Robot Arm

Science
- Area
- Behaviour of gases under pressure
- Friction
- Scientific investigation

Design & Technology
- Assembling components
- Control of mechanisms
- Evaluating
- Testing before making improvements
- Using mechanisms – levers

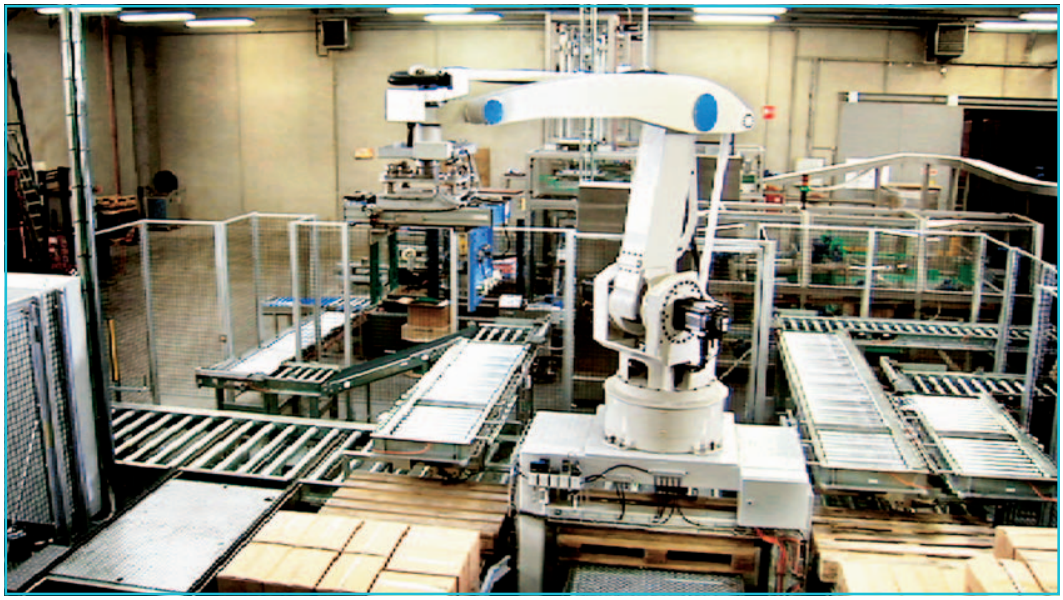
Vocabulary
- Area
- Cylinder
- Grip
- Levers
- Manometer
- Mass
- Pressure
- Pump
- Valve

Other materials required
- A collection of small objects of different size and weight
- Graph paper
- Several small pieces of crumpled up paper

Connect

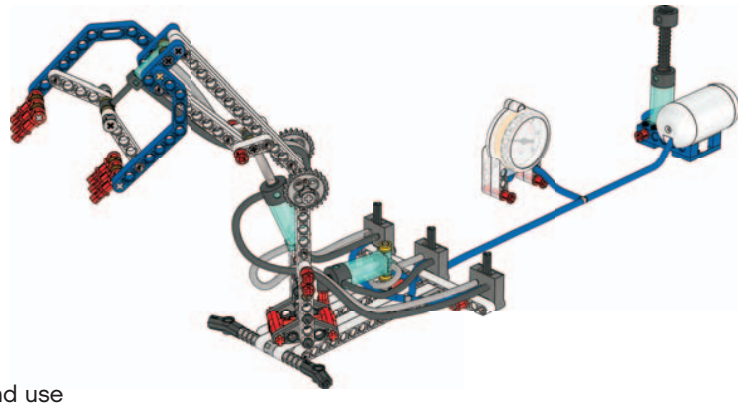
Robotic arms are used for jobs that involve picking up, moving and placing objects. Usually they do jobs which are difficult or repetitive, and need to be done quick and efficiently. To achieve maximum efficiency, the picking and placing sequence needs to be decided beforehand.

Build the Robot Arm and investigate how to make the most energy efficient sequence of strokes. Let's find out!



