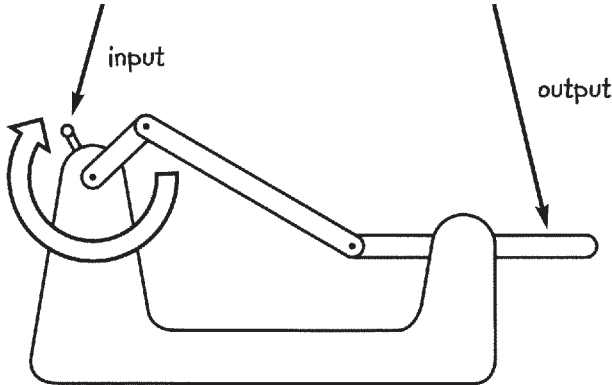


# Changing types of movement

## What to do

### Crank, link and slider mechanism

Turn the handle here and look at what happens here.



### Student's Book:

What can mechanisms do?  
pages 191-3

### Time available:

20 minutes

### You will learn:

About mechanisms that change movement and how to sketch and label them.

### You will need:

- Pencil
- 'Changing movement table'
- Set of mechanical models

Use your observations to fill in the 'Changing movement table' like this:

1 Note down a use for this mechanism.

2 Draw a quick annotated sketch of the mechanism.

3 Describe the input motion by ticking the right box and drawing the correct symbol.

Changing movement table

Mechanism	Sketch	Input movement	Symbol	Output movement	Symbol	System diagram
<b>Crank, link and slider</b> This mechanism is used in ...		It is linear <input type="checkbox"/> reciprocating <input type="checkbox"/> rotating <input checked="" type="checkbox"/> oscillating <input type="checkbox"/>		It is linear <input type="checkbox"/> reciprocating <input checked="" type="checkbox"/> rotating <input type="checkbox"/> oscillating <input type="checkbox"/>		
<b>Crank, link and lever</b> This mechanism is used in ...		It is linear <input type="checkbox"/> reciprocating <input type="checkbox"/> rotating <input type="checkbox"/> oscillating <input type="checkbox"/>	Symbol	It is linear <input type="checkbox"/> reciprocating <input type="checkbox"/> rotating <input type="checkbox"/> oscillating <input type="checkbox"/>	Symbol	
<b>Cam and follower</b>		It is linear <input type="checkbox"/>	Symbol	It is	Symbol	

4 Describe the output motion by ticking the right box and drawing the correct symbol.

5 Draw a system block that describes the function of the mechanism.

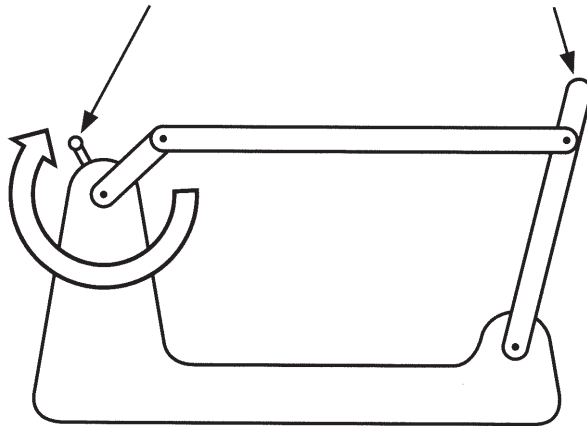
## Changing types of movement

### What to do

Fill in the 'Changing movement table' for each of the following mechanisms.

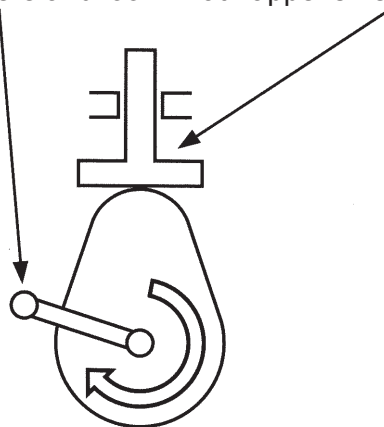
#### ***Crank, link and lever mechanism***

Turn the handle here and look what happens here.



