

Hydraulic Robot Arm

Design Brief:

Student teams will construct and operate a hand-made hydraulic robot to understand the mechanical and hydraulic properties of mechanisms.

Tools and Materials:

copies **Handouts**

large and small syringes

tubing

cardboard

wood

glue

screws

nails

various lab materials and tools necessary to complete the projects

25 ping pong balls

2 containers large enough to hold ping pong balls

Procedure:

1. Introduce the robot arm activity by demonstrating a working model.
2. Explain how to construct the robot arm using working drawings.
3. Organize the class into design teams. (Three is the optimal number due to the number of controls. The students will build the control that they will eventually operate.)
4. Distribute materials necessary to complete the arm. Having the materials cut to the correct sizes before the students begin construction will speed the assembly process. The materials can be determined using the working drawings. The hardware lists for the arm and controller as well as the drawings for assembly are listed.
5. Assist students as needed in lab and remind them of lab safety.
6. Discuss the robot arm competition and rules with the students.
7. Set up the game space and conduct the competition. Award prizes to the winners.



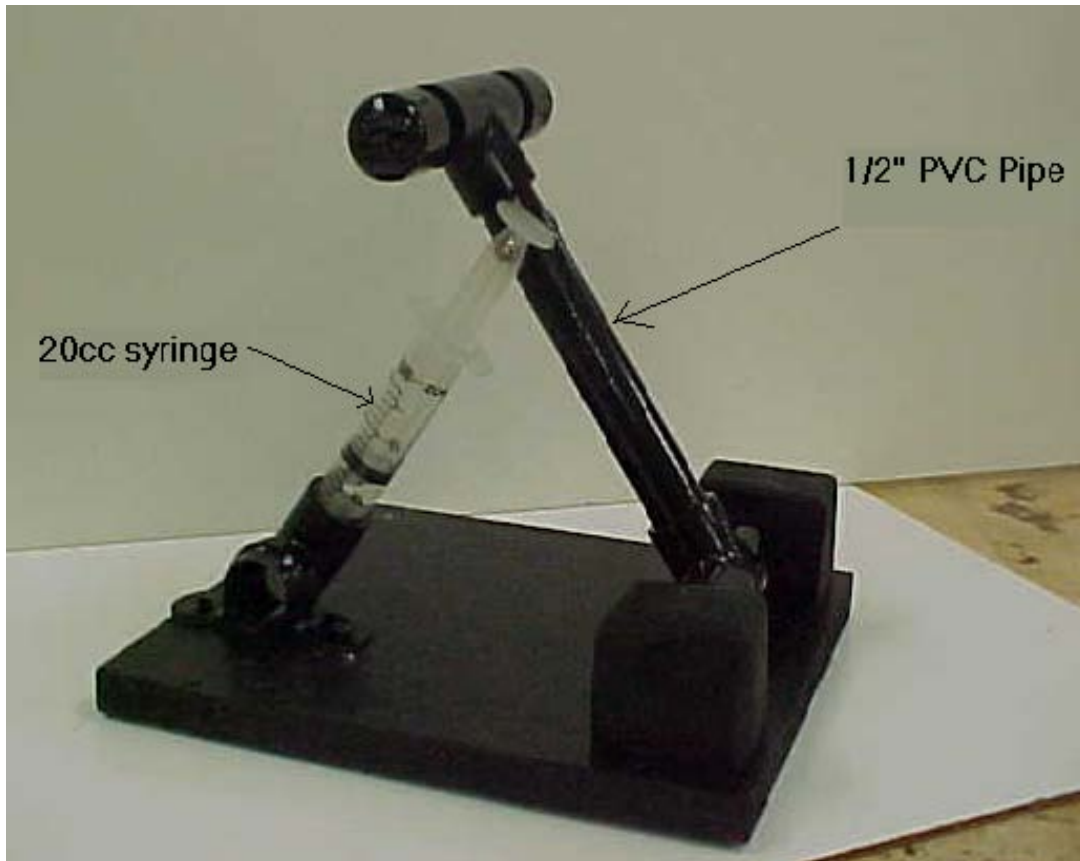
Hardware List for Robot Arm

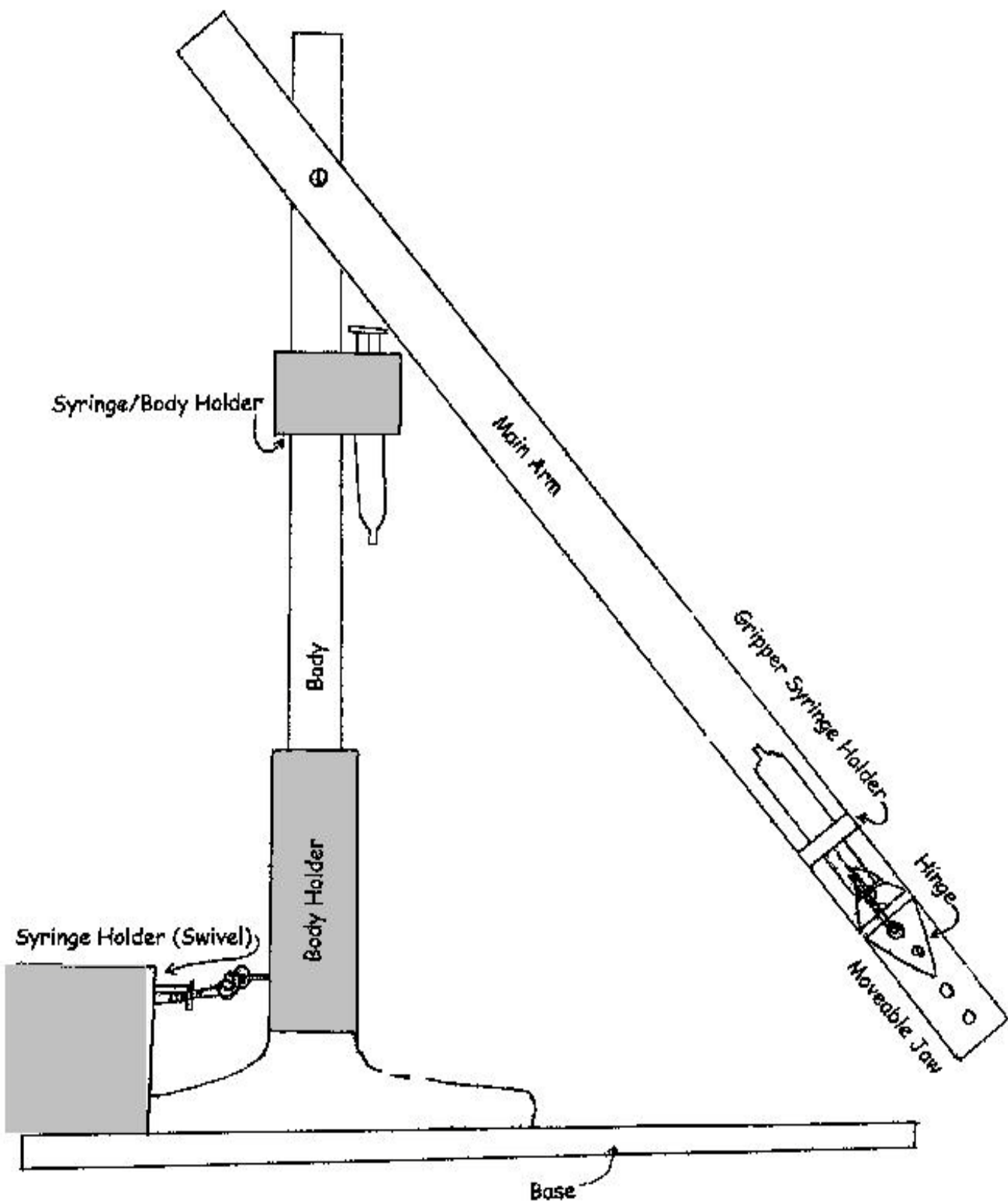
PART NO.	ITEM	QUANTITY
1	Eye bolt with nut – 1 ½" x 3/16"	4
2	#8 sheet metal screw	6
3	#8 x 2" bolt with nut	1
4	#8 x 1" bolt with nut	5
5	#6 x ¾" drywall screw	4
6	Washers	4
7	1" x 3" hinge	1
8	20cc syringe	2
9	5cc syringe	1
10	1/8" ID hose to length	3



