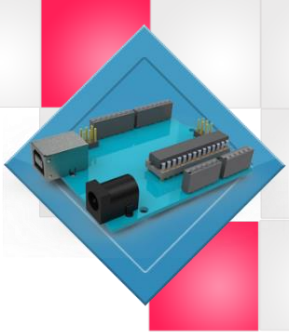
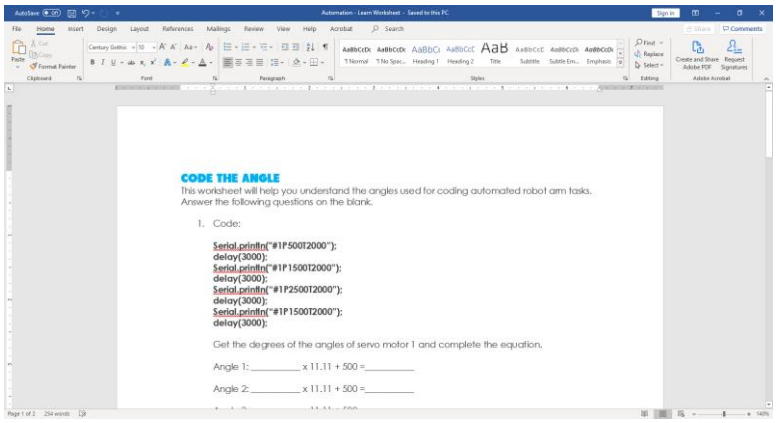


AUTOMATION

PICK UP AND PLACE

STEPS

1 **Download and print Automation - Learn Worksheet.docx.**



CODE THE ANGLE

This worksheet will help you understand the angles used for coding automated robot arm tasks. Answer the following questions on the blank.

1. Code:

```
Serial.println("#1P500T2000");
delay(3000);
Serial.println("#1P1500T2000");
delay(3000);
Serial.println("#1P2500T2000");
delay(3000);
Serial.println("#1P1500T2000");
delay(3000);
```

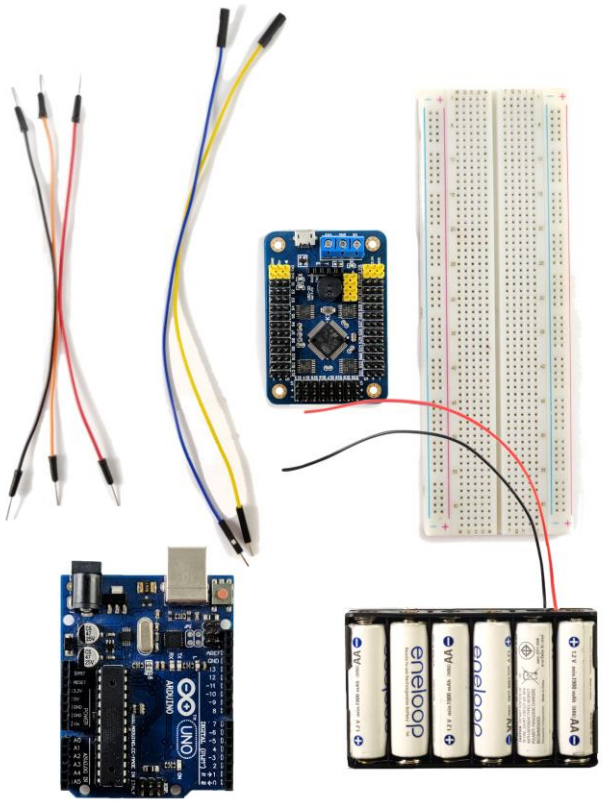
Get the degrees of the angles of servo motor 1 and complete the equation.

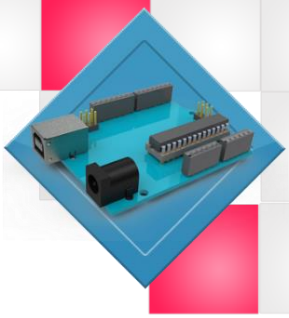
Angle 1: _____ x 11.11 + 500 =_____

Angle 2: _____ x 11.11 + 500 =_____

2 **Prepare the needed items:**

servo motor drive shield
3 male-to-male jumper wires
2 female-to-male jumper wires
breadboard
6 batteries
battery holder
Arduino



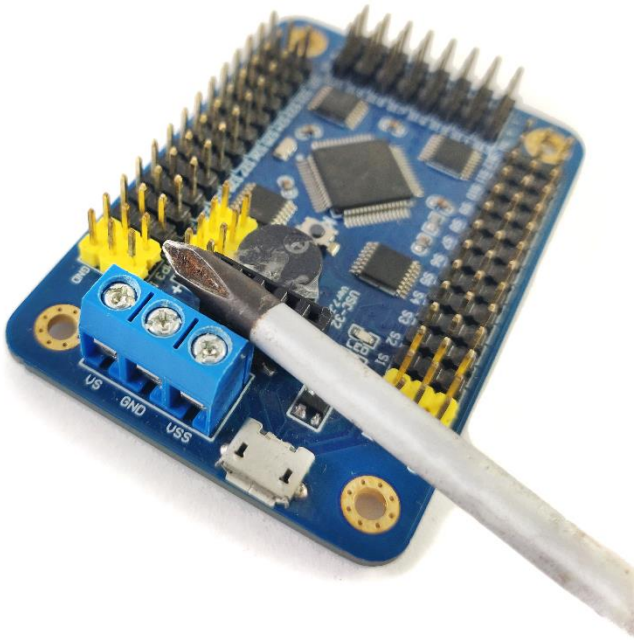


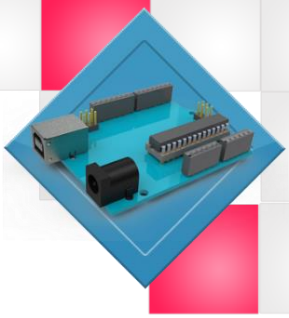
AUTOMATION

PICK UP AND PLACE

3 **Connect the wires.**

First, unscrew the VS, GND, and VSS nuts from the servo motor drive shield.

