Freewheeling

Name(s):

Which will roll furthest? Heavier or lighter carts, with bigger or smaller wheels? Let's find out!

Build the Freewheeler
(All of book 3A and book 3B to page 6, step 12.)

• Check all axles and bushings to make sure the wheels turn smoothly
• Let your freewheeler run down the ramp

Which will roll further ... heavy or light loads?
• Tip: Place a marker brick next to the track where you predict the cart will stop
• Reset the pointer on the dial after each test run

Test accordingly, following the challenges below:

<table>
<thead>
<tr>
<th></th>
<th>My prediction</th>
<th>My measurements</th>
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</thead>
<tbody>
<tr>
<td>A</td>
<td></td>
<td></td>
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<tr>
<td>B</td>
<td>Extra weight</td>
<td></td>
</tr>
<tr>
<td>C</td>
<td>Big wheels</td>
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<tr>
<td>D</td>
<td>Big wheels and extra weight</td>
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Are big wheels better than small?
• Try using big wheels on the back axle

Did you know?
The empty cart weighs about 58 g (~ 2 oz). And the weight brick weighs 53 g (~ 1.9 oz) -- almost the same!
The big wheels weigh 16 g (~ 0.5 oz) each and the small ones only 6 g (~ 0.2 oz) each.
Contemplate

Measure how far the empty cart rolls. Measure with a meter stick (or a yard stick) and compare with the pointer and dial. Record the distance and use a LEGO® brick as a marker of where it stopped. Test at least three times to be sure you have made a scientifically correct answer.

Use a white board marker to divide your dial into quarters. Record on diagram at right.

Carry out several tests.
There is no need to use rulers or measuring tapes – just use the readings on the dial.

Add a weight brick to the cart (book 3B, page 7, step 13). Predict how far it will roll this time by placing another marker brick along the track. Then test.

Jack's Big Wheel Deal
Will big wheels help the cart to roll further than the smaller wheels? Fit them onto the rear axle and test on the ramp (book 3B, page 7, step 14).


One rotation of the dial = _____ cm of car movement.

Pick a car type to retest. Use only the dial for distance measurements.

Car _____ went _____ rotations or ~ _____ cm

Stamp:
Super Scale
Build book 3B to page 12, step 12.
Replace the 8-tooth gear wheel with the 24 tooth gear. Predict and then test how far the cart will roll before the pointer completes one revolution.

One turn of the dial with the 24 tooth gear will be a _______ distance for the car. longer or shorter

1 rotation with 8 tooth = _______ cm
(see p. 2)

1 rotation with 24 tooth = _______ cm

So, a bigger (more toothed) gear causes

Super Slope
Predict first and then test what will happen if you double the height of the hill.

For car — we predict doubling ramp height will give _______ cm roll distance, because

Stamp
Larger scales ... and steeper hills

Build book 3B to page 12, step 12
Change the ramp position to be 30 cm (~12in) high.
Test your different types of freewheelers.

What I found out when making the slope steeper:

<table>
<thead>
<tr>
<th>My prediction</th>
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<tbody>
<tr>
<td><img src="image" alt="Diagram" /></td>
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<tr>
<td>A</td>
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<tr>
<td>Choose B, C, D</td>
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<tr>
<td>your design</td>
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My Amazing Downhill Racer!

Draw your favourite freewheelers design. Explain how the three best parts work.