



Highly Commended

Scientific Inquiry

Year R-2

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Scotch College - Junior School



Scientific Inquiry: Bicycle Gears

Question

Will a higher gear or lower gear help me go faster on my bike?

Hypothesis

I think that a higher gear will help me go faster.

Background

I did some research to learn more about how gears work.

A gear is a set of toothed wheels working together in a machine.

The driver gear is the gear that has the force or motion input. On a bike the force comes from the legs of the cyclist pushing on the pedals.

The follower gear is the gear that results in the force or motion output. On a bike they are found on the back wheel.

The gear ratio of a gear train is the number of teeth on the driver gear divided by the number of teeth on the follower gear.

Planning and conducting

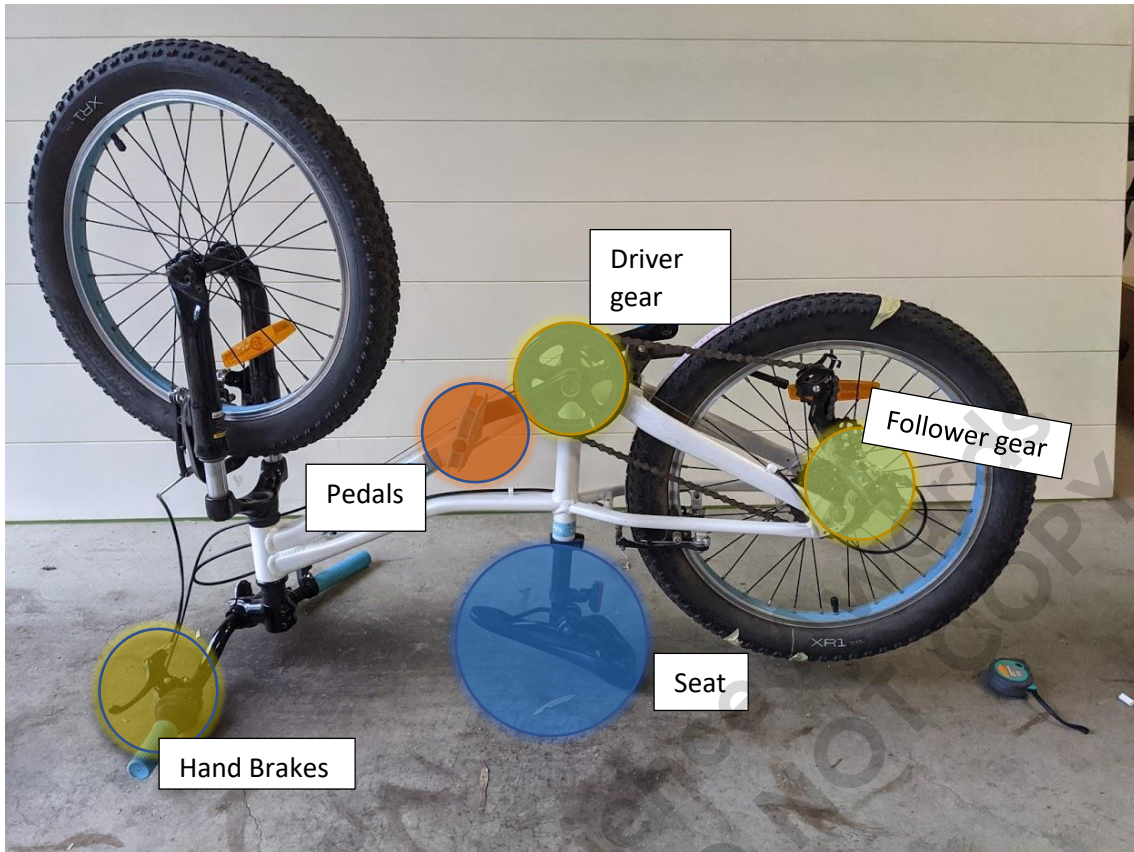
Method:

1. Put a chalk line on the bottom of the back wheel of the bike.
2. Measure the total circumference of the back wheel.
3. Turn to first gear and turn pedal 1 revolution and see how many revolutions the chalk line has turned.
4. Repeat steps 1 and 2 for third, fifth and seventh gears so you can see the difference between each gear.
5. Count the number of teeth on the pedal gear and the first, third, fifth and seventh gears.
6. Calculate the gear ratio and compare this to the number of revolutions in steps 2 and 3.

Equipment and materials

I chose to do this experiment using:

- My bike (with 7 gears)
- Bright chalk
- Fabric measuring tape
- Pencil
- Paper or notebook.





Risks and hazards

Your finger could get caught in cogs and wheels so only touch the pedals and do not touch wheels when moving. Only stop the wheels from moving by using the hand brakes. Do not touch the wheels when they are turning.