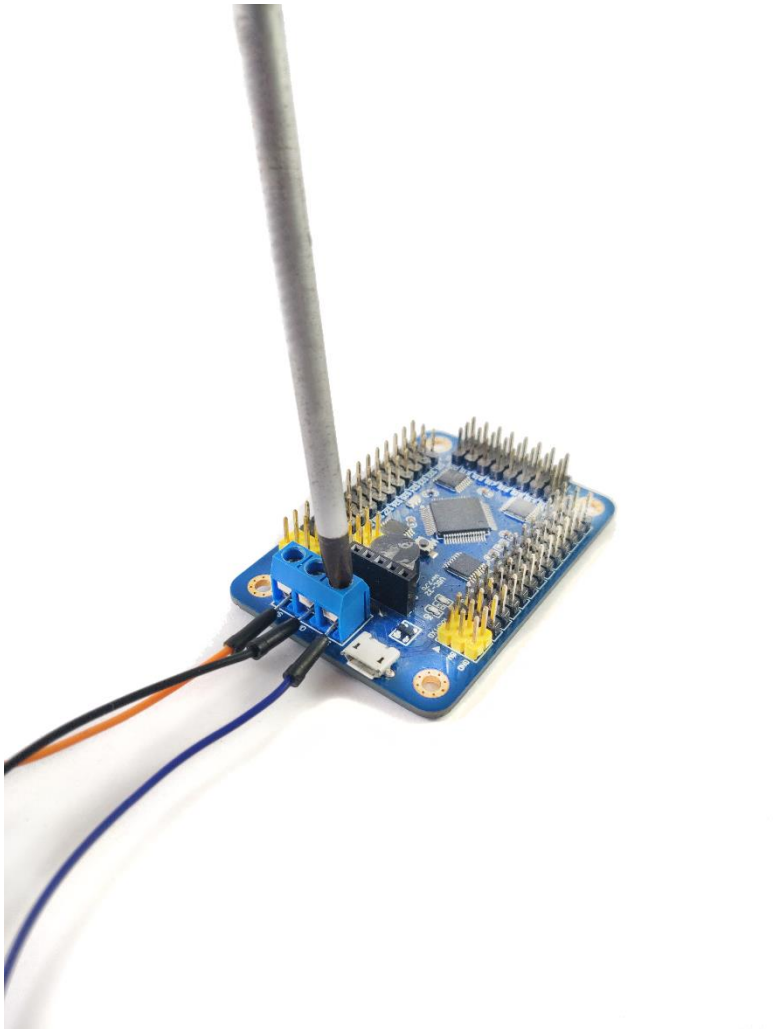


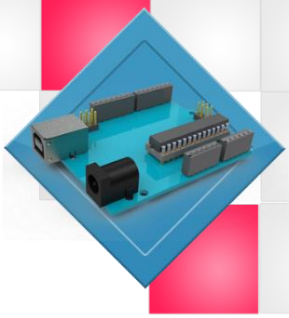


AUTOMATION

PICK UP AND PLACE

Then, insert the three **male-to-male jumper wires** before tightly screwing the VS, GND, and VSS nuts back to lock the jumper wires in place. Use a **black** or **any dark jumper wire** for the **GND nut**, and a **light-colored jumper wire** each for the **VS** and **VSS nuts**.



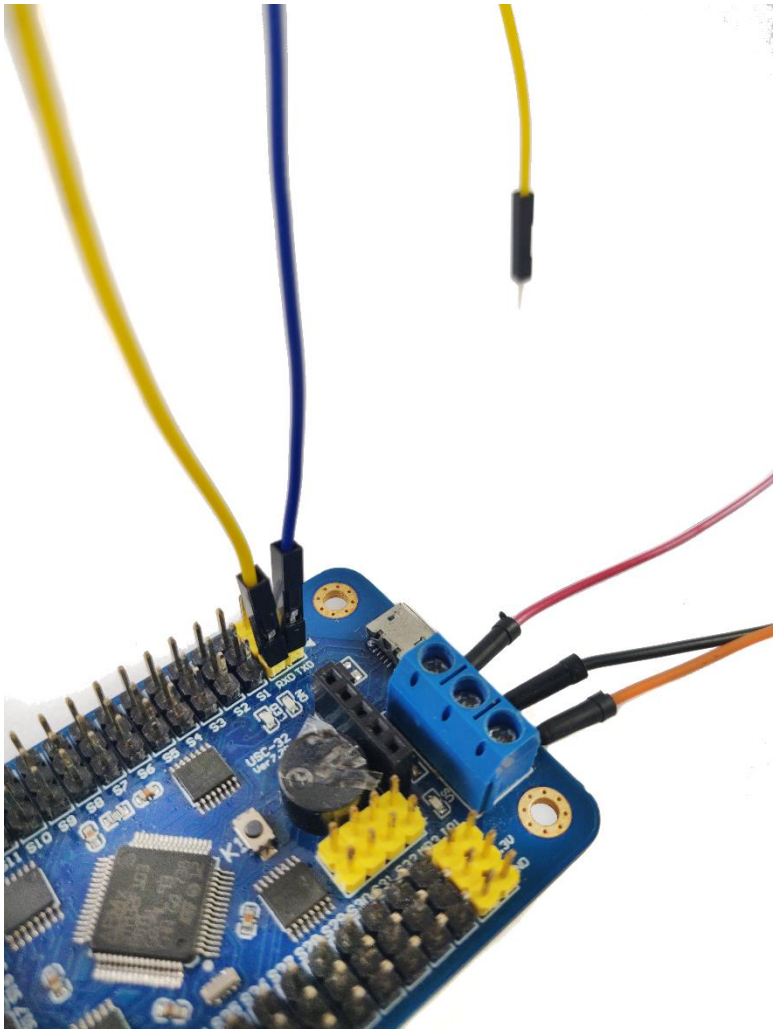


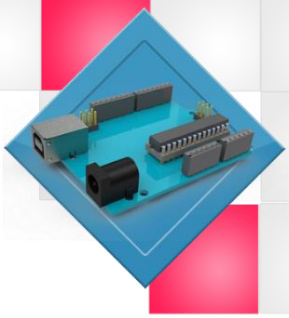
AUTOMATION

PICK UP AND PLACE

4 **Connect the signal.**

Insert the female side of the jumper wire to the **RX** and **TX pins** of the servo motor drive shield.