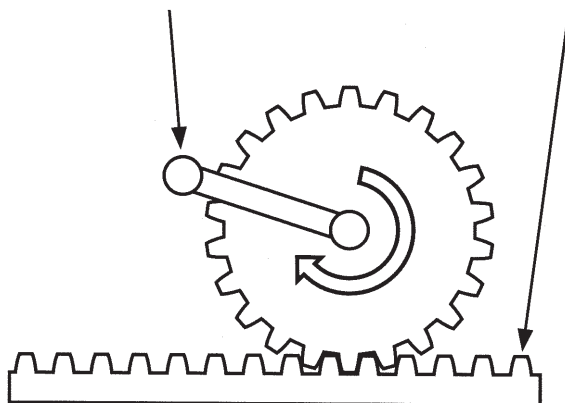
#### ***Cam and follower mechanism***

Turn the handle here and look what happens here.



#### ***Rack and pinion mechanism***

Turn the handle here and look what happens here.



What happens if you pull or push here?

Changing types of movement

Changing movement table

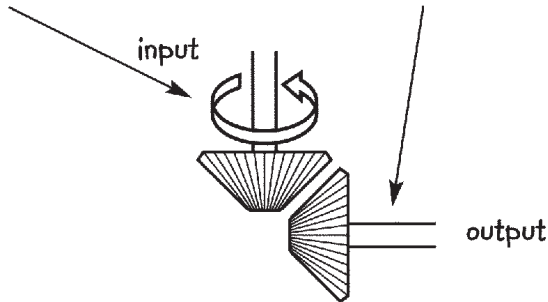
Mechanism	Sketch	Input movement	Symbol	Output movement	Symbol	System diagram
<b>Crank, link and slider</b> This mechanism is used in ...		It is linear <input type="checkbox"/> reciprocating <input type="checkbox"/> rotating <input type="checkbox"/> oscillating <input type="checkbox"/>	<b>Symbol</b>	It is linear <input type="checkbox"/> reciprocating <input type="checkbox"/> rotating <input type="checkbox"/> oscillating <input type="checkbox"/>	<b>Symbol</b>	
<b>Crank, link and lever</b> This mechanism is used in ...		It is linear <input type="checkbox"/> reciprocating <input type="checkbox"/> rotating <input type="checkbox"/> oscillating <input type="checkbox"/>	<b>Symbol</b>	It is linear <input type="checkbox"/> reciprocating <input type="checkbox"/> rotating <input type="checkbox"/> oscillating <input type="checkbox"/>	<b>Symbol</b>	
<b>Cam and follower</b> This mechanism is used in ...		It is linear <input type="checkbox"/> reciprocating <input type="checkbox"/> rotating <input type="checkbox"/> oscillating <input type="checkbox"/>	<b>Symbol</b>	It is linear <input type="checkbox"/> reciprocating <input type="checkbox"/> rotating <input type="checkbox"/> oscillating <input type="checkbox"/>	<b>Symbol</b>	
<b>Rack and pinion</b> This mechanism is used in ...		It is linear <input type="checkbox"/> reciprocating <input type="checkbox"/> rotating <input type="checkbox"/> oscillating <input type="checkbox"/>	<b>Symbol</b>	It is linear <input type="checkbox"/> reciprocating <input type="checkbox"/> rotating <input type="checkbox"/> oscillating <input type="checkbox"/>	<b>Symbol</b>	

# Changing axis and direction of rotation

## What to do

### Bevel gears

Turn here and look at what happens here.



Use your observations to fill in the 'Changing axis and direction table' like this:

1 Note down a use for the mechanism

2 Draw a quick labelled sketch of the mechanism; label the input and the output.

3 Describe how the output is different from the input.

4 Draw a system block that describes the function of the mechanism

**Changing axis and direction table**

Mechanism	Sketch	How is the output different from the input?	System diagram
<b>Bevel gears</b> This mechanism is used in ...		Is the rotation in a different direction? YES <input checked="" type="checkbox"/> NO <input type="checkbox"/> Is the rotation along a different axis? YES <input checked="" type="checkbox"/> NO <input type="checkbox"/>	Rotary motion 
<b>Worm and wheel</b> This mechanism is used in ...		Is the rotation in a different direction? YES <input type="checkbox"/> NO <input type="checkbox"/> Is the rotation along a different axis? YES <input type="checkbox"/> NO <input type="checkbox"/>	
<b>Flexible couplings</b>		Is the rotation in a different direction? YES <input type="checkbox"/> NO <input type="checkbox"/>	

### Student's Book:

What can mechanisms do?  
pages 191-3

### Time available:

20 minutes

### You will learn:

About mechanisms that change the axis and direction of rotation and how to sketch and label them.