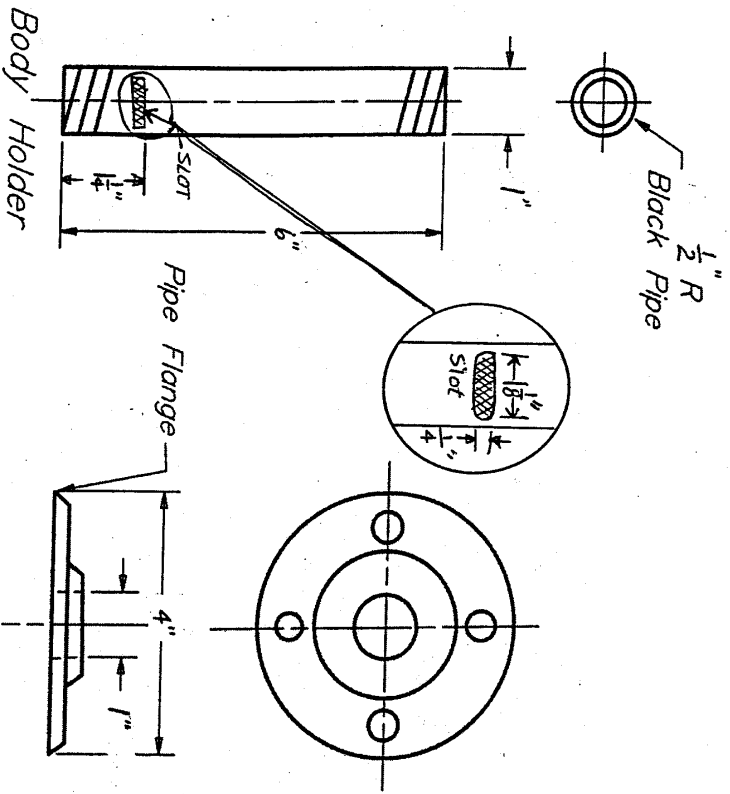
Hardware List for Controller

PART NO.	ITEM	QUANTITY
1	1/2" x 14" PVC Pipe	1
2	1/2" PVC Tee	2
3	1/2" PVC Elbow	1
4	1/2" PVC end cap	2
5	#8 x 2" bolt with washer and nut	1
6	#6 x 3/4" drywall screw	2
7	1/2" PVC pipe strap	1
8	20 cc syringe	1
9	1/8" ID hose to length	1

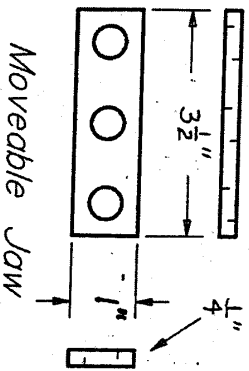




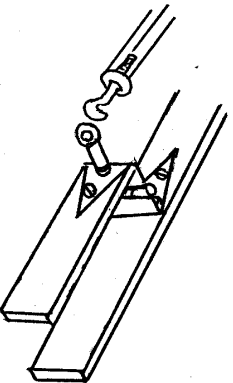
ROBOT ARM DIRECTIONS

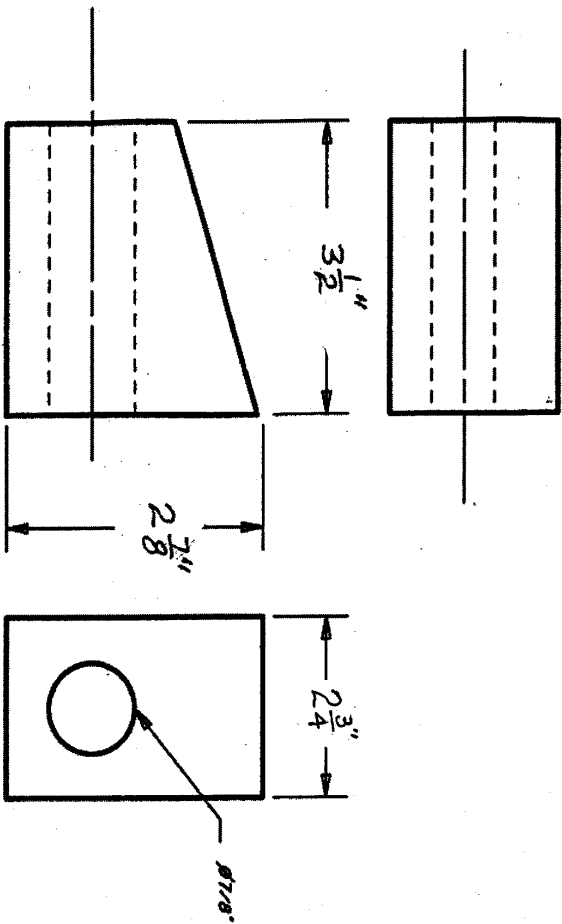


- Cut the slot in the black pipe.
- Screw the black pipe into the flange.
- Mount the flange onto the base board.