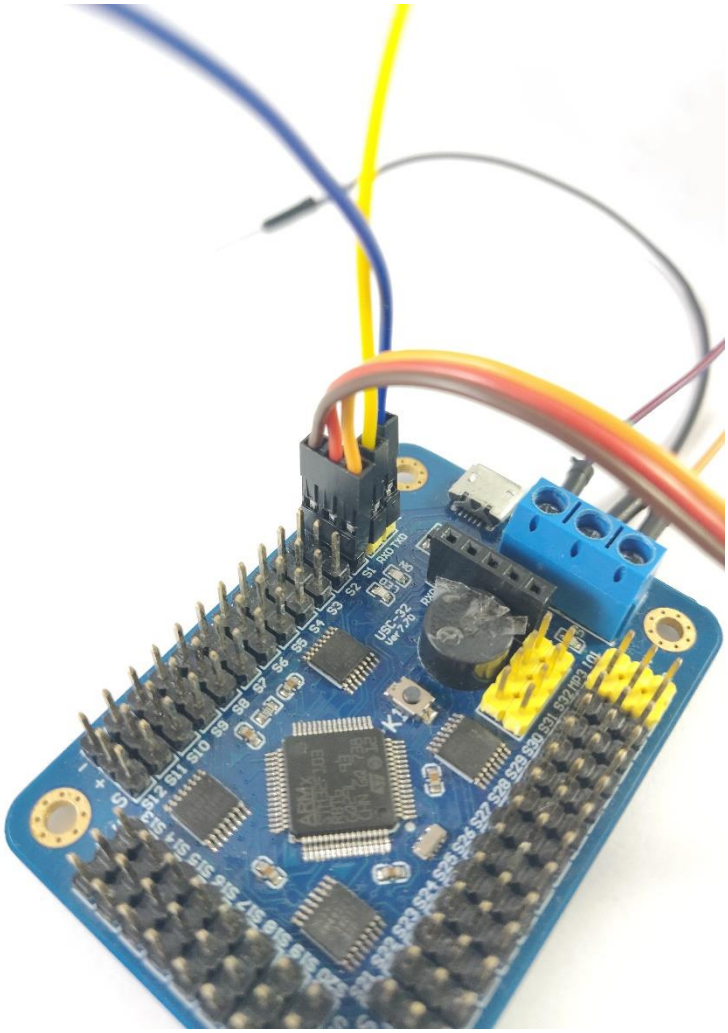
AUTOMATION

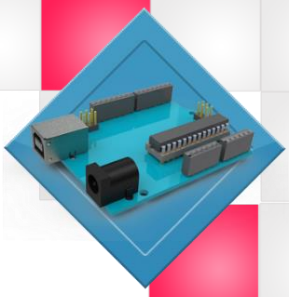
PICK UP AND PLACE

5 **Drive the servo motor.**

Connect the servo motors of your robot arm to the drive shields as follows:

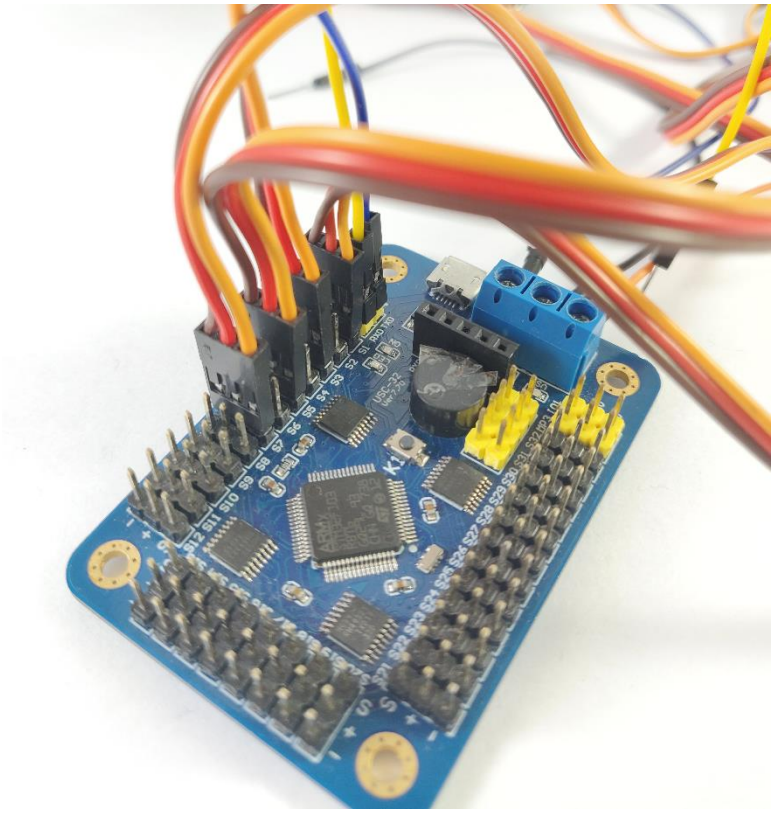
Servo motor 1 to **pin S1**
Servo motor 2 to **pin S3**
Servo motor 3 to **pin S5**
Servo motor 4 to **pin S7**