### You will need:

- Pencil
- Changing axis and direction table'
- Set of mechanical models

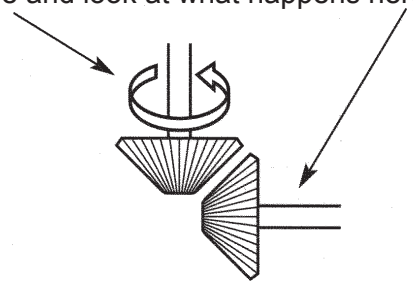
# Changing axis and direction of rotation

## What to do

5 Fill in the 'Changing axis and direction table' for each of the following mechanisms.

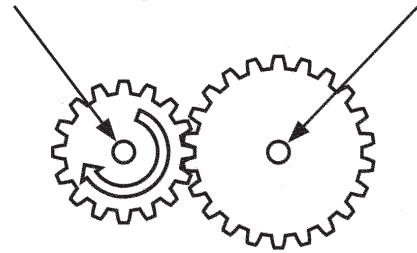
### Bevel gear

Turn here and look at what happens here.



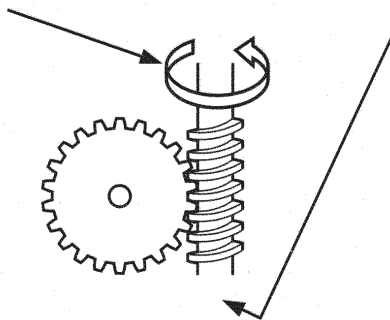
### Simple gear train

Turn here and look at what happens here.



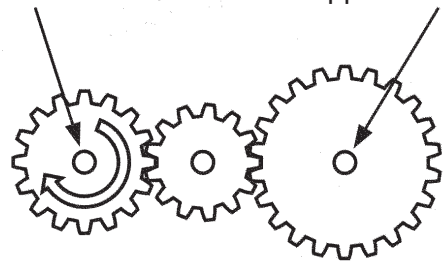
### Worm and wheel

Turn here and look at what happens here.



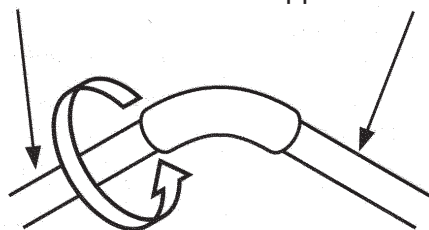
### Idler gear

Turn here and look at what happens here.



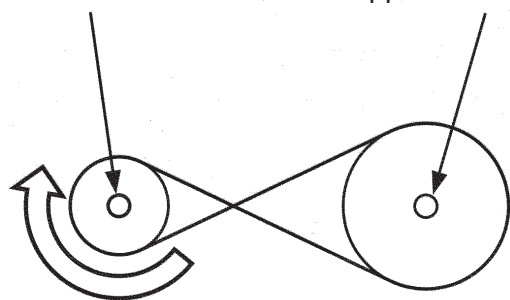
### Flexible couplings

Turn here and look at what happens here.



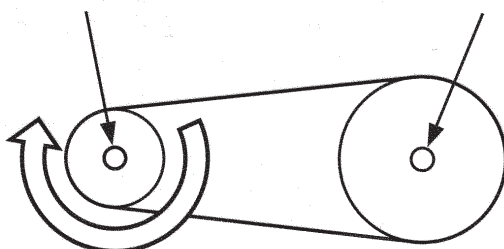
### Cross-over belt drive

Turn here and look at what happens here.



### Belt drive

Turn here and look at what happens here.



