

Merry-Go-Round

Curriculum Links and Statements

Design and Technology

Through a variety of creative and practical activities, pupils should be taught the knowledge, understanding and skills needed to engage in an iterative process of designing and making.

Technical Knowledge

Pupils should be taught to:

Understand and use mechanical systems in their products [for example, gears, pulleys, cams, levers and linkages]

Science - Year 5 Programme of Study

Forces

Pupils should be taught to:

Recognise that some mechanisms, including levers, pulleys and gears, allow a smaller force to have a greater effect

Mathematics - Year 5 Programme of Study

Number

Pupils should be taught to:

Identify multiples and factors, including finding all factor pairs of a number, and common factors of two numbers

Mathematics - Year 6 Programme of Study

Ratio and Proportion

Pupils should be taught to:

- Solve problems involving the relative sizes of two quantities where missing values can be found by using integer multiplication and division facts
- Solve problems involving similar shapes where the scale factor is known or can be found

Pupils should consolidate their understanding of ratio when comparing quantities, sizes and scale drawings by solving a variety of problems. They might use the notation a:b to record their work.

English

Spoken Language Years 1-6

Pupils should be taught to:

- ask relevant questions to extend their understanding and knowledge
- give well-structured descriptions, explanations and narratives for different purposes
- use spoken language to develop understanding through speculating, hypothesising, imagining and exploring ideas

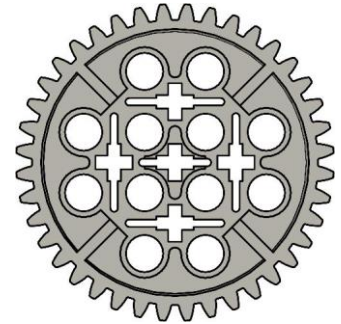
Connect

Here at LEGOLAND® Discovery Centre, we have a ride that uses gears. The gears can be used to make the ride go slower or much faster. Today, you will work with gears. You will observe the direction that the gears rotate and how fast the gears rotate.

Years 5-6

Use Principle Models: Gears A6 and A7 in order. Teacher pages are 2, 3, and 4. Pupil worksheets are pages 5, 6, and 7 in the Teacher's Guide.

Years 5-6



Tip:

Before building the models, pair the pupils up and have each group of two work with one set. Tell the pupils they should not pull parts and pieces from another set; they have everything they need right in front of them.

Main Activity: Merry-Go-Round

Teacher's Notes

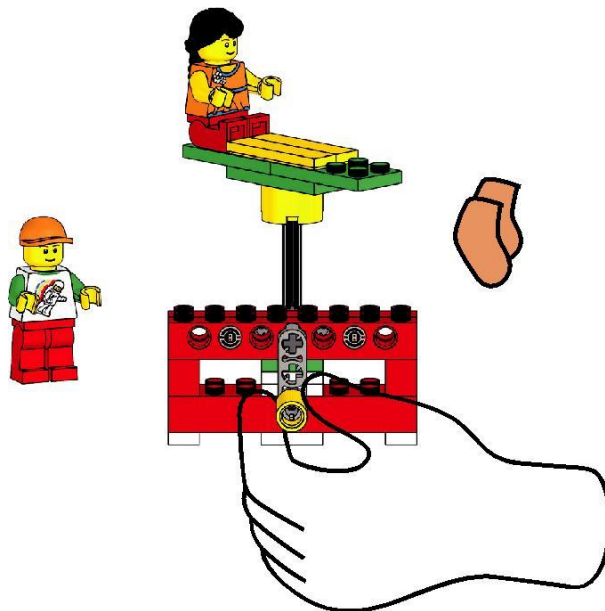
Construct

1. First, build Merry-Go-Round Model A6 and make it turn.

Follow Building Instructions A, pages 34 to 42, steps 1 to 11.