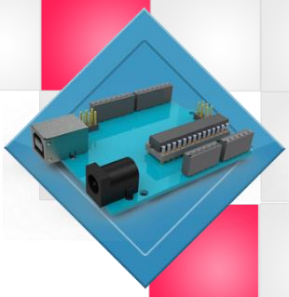




AUTOMATION

PICK UP AND PLACE



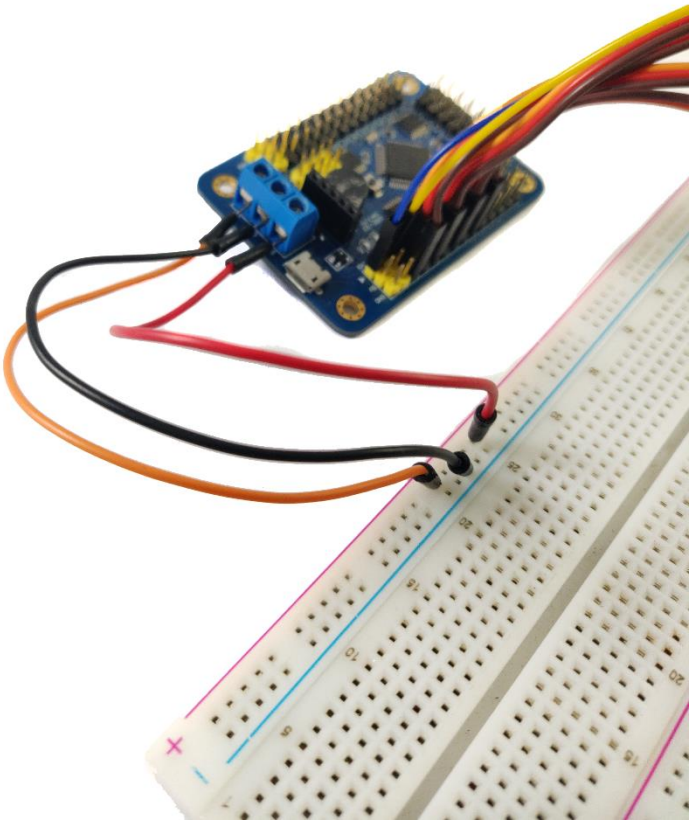


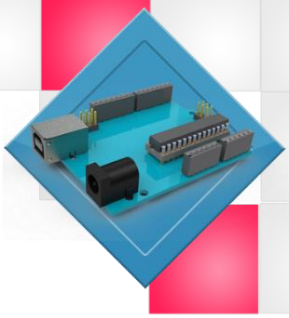
AUTOMATION

PICK UP AND PLACE

6 **Finish the connection.**

Connect the **VS** and **VSS wires** to the **positive horizontal run** and the **GND wire** to the **negative horizonal run** of the breadboard.

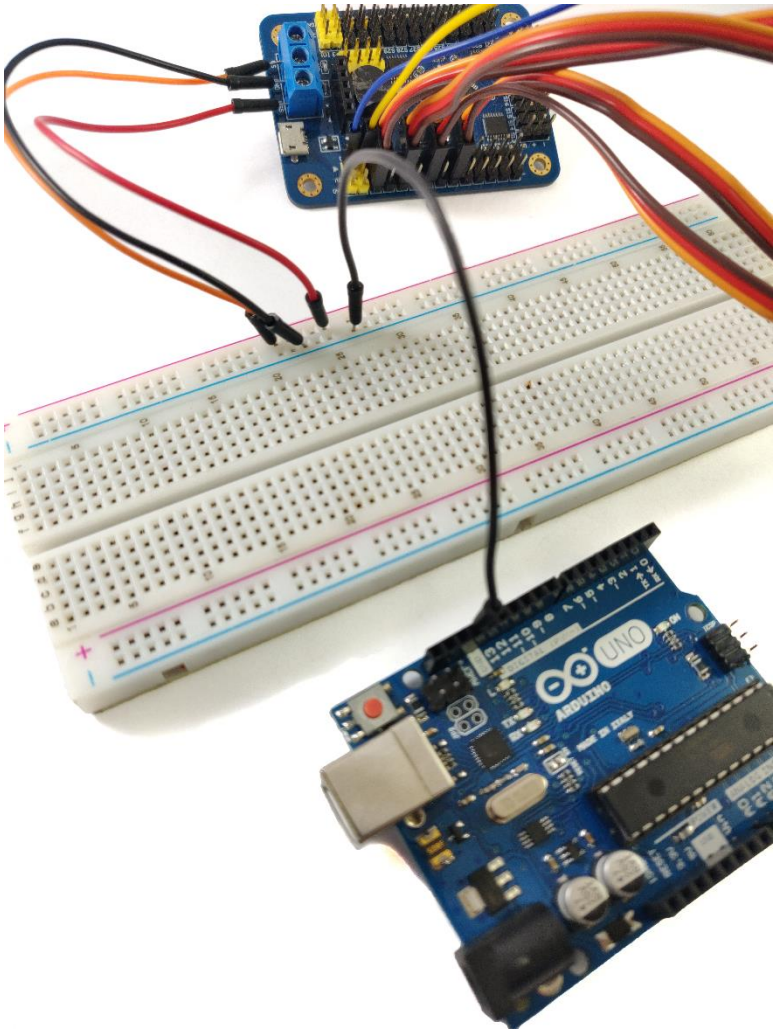


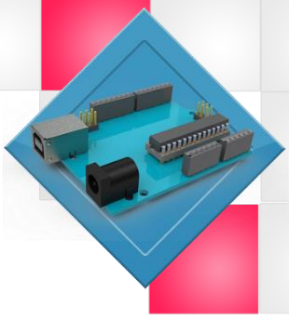


AUTOMATION

PICK UP AND PLACE

Add a **black jumper wire** to the **negative horizontal run** and connect it to the **ground pin** of the Arduino.