Results

I made a table of my measurements below. The revolutions of the back wheel was calculated by dividing the distance of the fabric measuring tape at the chalk mark by the total circumference of the back wheel.

Table 1

Gear:	1	3	5	7
Revolutions of Back Wheel for One Revolution of the Pedals	1.54	1.44	1.98	2.05
	1.35	1.54	1.77	2.32
	1.42	1.48	1.77	2.33
	1.13	1.43	1.72	2.32
	1.19			
	1.24			
Average Revolutions of Back Wheel	1.31	1.47	1.81	2.26

When on first gear the rotation is less than the rotation on the gear 7.

So, the wheel turns quicker on seventh gear.

Gear 7 has greater than one more revolution than gear 1, so I travel further.

Table 2

Gear:	1	3	5	7
Number of teeth on following gear	28	22	18	14
Number of teeth on driver gear	32	32	32	32
Gear ratio	1.14	1.45	1.78	2.29

Seventh gear has a greater gear ratio than first gear.

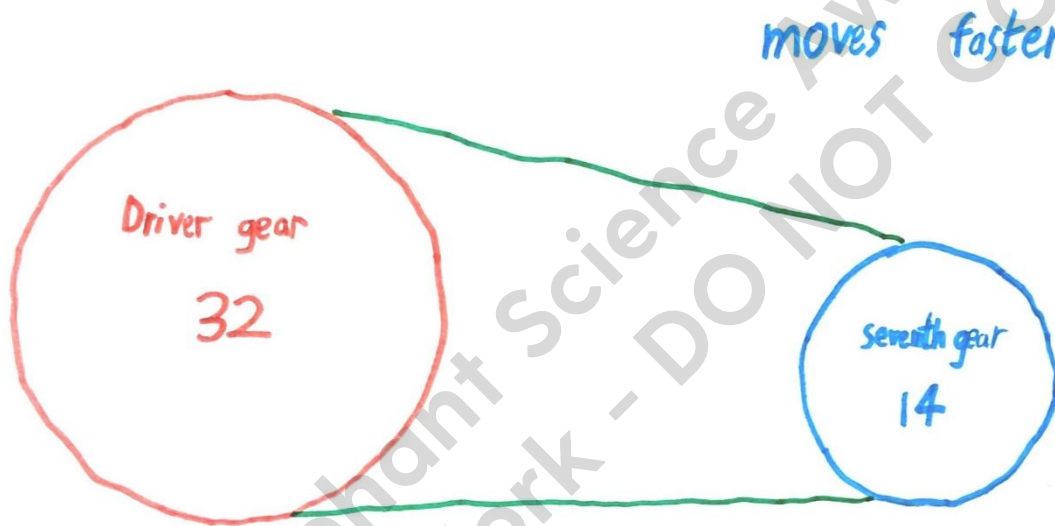


Figure 1

First gear has more teeth on follower gear than seventh gear.

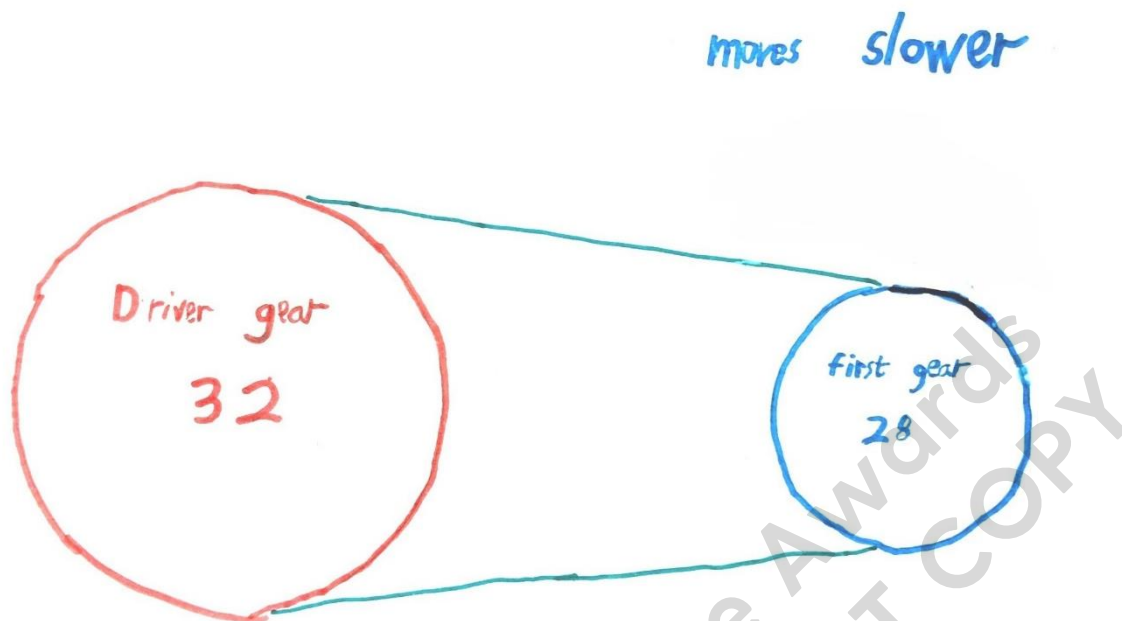


Figure 2

The number of turns of the back wheel divided by the number of turns of the pedals is remarkably close to the gear ratio on gears 3, 5 and 7. The reason that first gear had numbers not close together is because there were errors.