# Changing axis and direction of rotation

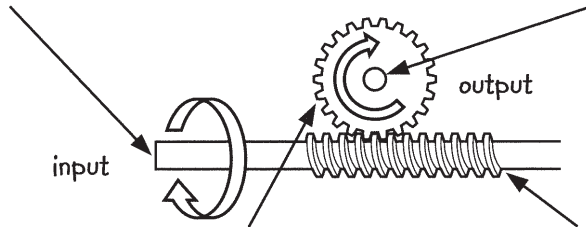
## Changing axis and direction table

Mechanism	Sketch	How is the output different from the input?	System diagram
<p><b>Bevel gears</b></p> <p>This mechanism is used in ...</p>		<p>Is the rotation in a different direction?                      YES <input type="checkbox"/> NO <input type="checkbox"/></p> <p>Is the rotation along a different axis?                      YES <input type="checkbox"/> NO <input type="checkbox"/></p>	
<p><b>Worm and wheel</b></p> <p>This mechanism is used in ...</p>		<p>Is the rotation in a different direction?                      YES <input type="checkbox"/> NO <input type="checkbox"/></p> <p>Is the rotation along a different axis?                      YES <input type="checkbox"/> NO <input type="checkbox"/></p>	
<p><b>Flexible couplings</b></p> <p>This mechanism is used in ...</p>		<p>Is the rotation in a different direction?                      YES <input type="checkbox"/> NO <input type="checkbox"/></p> <p>Is the rotation along a different axis?                      YES <input type="checkbox"/> NO <input type="checkbox"/></p>	
<p><b>Belt drive</b></p> <p>This mechanism is used in ...</p>		<p>Is the rotation in a different direction?                      YES <input type="checkbox"/> NO <input type="checkbox"/></p> <p>Is the rotation along a different axis?                      YES <input type="checkbox"/> NO <input type="checkbox"/></p>	
<p><b>Simple gear train</b></p> <p>This mechanism is used in ...</p>		<p>Is the rotation in a different direction?                      YES <input type="checkbox"/> NO <input type="checkbox"/></p> <p>Is the rotation along a different axis?                      YES <input type="checkbox"/> NO <input type="checkbox"/></p>	
<p><b>Idler gears</b></p> <p>This mechanism is used in ...</p>		<p>Is the rotation in a different direction?                      YES <input type="checkbox"/> NO <input type="checkbox"/></p> <p>Is the rotation along a different axis?                      YES <input type="checkbox"/> NO <input type="checkbox"/></p>	
<p><b>Cross-over belt</b></p> <p>This mechanism is used in ...</p>		<p>Is the rotation in a different direction?                      YES <input type="checkbox"/> NO <input type="checkbox"/></p> <p>Is the rotation along a different axis?                      YES <input type="checkbox"/> NO <input type="checkbox"/></p>	

# Changing force, speed and distance

## What to do Worm and wheel

Turn here and feel how hard it is to stop it moving here.



Look at how much it turns here for one complete turn here.

*(Remember you won't always be able to feel a big difference because of friction in the system)*

Use your observations to fill in the 'Changing force, speed and distance table' like this:

### Student's Book:

What can mechanisms do?

Pages 191-3

### Time available:

20 minutes

### You will learn:

About mechanisms that affect force, speed and distance and how to sketch and label them.

### You will need:

- Pencil
- Set of mechanical models
- 'Changing force, speed and distance table'

- 1 Describe how the output is different from the input by answering the Yes/No questions
- 2 Draw a quick labelled sketch of the mechanism; label the input and the output

### Changing force, speed and distance table

Mechanism	Sketch	Is the output force bigger than the input?	Does the output move or turn faster than the input?	System diagram
<b>Worm and wheel</b> This mechanism is used in ...		YES <input checked="" type="checkbox"/> NO <input type="checkbox"/>	YES <input type="checkbox"/> NO <input checked="" type="checkbox"/>	
<b>Simple gears</b> (adding up)		YES <input type="checkbox"/>	YES <input type="checkbox"/>	

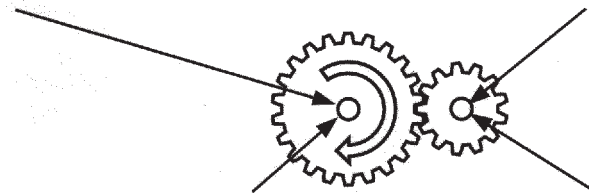
- 3 Note down a use for the mechanism.
- 4 Draw a system block that describes the function of the mechanism.

# Changing force, speed and distance

5 Fill in the 'Changing force, speed and distance table' for each of the following mechanisms.

### Simple gear train - gearing up

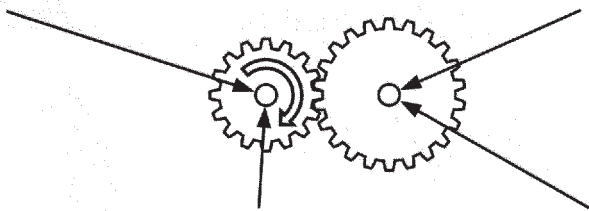
Turn here and feel how hard it is to stop it moving here



Look at how far it turns here for one complete turn here.