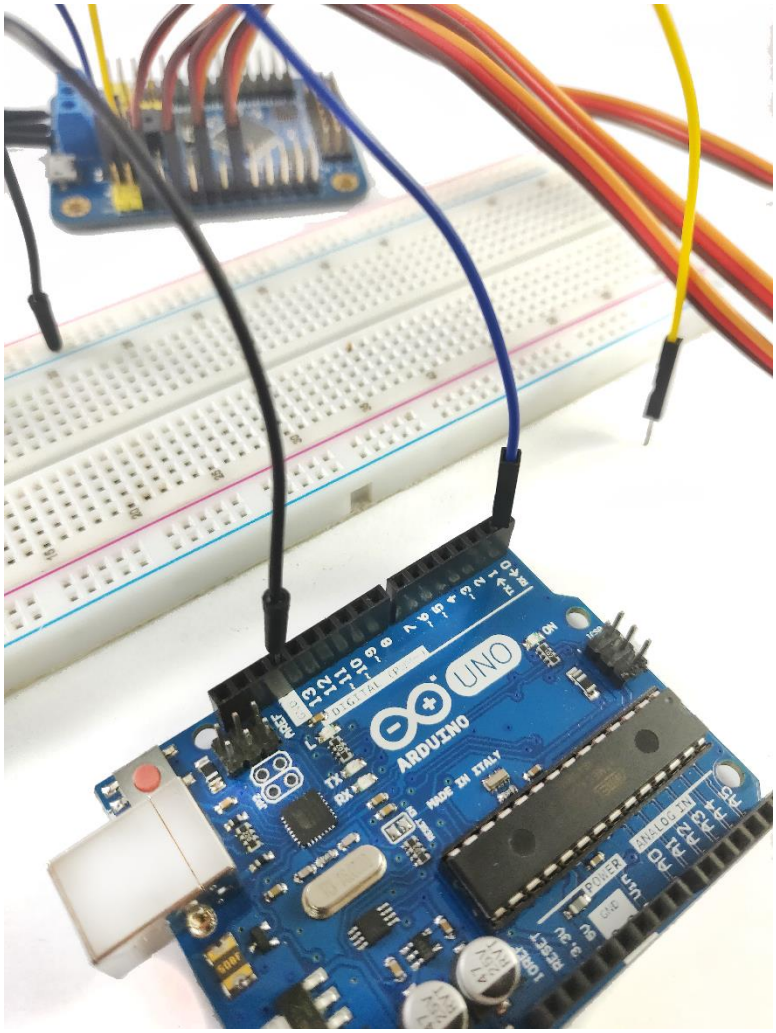


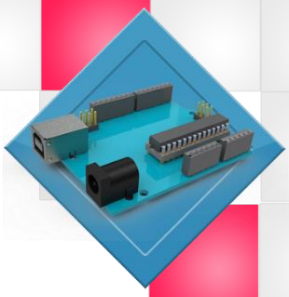


AUTOMATION

PICK UP AND PLACE

Connect the **TX wire** to the **RX pin** of the Arduino.

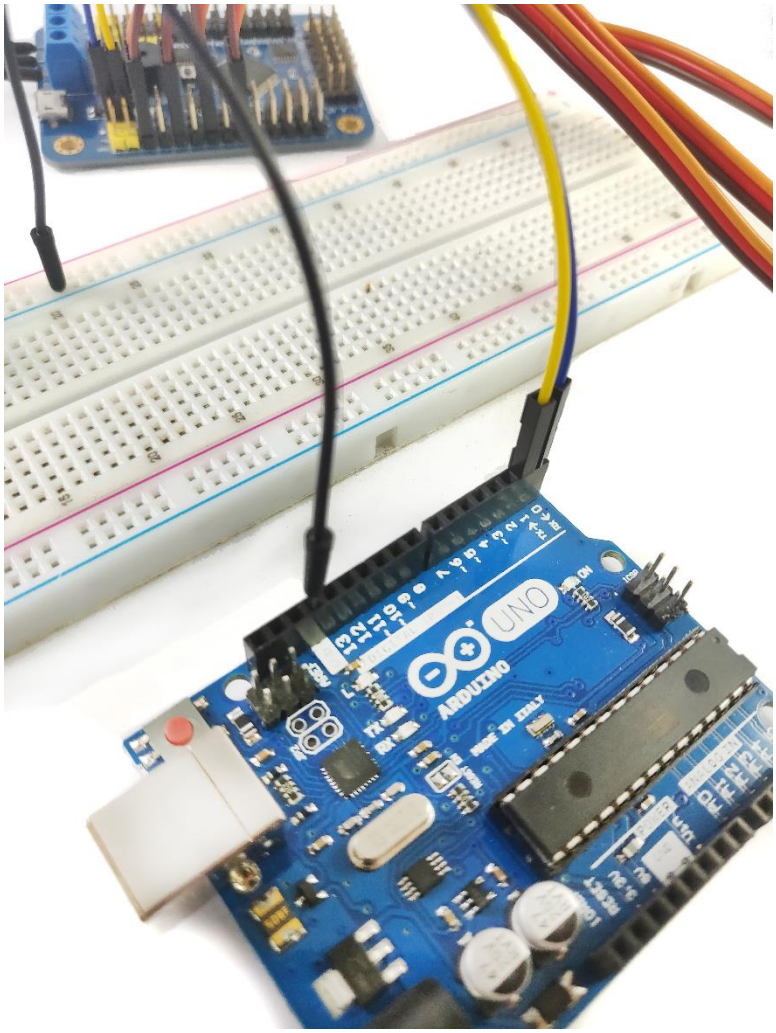


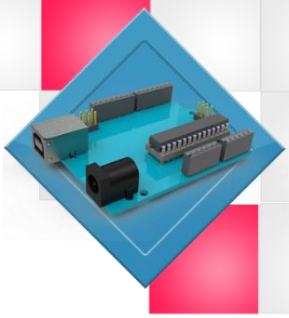


AUTOMATION

PICK UP AND PLACE

Connect the **RX wire** to the **TX pin** of the Arduino.