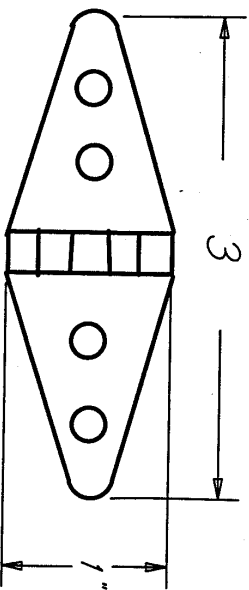
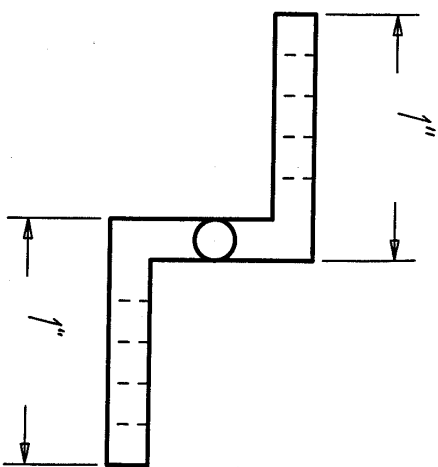
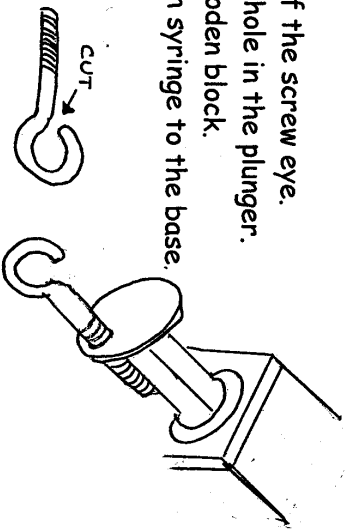
- Cut the wood to size for the jaw of the gripper.
- Attach it to the hinge using screws and an eye screw.
- Hook the two eye screws together.





Syringe Holder (swivel)

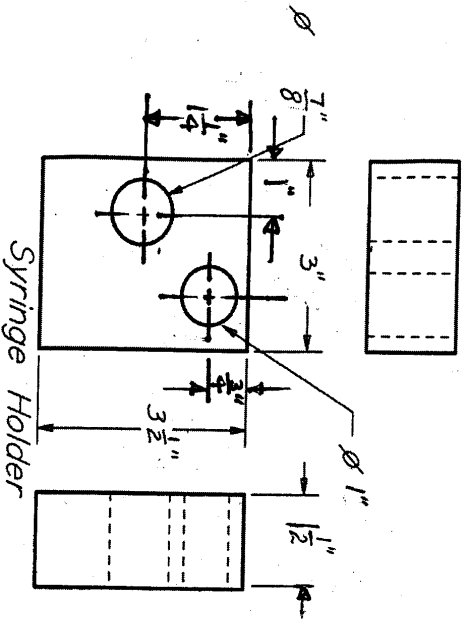
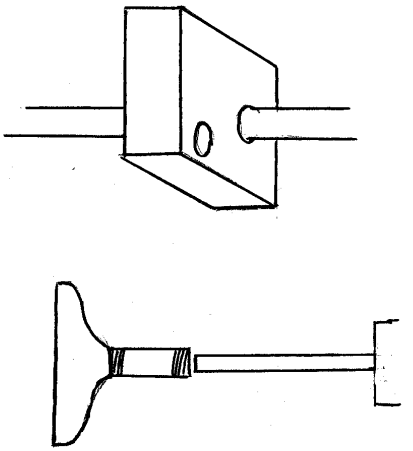
- Cut the wood for the pivot syringe.
- Drill a hole in the wood block for the pivot syringe.
- Drill a hole in the plunger end of the pivot syringe to accommodate a screw eye with nut.
- Cut 1/4 inch off the eye part of the screw eye.
- Attach the screw eye to the hole in the plunger.
- Slide the syringe into the wooden block.
- Attach the wooden block with syringe to the base.



- Bend the hinge as described in the drawing.
- Attach the hinge to the arm using screws.