### Simple gear train - gearing down

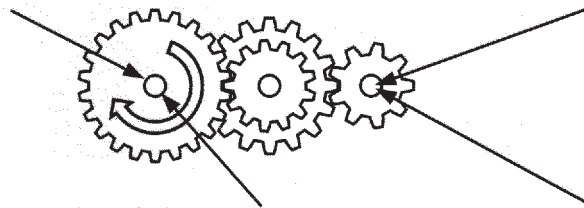
Turn here and feel how hard it is to stop it moving here.



Look at how far it turns here for one complete turn here.

### Compound gear train - gearing up

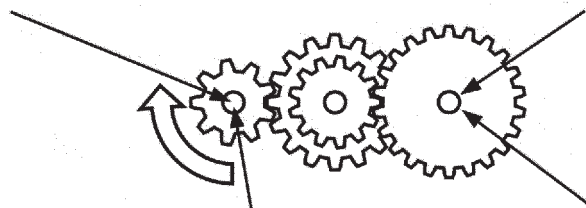
Turn here and feel how hard it is to stop it moving here.



For one complete turn here look how far it turns here.

### Compound gear train - gearing down

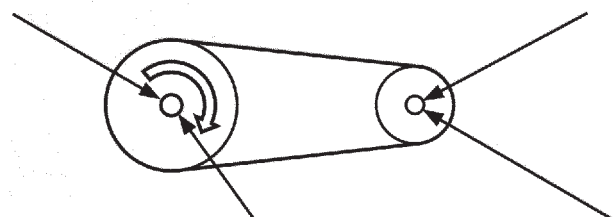
Turn here and feel how hard it is to stop it moving here.



For one complete turn here look how far it turns here.

### Belt drive

Turn here and feel how hard it is to stop it moving here.

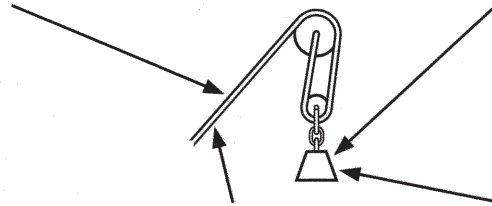


Look at how far it turns here for one complete turn here.

## Changing force, speed and distance

### ***Pulley***

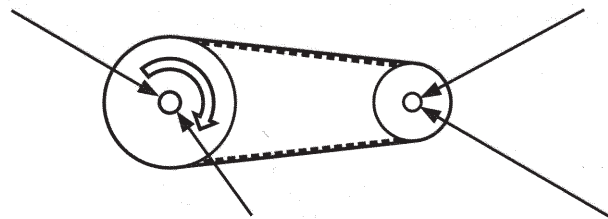
Pull here and feel how much harder it pulls here.



Look at how far a short pull here makes it move here.

### ***Sprocket and chain drive***

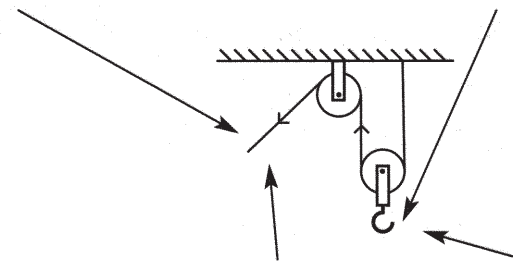
Turn here and feel how hard it is to stop it moving here.



Look at how far it turns here for one complete turn here.

### ***Two-pulley hoist***

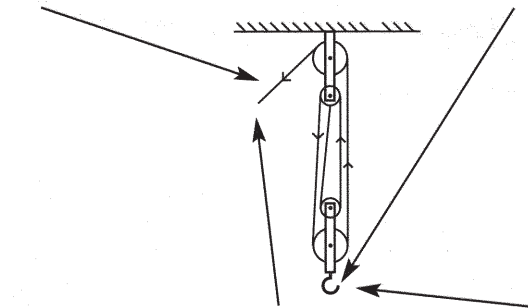
Pull here and feel how much harder it pulls here.



Look at how far a short pull here makes it move here.

### ***Four-pulley hoist***

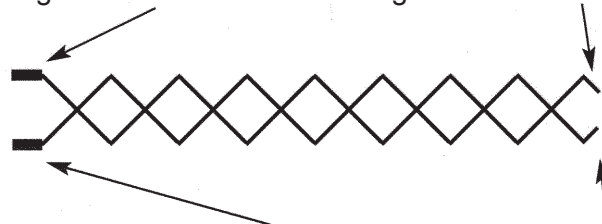
Pull here and feel how much harder it pulls here.