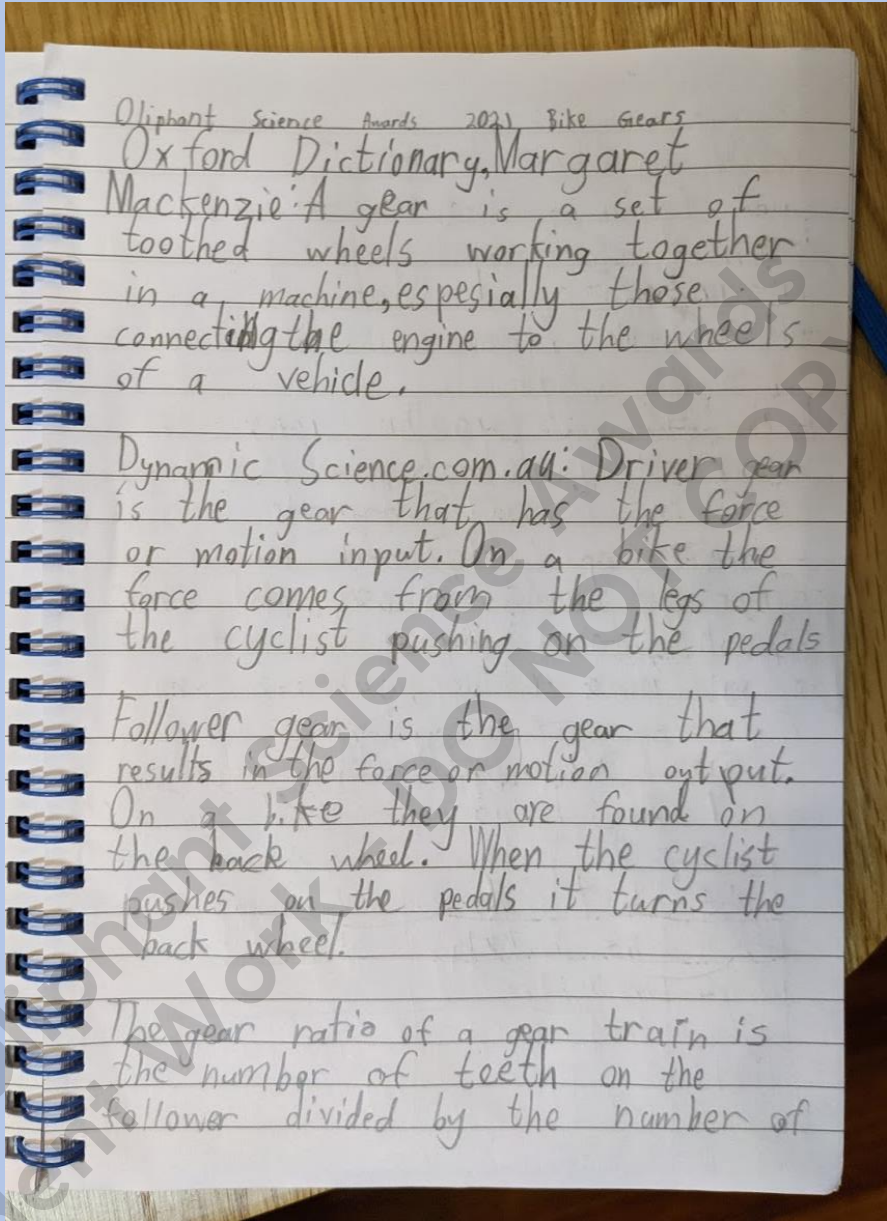
The measurement of revolutions was not exactly accurate because the back wheel could spin freely after one revolution of the pedals.

