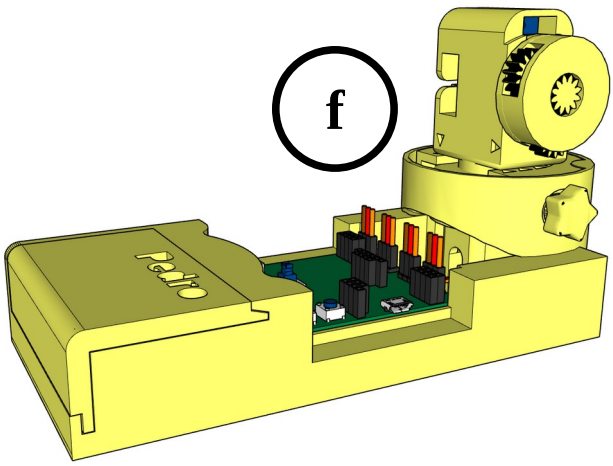




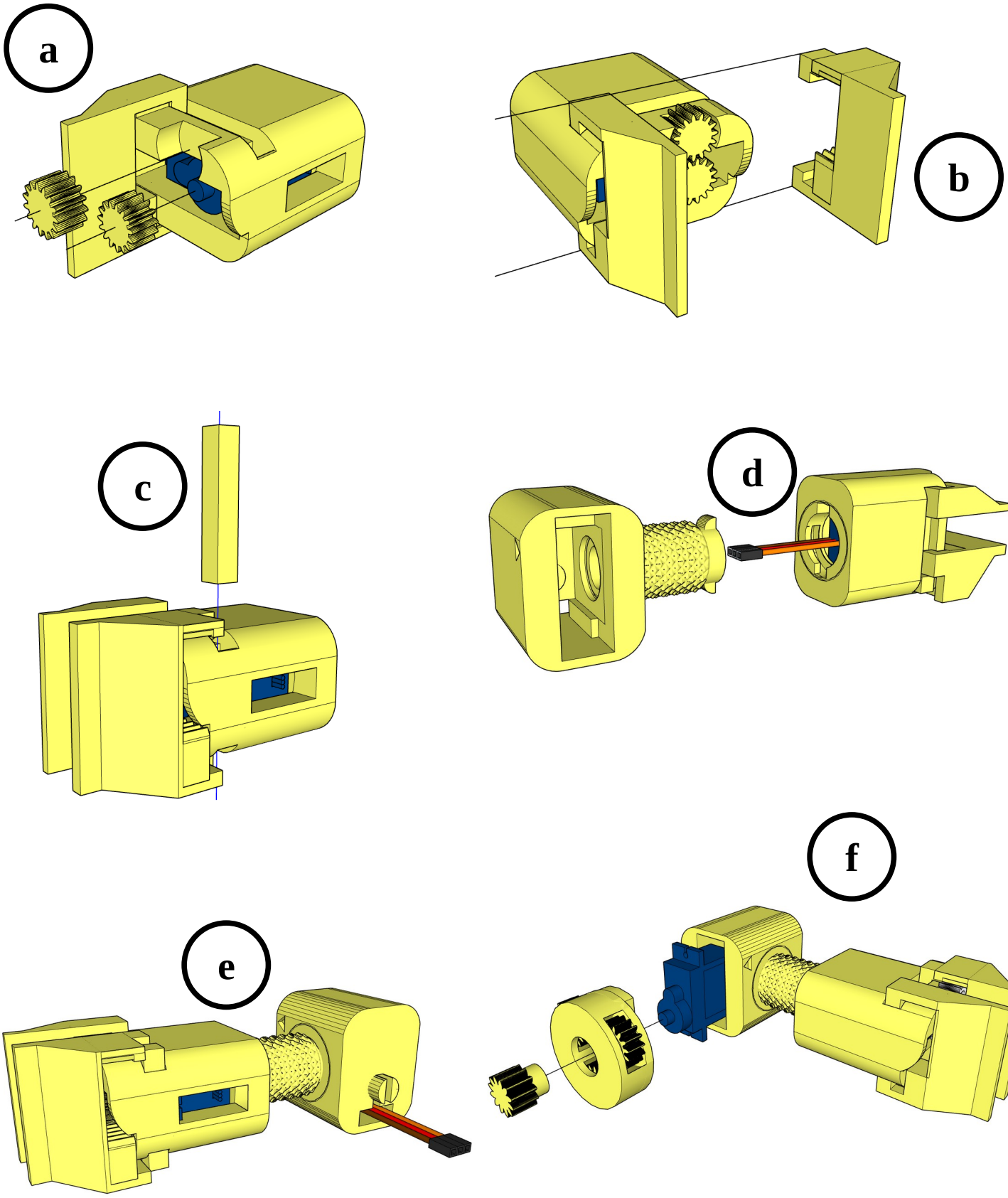




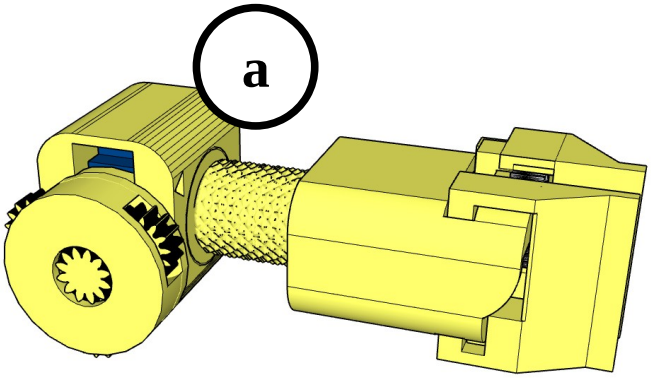