Look at how far a short pull here makes it move here.

### ***Lazy-tongs***

Push together here and feel how big the force is here.



When the handles are pushed together here look how far it moves here.

# Changing force, speed and distance

*Changing force, speed and distance table*

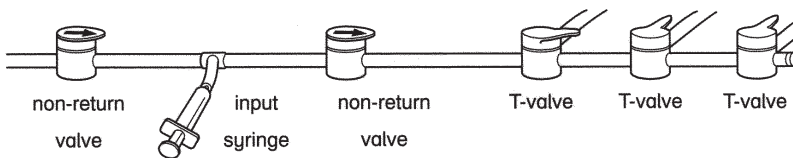
Mechanism	Sketch	Does the output give more force than the input?	Does the output move further than the input?	System diagram
<b>Worm and wheel</b> This mechanism is used in ...		YES <input type="checkbox"/> NO <input type="checkbox"/>	YES <input type="checkbox"/> NO <input type="checkbox"/>	
<b>Simple gears (gearing up)</b> This mechanism is used in ...		YES <input type="checkbox"/> NO <input type="checkbox"/>	YES <input type="checkbox"/> NO <input type="checkbox"/>	
<b>Simple gears (gearing down)</b> This mechanism is used in ...		YES <input type="checkbox"/> NO <input type="checkbox"/>	YES <input type="checkbox"/> NO <input type="checkbox"/>	
<b>Compound gears (gearing up)</b> This mechanism is used in ...		YES <input type="checkbox"/> NO <input type="checkbox"/>	YES <input type="checkbox"/> NO <input type="checkbox"/>	
<b>Compound gears (gearing down)</b> This mechanism is used in ...		YES <input type="checkbox"/> NO <input type="checkbox"/>	YES <input type="checkbox"/> NO <input type="checkbox"/>	
<b>Belt drive</b> This mechanism is used in ...		YES <input type="checkbox"/> NO <input type="checkbox"/>	YES <input type="checkbox"/> NO <input type="checkbox"/>	
<b>Pulley</b> This mechanism is used in ...		YES <input type="checkbox"/> NO <input type="checkbox"/>	YES <input type="checkbox"/> NO <input type="checkbox"/>	
<b>2 pulley hoist</b> This mechanism is used in ...		YES <input type="checkbox"/> NO <input type="checkbox"/>	YES <input type="checkbox"/> NO <input type="checkbox"/>	
<b>4 pulley hoist</b> This mechanism is used in ...		YES <input type="checkbox"/> NO <input type="checkbox"/>	YES <input type="checkbox"/> NO <input type="checkbox"/>	
<b>Lazy tongs</b> This mechanism is used in ...		YES <input type="checkbox"/> NO <input type="checkbox"/>	YES <input type="checkbox"/> NO <input type="checkbox"/>	

# Introducing syringe systems

## Using syringes

### What to do

- 1 Find these parts on the pick-and-place arm.



- 2 Set the valves in the positions shown in the first row of the 'Pick-and-place arm truth table'.
- 3 Pump the input syringe twice and note what happens.

### Student's Book:

Using syringes  
page 214

### Time available:

30 minutes

### You will learn:

How to control the flow of air in a system of syringes by using valves.

### You will need:

- Syringe-operated pick-and-place arm with all output syringes in the half-way position
- 'Pick-and-place arm truth table'

### Pick-and-place arm truth table

Valve positions					What happens
Non-return valve	Non-return valve	T-valve (controls jaws)	T-valve (controls rise and fall)	T-valve (controls swing)	

### What to write

- Record your findings in the 'Pick-and-place arm truth table'.

### What to do

- 4 Work through the positions of the valves s shown in each row of the 'Pick-and-place arm truth table', recording your findings as you go.

### What to write

- Complete the 'What happens' column in the 'Pick-and-place arm truth table' using these labels:
  - jaws open
  - arm rises
  - arm swings right
  - jaws close
  - arm falls
  - arm swings left

### What to do

- 5 Now that you know how to make the arm move in six different ways, try the following test of skill. Place a cotton reel on the baseboard. Control the arm so that it moves to the reel, picks it up, and moves it to another position on the baseboard, releases it, and returns to the starting position. How fast can you do it?

**Introducing syringe systems**

*Pick-and-place arm truth table*

Valve positions					What happens
Non-return valve	Non-return valve	T-valve (controls jaws)	T-valve (controls rise and fall)	T-valve (controls swing)	