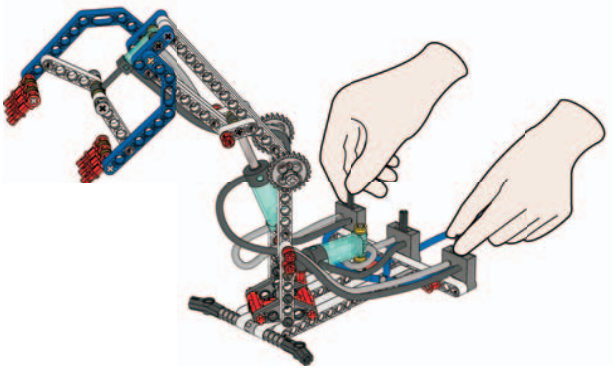
Construct

Build the Robot Arm.
(All of book 4A and book 4B to page 19, step 19)



- Pump air into the system and use the manometer to detect whether there is an air leak

- Try all valve settings and check all moving parts to ensure that they move freely



- Then turn the arm to its resting position: turned to the far right, arm up and grippers open, and empty the air tank

Hint
The easiest way to empty the air tank is to disconnect the tube going from the air tank to the valve.

Contemplate

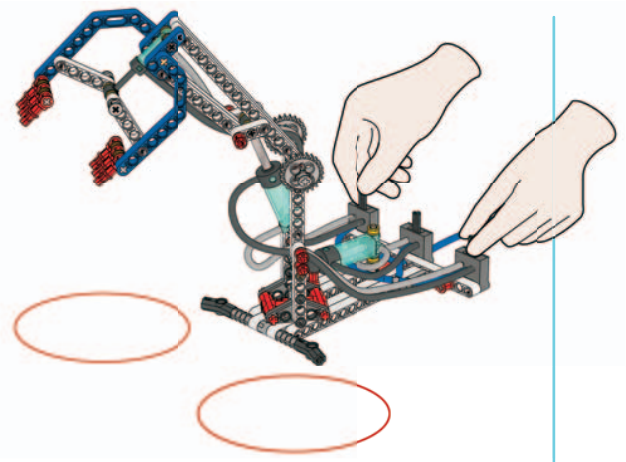
What is the most energy efficient sequence?

Find out which sequence is the most energy efficient for picking and placing objects.

First, predict which sequence of strokes is the most energy efficient at picking and placing a pellet of paper. Your sequence has to start in the resting position, use all six movements at least once and then return to the resting position.
Record your predictions on the worksheet.

Then, test your sequence of strokes and note the loss of pressure after each stroke.
Start with 2.5 bars of pressure.
Record your findings on the worksheet and graph paper.

Test several times to make sure your results are consistent.



Stroke	My sequence
A	
B	
C	
D	
E	
F	
G	
H	

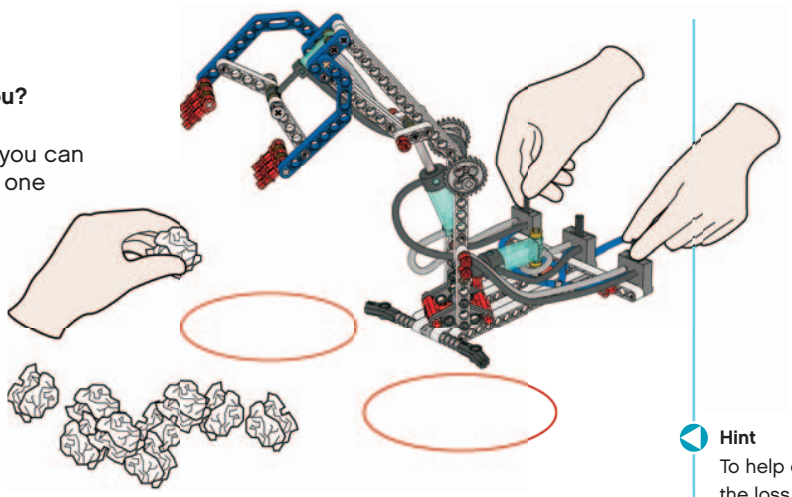
Have the students reflect on their investigations by asking questions such as:

- What did you predict would happen and why?

- How does the Robot Arm work?

- Can you explain any features of the pressure graph?

Continue



How good of a robot operator are you?

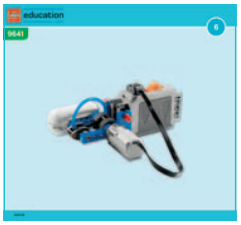
Find out how quickly and accurately you can pick and place pellets of paper from one circle to another

First, predict how many pellets you can accurately place within the circle in 30 seconds.
Record your predictions on the worksheet.

Then, test how many pellets you actually place accurately within the circle in 30 seconds.
Record your findings on the worksheet.

Repeat the test three times to see if your speed and accuracy improve.

Hint
To help overcome the loss of pressure, you could build a compressor.



Optional: How about new grippers?
Design and make your own grippers that will help you to pick and place different objects of your choice.