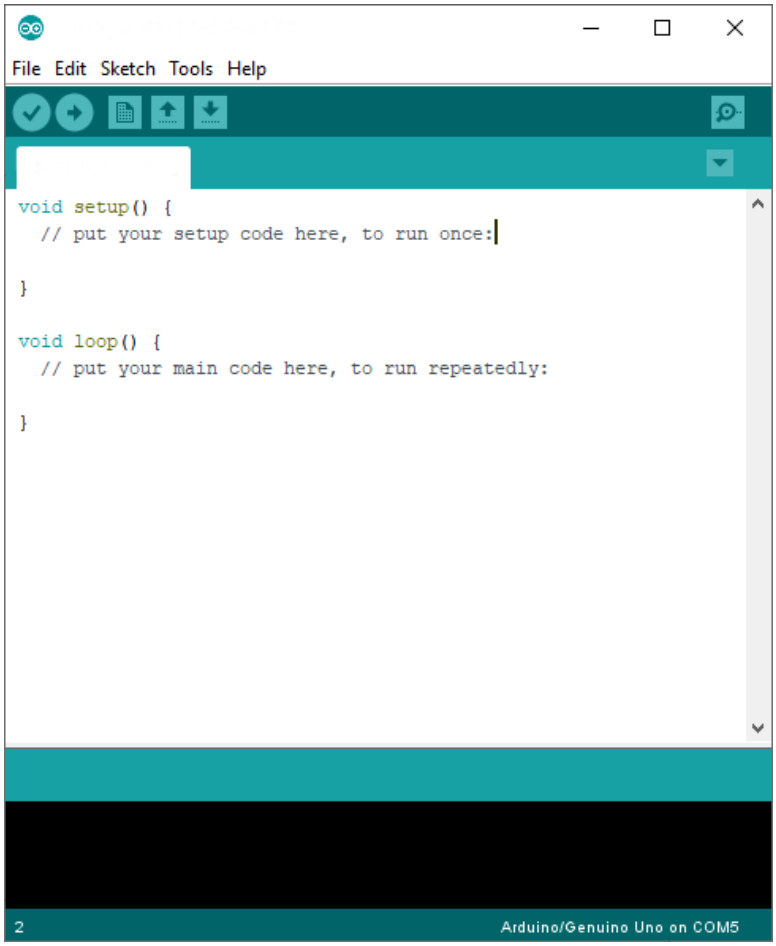


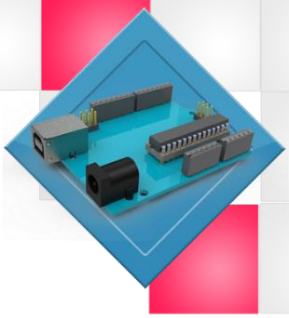
AUTOMATION

PICK UP AND PLACE

7 **Encode.**

Open **Arduino IDE** and create a new file.



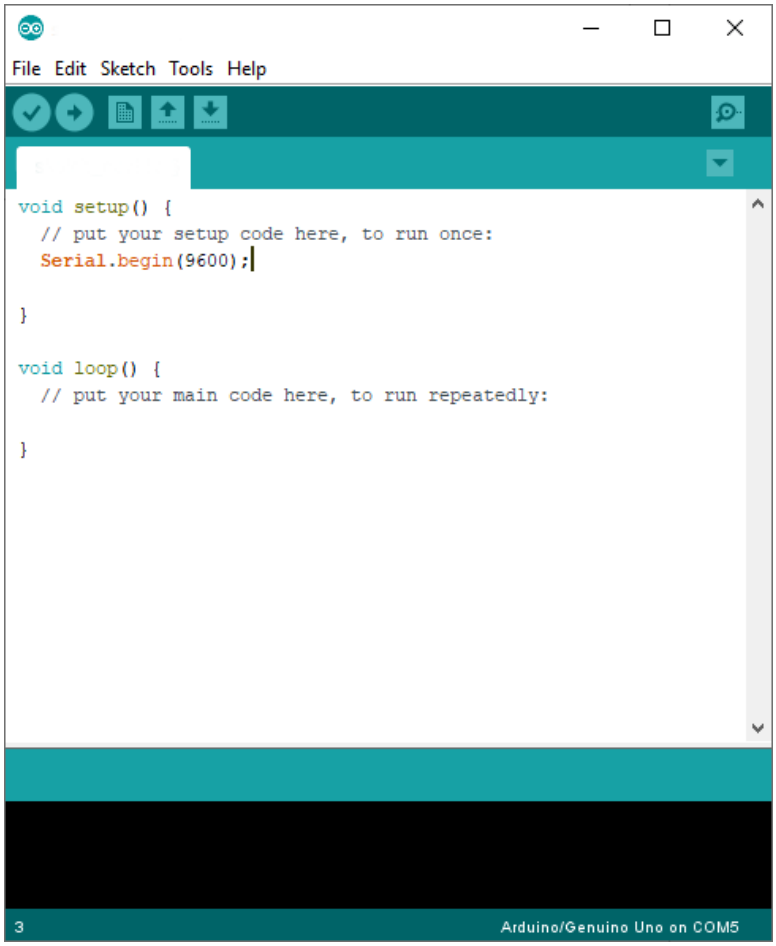


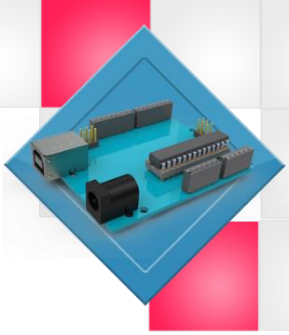
AUTOMATION

PICK UP AND PLACE

8 **Begin the serial.**

Begin the serial inside **void setup()** by coding **Serial.begin(9600);** which will initiate the serial communication.





AUTOMATION

PICK UP AND PLACE

Inside **void loop()**, type the following:

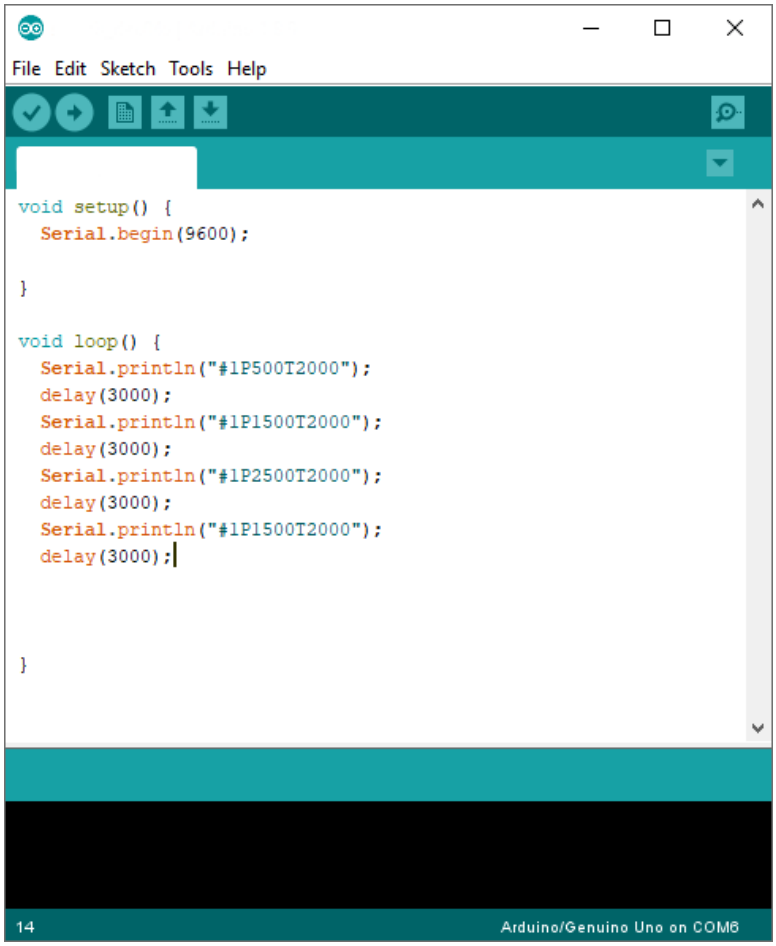
Serial.println("#1P500T2000");
delay(3000);
erial.println("#1P1500T2000");
delay(3000);
Serial.println("#1P2500T2000");
delay(3000);
Serial.println("#1P1500T2000");
delay(3000);