When Merry-Go-Round Model A6 has been built, check the following:

- *Crank the yellow handle to make sure the merry-go-round turns.*
- *Make sure the minifigure is attached securely. Pupils are welcome to use either Max or Mia, but they should be told that it is easier to count how many times the merry-go-round makes a full turn with only one minifigure on the merry-go-round.*



Tip:

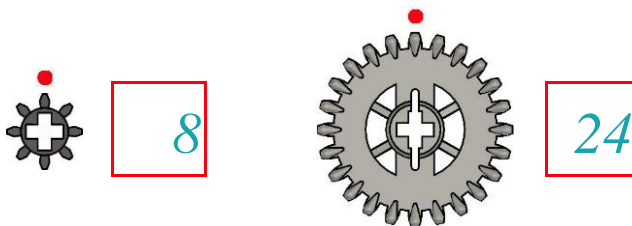
Ensure pupils take turns with their partner testing each model variation.

Hint

Pupils should be reminded that the drive gear is the gear turned by an outside effort, in this case their hand cranking the yellow handle.

Contemplate

2. Count the teeth on the gears. Start counting from the dot.



There are two gears used in model A6: a spur gear (8 teeth) and a crown gear (24 teeth).

3. Then look carefully at the pictures of the models and compare Merry-Go-Round Model A6 to Merry-Go-Round Model A7.

- Circle what is different.
- What do you notice? Explain how the models are different.

Pupils should notice the difference in both size and number of gears used on model A6 compared to model A7.

4. Next, look carefully at the pictures of the models and make a prediction.

If I compare model A6 to model A7, then I think Merry-Go-Round Model (A6/A7) will turn faster.

Encourage pupils to discuss the effects the different gearing has on the merry-go-rounds in their own words. For the prediction, the correct answer is model A7; however, it does not matter whether pupils get the answer right or wrong at this point, only that they should make a prediction that can be checked later.

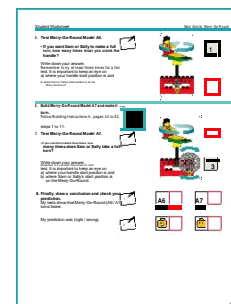
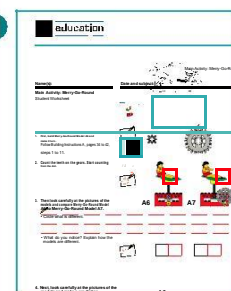
5. Test Merry-Go-Round Model A6.

- If you want Max or Mia to make a full turn, how many times must you crank the handle?

Have pupils observe the starting point of both the handle and the minifigure. Encourage them to try more than once, to ensure that their observations are correct. Pupils must write their answer on the Pupil Worksheet.

The pupils will have to crank the handle three times for Merry-Go-Round Model A6 to turn once. The gear ratio is 3:1; this is a gearing down arrangement (because $24/8 = 3/1$), and the merry-go-round turns slowly. Pupils should be made aware that the angled gearing enables the rotary motion to be transmitted through a 90-degree angle.

Note: *If possible, keep an example of Merry-Go-Round Model A6 for pupils to compare with Merry-Go-Round Model A7.*



6. Build Merry-Go-Round Model A7 and make it turn.

Follow Building Instructions A, pages 44 to 52, steps 1 to 11.
 Encourage pupils to identify the gears and count the teeth on the gears. There are four gears used in the model: two small spur gears (8 teeth), a crown gear (24 teeth), and a large spur gear (40 teeth).

7. Test Merry-Go-Round Model A7.

- If you crank the handle three times, how many times does Max or Mia make a full turn?

Have pupils pay attention to the starting positions of the handle and the minifigure as described earlier. Encourage them to try more than once, to ensure that their observations are correct.

Three turns of the 40-tooth gear produce five turns of the merry-go-round. The gear ratio is 3:5 (because $24/40 = 3/5$), and the merry-go-round turns at a much faster pace.

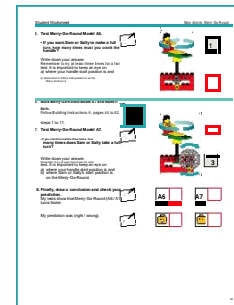
8. Finally, draw a conclusion and check your prediction.

Merry-Go-Round Model A7 turns faster because of the gearing-up arrangement with the 40-tooth drive gear and the 24-tooth driven gear.



Hint

It is recommended that pupils work in pairs; one pupil can observe the minifigure while the other cranks the handle a full turn.



