# Dogbot

**Design and technology**
- Designing mechanical toys
- Levers and linkages
- Mechanical programming of actions
- Pulleys and gearing
- Using and combining components

**Science**
- Force and energy
- Friction
- Scientific investigation

**Vocabulary**
- Cams
- Gears
- Levers
- Linkages
- Pivots
- Sequencing

**Other materials required**
- Crayons
- Decorative materials: wool, foil, card, paper, etc.
- Scissors
- Sticky tape

## Connect

Zog is very bored. He dreams of a special friend that is always happy, wide awake and with whom he can share a bone. Jack and Jill have an idea.

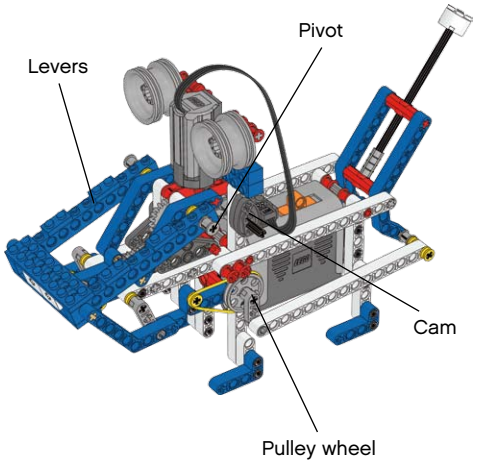
**How can we make an exciting friend for Zog to play with?**
**Let's find out.**

## Construct

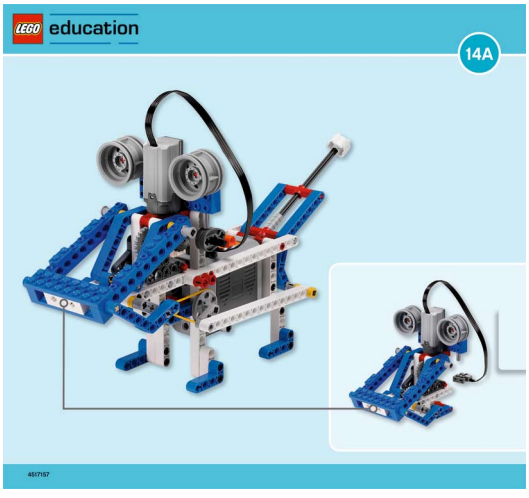
**Build Dogbot**
(all of book 14A and book 14B to page 19, step 27).

There are many moving parts on Dogbot, but only one motor. Turn on Dogbot by pushing backwards on the battery switch. If the motor is not turning freely, you need to check several parts of the Dogbot:

- The lever on the upper jaw should move up and down
- The cams should rotate freely, moving the eyes attached to the axles up and down
- The lever on the tail should wag up and down




**Did you know?**
The jaw and tail movements both feature compound levers with several pivots.



## Contemplate

### Is Dogbot wide awake?

When Dogbot is wide awake its eyes move about a lot!

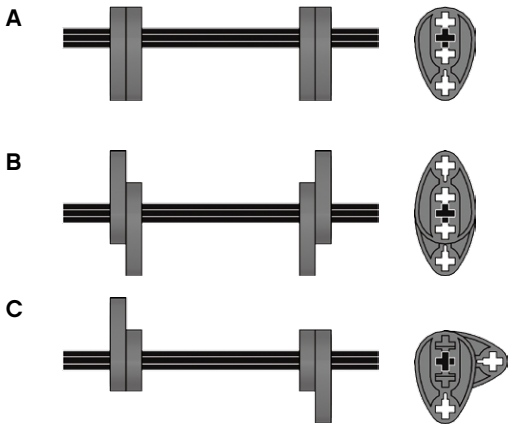
Which cam setting will produce a Sleepy, Awake and Wide Awake Dogbot?

Predict first which eye action cam setting A will produce. Then test your prediction. Next, follow the same procedure for cam settings B and C.

*Cam setting A (page 19, step 27) results in a sleepy Dogbot, i.e. only one eye bounce per turn of the cam.*

*Cam setting B (page 20, step 28) results in a Dogbot that is awake, i.e. the eyes bounce twice per turn but at regular intervals.*

*Cam setting C (page 21, step 29) gives us a Dogbot who is wide awake, i.e. the eyes bounce twice per turn but at irregular intervals – one eye is up when the other is down!*




**Did you know?**
Cams work inside car engines, clocks, toys, sewing machines, and locks – in fact anywhere complex, timed actions are required.

### How wide can Dogbot's jaws open?

By changing the peg position you can change the extent to which Dogbot can open his jaws.

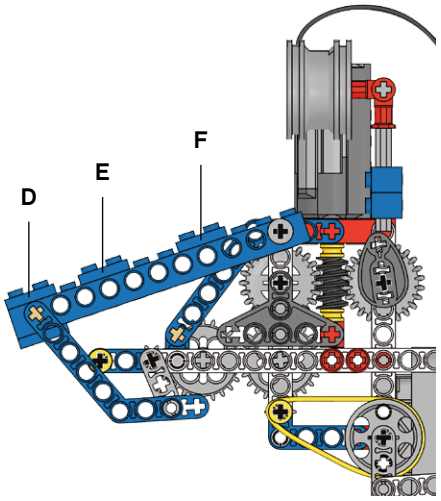
First predict how wide peg position D will make Dogbot's jaws open. Then test your prediction. Next, follow the same procedure for peg positions E and F.

*Position D (page 22, step 30) allows Dogbot to open his jaws wide.*

*Position E (page 23, step 31) means Dogbot can open his jaws even wider.*

*Position F (page 24, step 32) is the widest possible setting for Dogbot's jaws.*

*The closer the peg position is to the pivot, the wider the jaws open. The upper jaw is a 3rd class lever.*




**Did you know?**
Your lower jaw is a lever. Feel where the muscle connects to the bone of the lower jaw. Your jaws are 3rd class levers just like Dogbot – just upside down!

## Continue

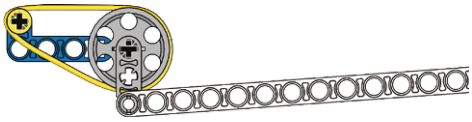
**Can Dogbot be happier?**

Dogbot wags its tail when it's happy.
The faster the wag, the happier it is.

First predict how happy Dogbot is using pulley setting A. Then test your prediction.
Next, follow the same procedure with pulley settings B and C.

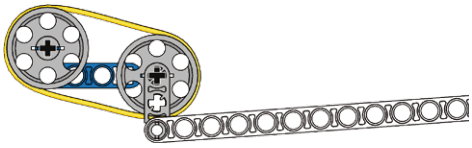
*Pulley setting A results in a slow wag, i.e. a happy Dogbot.*

**A**



*Pulley setting B results in a faster wag – in fact three times faster than pulley setting A. Dogbot is now even happier.*

**B**



*Pulley setting C gives the fastest wag – three times faster than pulley setting B. This is the happiest Dogbot can be!*

**C**