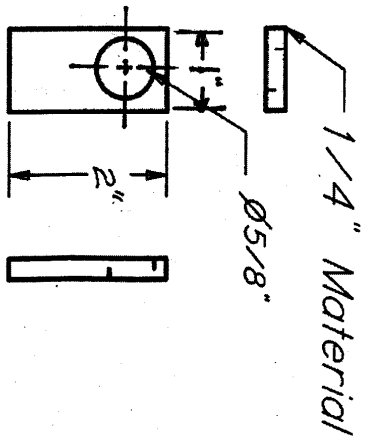
Note: Base is 10" x 12"
 Thickness 3/4" recommended but not necessary
 Picture not to scale.

Base

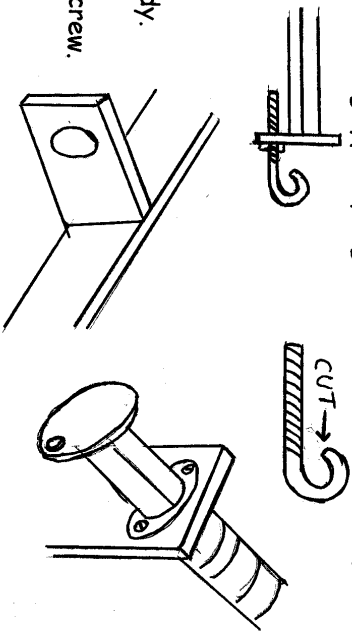


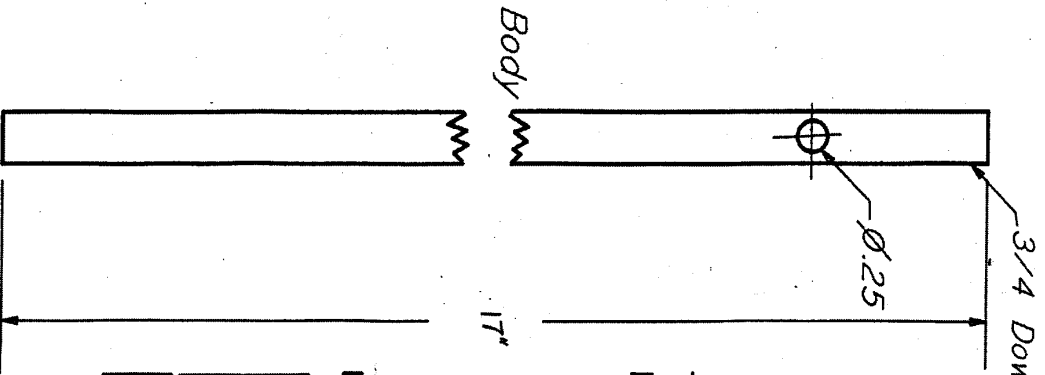
Cut the wood for the lifting arm syringe.
 Drill a hole in the wood block for the lifting arm syringe and body.
 Slide the block onto the body of the robot arm and fasten it.
 Slide the lifting arm syringe into the hole and fasten it with a screw.

Gripper Syringe Holder



Cut the wood for the gripper syringe.
 Drill a hole in the wood block for the gripper syringe.
 Drill a hole in the plunger end of the gripper syringe to accommodate a screw eye with nut.
 Cut 1/4 inch off the eye part of the screw eye.
 Attach the screw eye to the hole in the plunger. Slide the syringe into the wooden block.
 Attach the gripper syringe holder to the arm with glue.





Drill a hole in the body as viewed in the drawing.
 Attach the body and arm using a screw.