Name(s): _____

Date and subject: _____

Main Activity: Merry-Go-Round

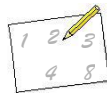


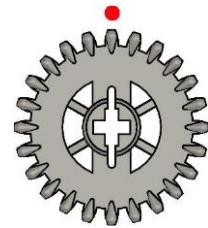
1. First, build Merry-Go-Round Model A6 and make it turn.

Follow Building Instructions A, pages 34 to 42, steps 1 to 11.



2. Count the teeth on the gears. Start counting from the dot.





3. Then look carefully at the pictures of the models and compare Merry-Go-Round Model A6 to Merry-Go-Round Model A7.

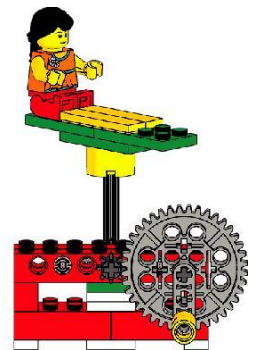
• Circle what is different.



A6



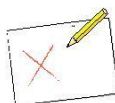
A7



• What do you notice? Explain how the models are different.



4. Next, look carefully at the pictures of the models and make a prediction.



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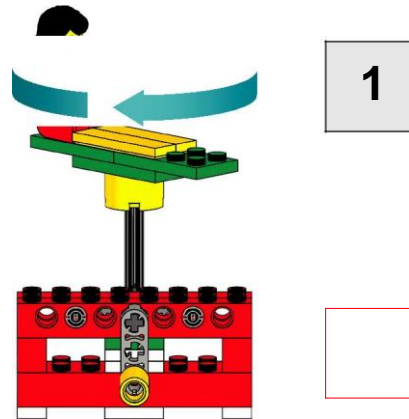
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If I compare model A6 to model A7, then I think Merry-Go-Round Model (A6 / A7) will turn faster.

5. Test Merry-Go-Round Model A6.

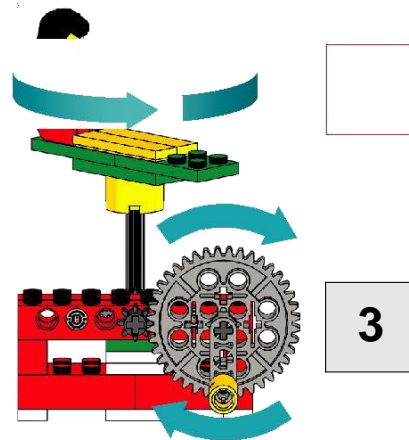
- If you want Max or Mia to make a full turn, how many times must you crank the handle?

Write down your answer.
Remember to try at least three times for a fair test. It is important to keep an eye on
a) where your handle start position is and
b) where Max or Mia's start position is on the Merry-Go-Round.



6. Build Merry-Go-Round Model A7 and make it turn.

Follow Building Instructions A, pages 44 to 52, steps 1 to 11.



7. Test Merry-Go-Round Model A7.

- If you crank the handle three times, how many times does Max or Mia take a full turn?

Write down your answer.
Remember to try at least three times for a fair test. It is important to keep an eye on
a) where your handle start position is and
b) where Max or Mia's start position is on the Merry-Go-Round.



8. Finally, draw a conclusion and check your prediction.

My tests show that Merry-Go-Round (A6 / A7) turns faster.

My prediction was (right / wrong).



A6	
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A7	
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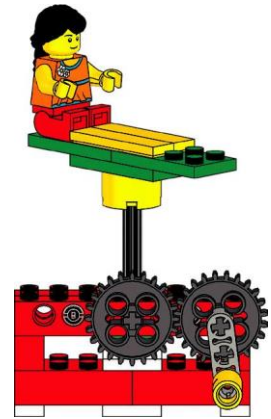
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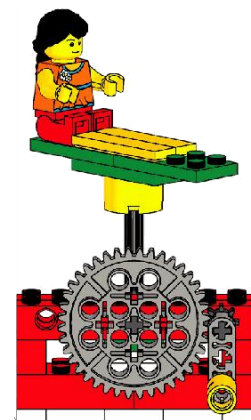
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Explore the effect of the different gearings illustrated. Build them into the Merry-Go-Round one after the other.

What do you notice?
Explain how the gearings are different.
Record observations.







Draw some gear trains (many gears meshing), or some everyday machines and mechanisms where gears are used.



Blank drawing area for gear trains and mechanisms.