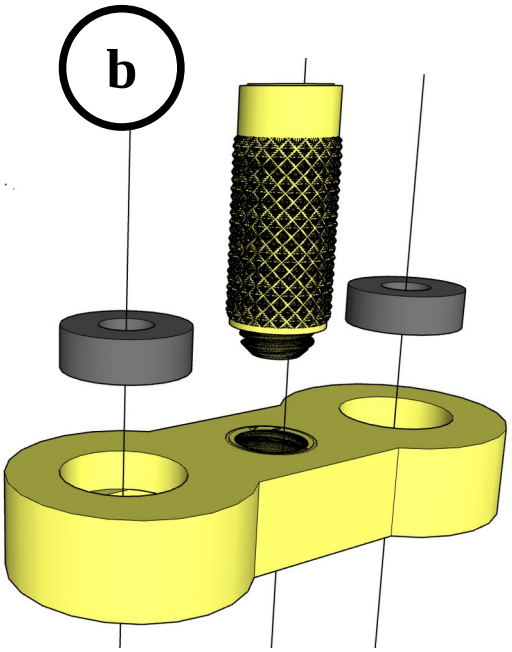


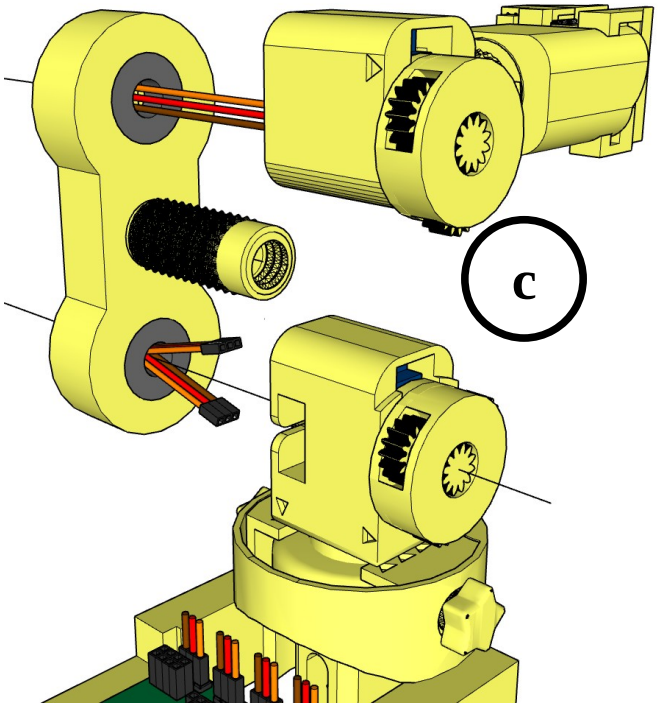
Step 2:

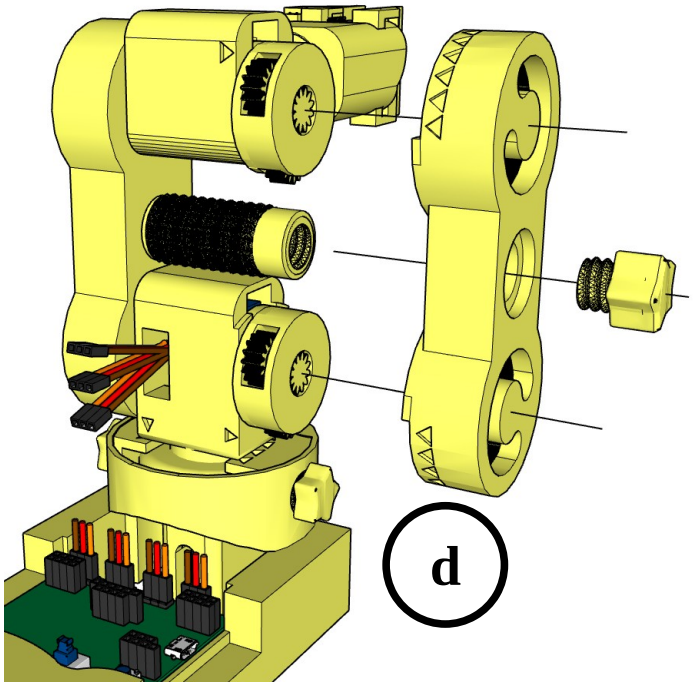


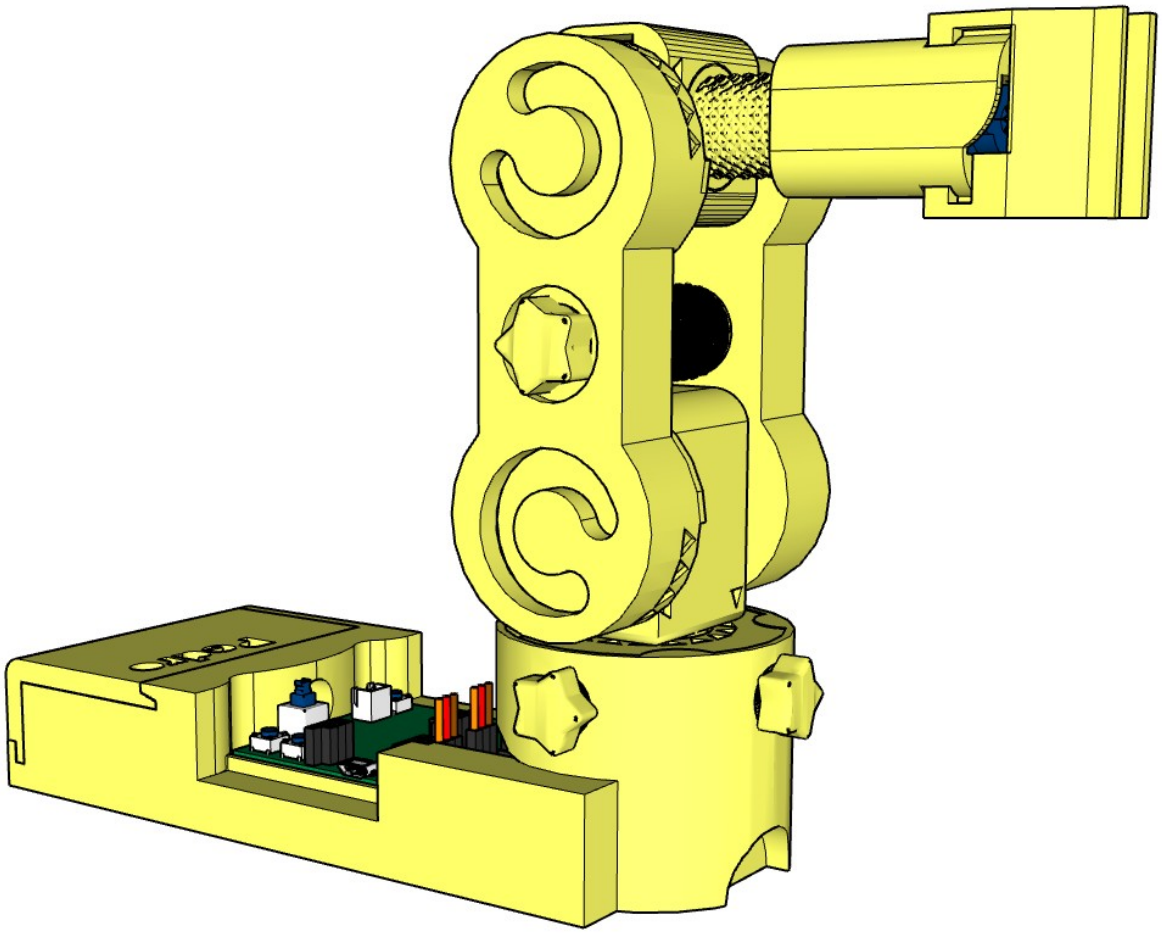
Step 3:











Multiple Choice Quiz ✅