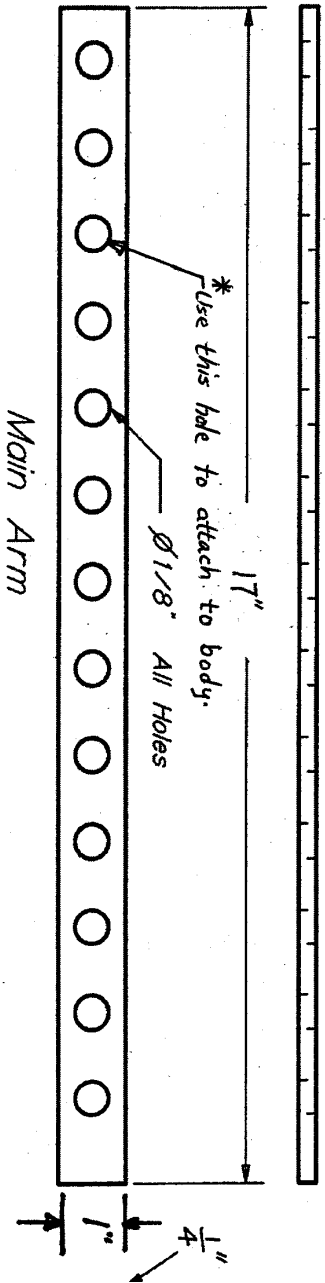
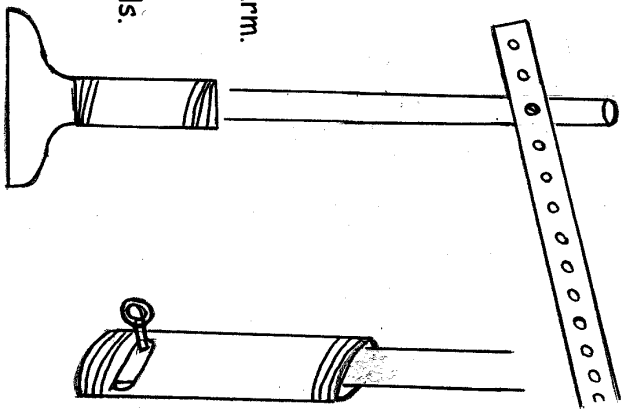
Slide the body into the metal pipe.

Put a screw eye into the slot in the black pipe.

The screw eye should be attached opposite the arm.

Hook the two screw eyes together.

Attach hoses, fill with water, and attach controls.

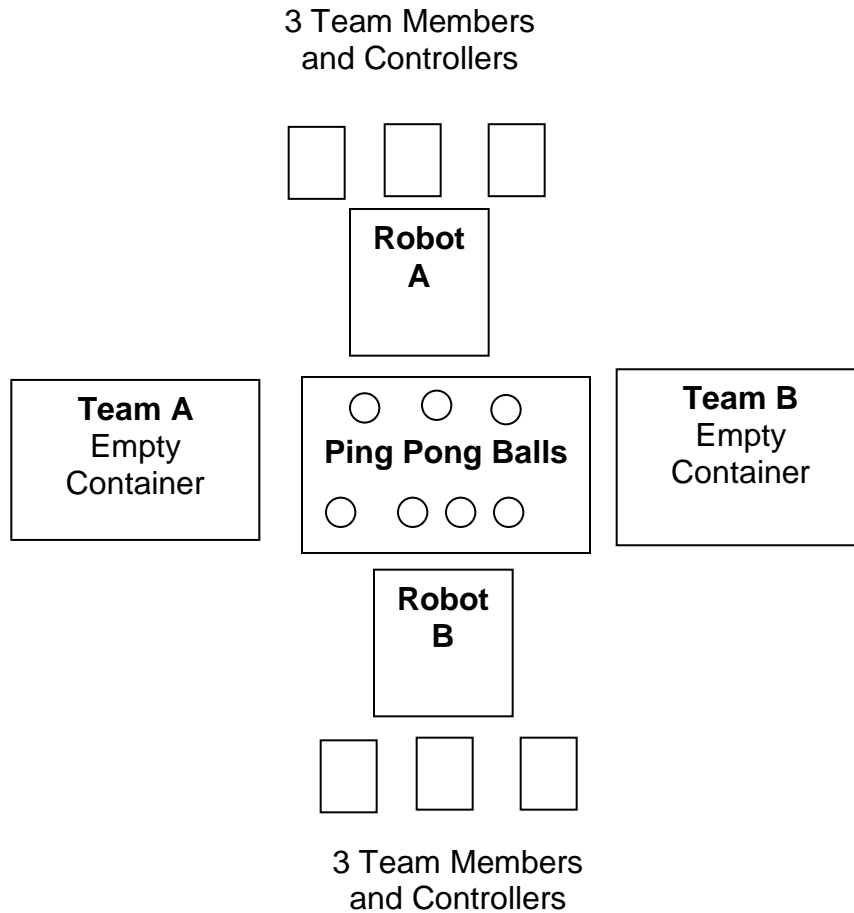


Drill a hole in the arm as viewed in the drawing.

Robot Arm Competition

The object is to move as many ping-pong balls as possible from the central location to the collector in 3 minutes.

1. Two teams will place their robot arms on opposite sides of the container of ping-pong balls with their empty collector containers to the right side of the robot.



2. There must be 3 members on each team with each team member moving one controller.
3. The competition will not be stopped due to broken equipment. Teams may repair their robot arms and return to the competition.