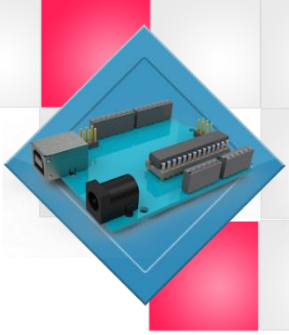
Cut the power from the battery by removing either the positive or negative wire from the battery holder.

Before uploading the code, remove the RX and TX wires connected to the Arduino first. Otherwise, the code will not upload properly.

After uploading, reconnect the RX and TX wires to their respective pins. Also reconnect the positive and negative wires from the battery holder to the breadboard.

Observe the robot arm move and answer the Automation – Learn Worksheet.





AUTOMATION

PICK UP AND PLACE

9 **Continue the serial.**

Inside **void loop()**, type the emboldened codes:

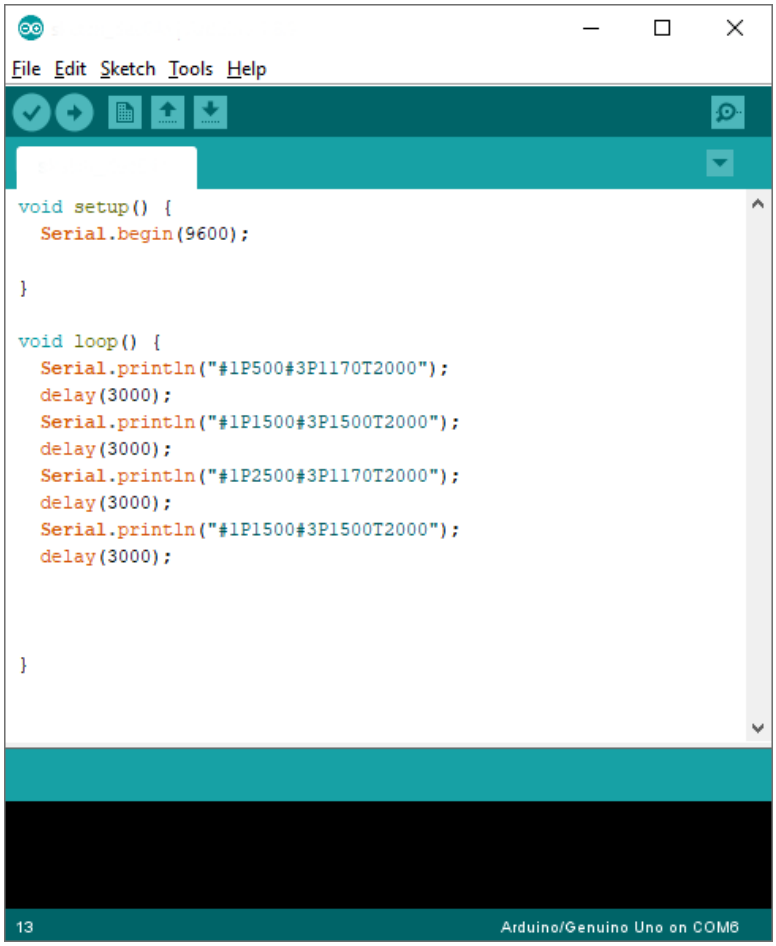
```
Serial.println("#1P500#3P1170T2000");
delay(3000);
Serial.println("#1P1500 #3P1500T2000");
delay(3000);
Serial.println("#1P2500#3P1170T2000");
delay(3000);
Serial.println("#1P1500#3P1500T2000");
delay(3000);
```

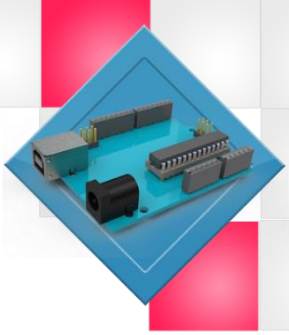
Cut the power from the battery by removing either the positive or negative wire from the battery holder.

Before uploading the code, remove the RX and TX wires connected to the Arduino first. Otherwise, the code will not upload properly.

After uploading, reconnect the RX and TX wires to their respective pins. Also reconnect the positive and negative wires from the battery holder to the breadboard.

Observe the robot arm move and answer the Automation – Learn Worksheet.





AUTOMATION

PICK UP AND PLACE

Inside **void loop()**, type the emboldened bold codes:

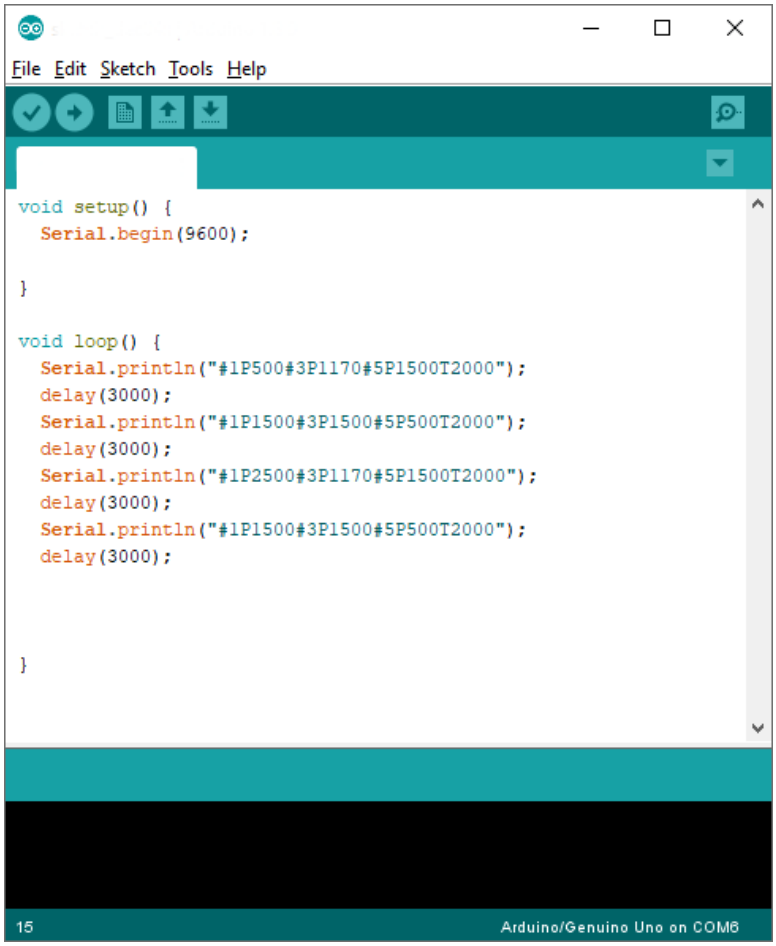
```
Serial.println("#1P500#3P1170#5P1500T2000");
delay(3000);
Serial.println("#1P1500#3P1500#5P500T2000");
delay(3000);
Serial.println("#1P2500#3P1170#5P1500T2000");
delay(3000);
Serial.println("#1P1500#3P1500#5P500T2000");
delay(3000);
```

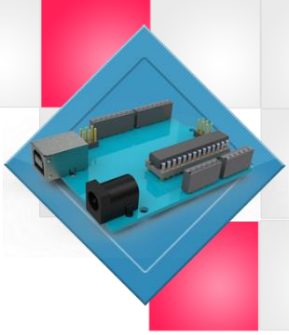
Cut the power from the battery by removing either the positive or negative wire from the battery holder.

Before uploading the code, remove the RX and TX wires connected to the Arduino first. Otherwise, the code will not upload properly.

After uploading, reconnect the RX and TX wires to their respective pins. Also reconnect the positive and negative wires from the battery holder to the breadboard.

Observe the robot arm move and answer the Automation – Learn Worksheet.





AUTOMATION

PICK UP AND PLACE

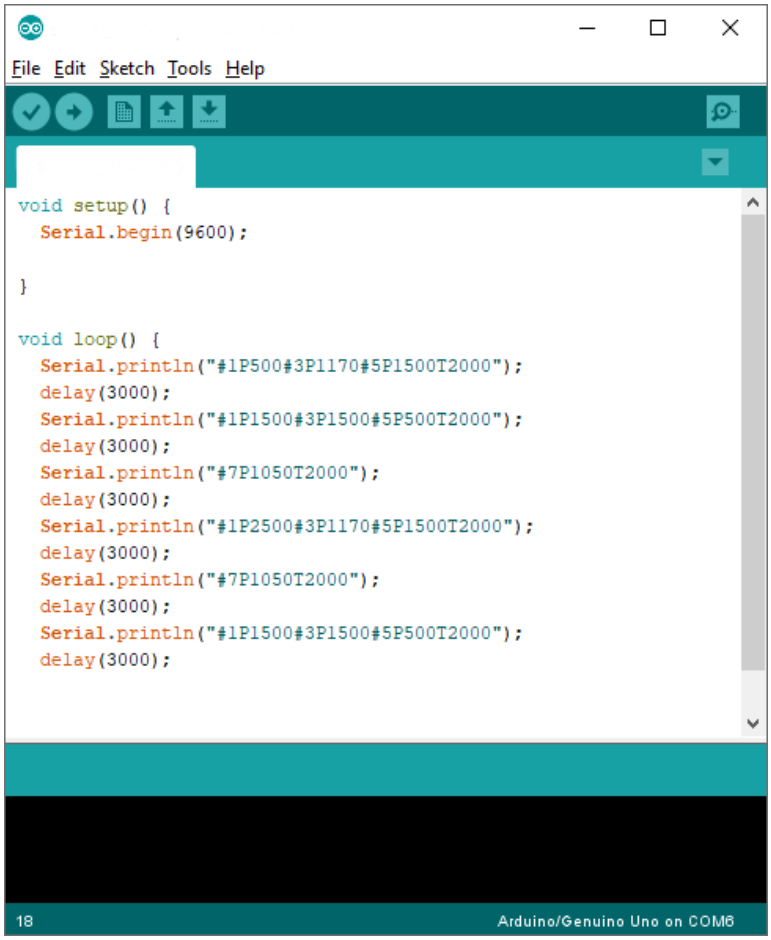
Inside **void loop()**, type the emboldened codes:

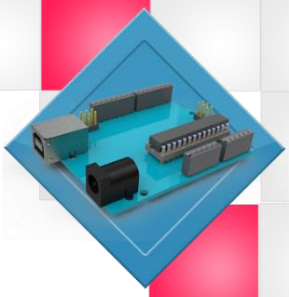
Serial.println("#1P500#3P1170#5P1500T2000");
delay(3000);
Serial.println("#1P1500#3P1500#5P500T2000");
delay(3000);
Serial.println("#7P1050T2000");
delay(3000);
Serial.println("#1P2500#3P1170#5P1500T2000");
delay(3000);
Serial.println("#7P610T2000");
delay(3000);
Serial.println("#1P1500#3P1500#5P500T2000");
delay(3000);

Cut the power from the battery by removing either the positive or negative wire from the battery holder.

Before uploading the code, remove the RX and TX wires connected to the Arduino first. Otherwise, the code will not upload properly.

After uploading, reconnect the RX and TX wires to their respective pins. Also reconnect the positive and negative wires from the battery holder to the breadboard.





AUTOMATION

PICK UP AND PLACE

You have now automated the robot arm. Observe how it moves and answers the Automation – Learn Worksheet.