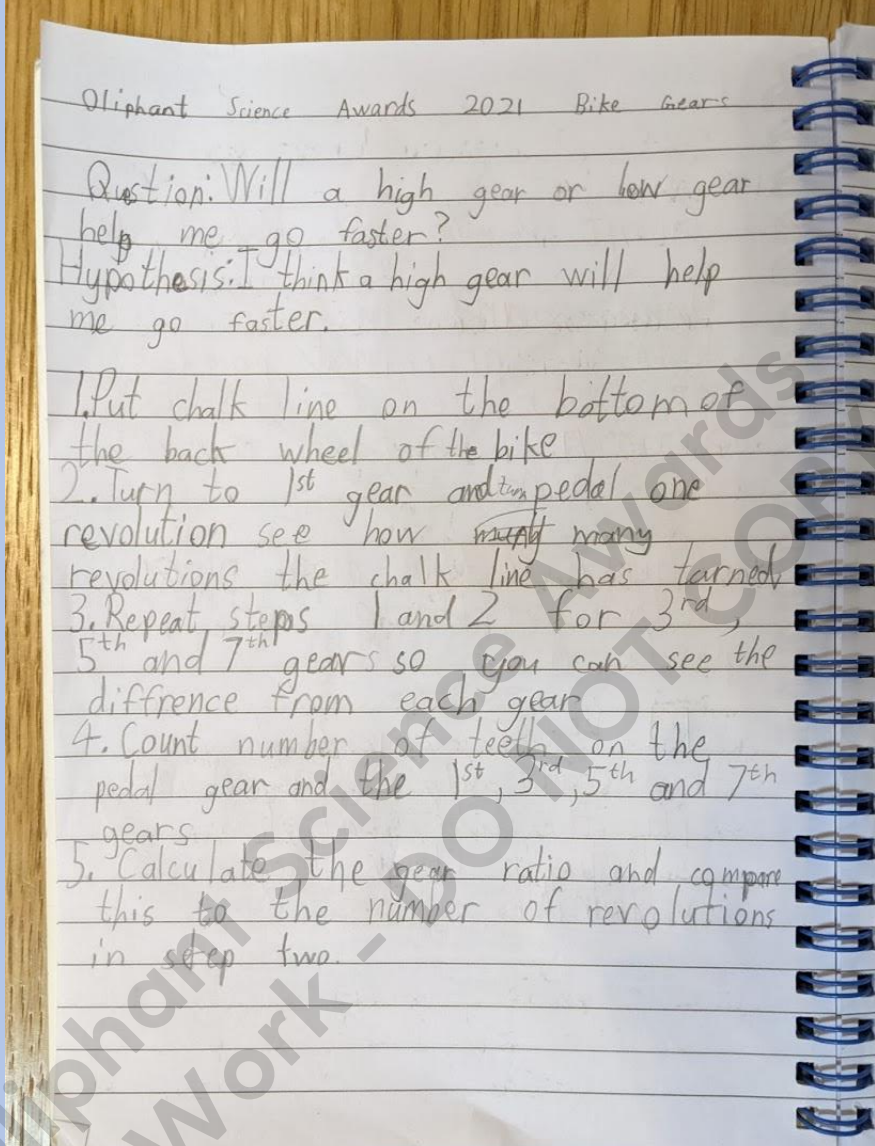
So, the back wheel had to be stopped after 1 revolution of turning the pedal.

Conclusion

My experiment shows that a higher gear will help me go faster because the revolutions of the back wheel are greater than the other gears. To investigate this further I could do this experiment with a bike with more gears. I would also like to learn more about the force, or torque using each of the gears.

Log Book

Date	Remarks
26/06/2021	<p data-bbox="469 300 989 329">I did some research found out about gears.</p>  <p data-bbox="574 421 1157 465">Elephant Science Awards 2021 Bike Gears</p> <p data-bbox="574 465 1157 510">Oxford Dictionary, Margaret Mackenzie: A gear is a set of toothed wheels working together in a machine, especially those connecting the engine to the wheels of a vehicle.</p> <p data-bbox="574 761 1292 996">Dynamic Science.com.au: Driver gear is the gear that has the force or motion input. On a bike the force comes from the legs of the cyclist pushing on the pedals</p> <p data-bbox="574 1019 1268 1288">Follower gear is the gear that results in the force or motion output. On a bike they are found on the back wheel. When the cyclist pushes on the pedals it turns the back wheel.</p> <p data-bbox="574 1321 1284 1467">The gear ratio of a gear train is the number of teeth on the follower divided by the number of</p> <p data-bbox="469 1585 1018 1615">I wrote down my method for the experiment.</p>

Date	Remarks
	 <p>Elephant Science Awards 2021 Bike Gears</p> <p>Question: Will a high gear or low gear help me go faster?</p> <p>Hypothesis: I think a high gear will help me go faster.</p> <ol style="list-style-type: none">1. Put chalk line on the bottom of the back wheel of the bike2. Turn to 1st gear and pedal one revolution see how many many revolutions the chalk line has turned3. Repeat steps 1 and 2 for 3rd, 5th and 7th gears so you can see the difference from each gear4. Count number of teeth on the pedal gear and the 1st, 3rd, 5th and 7th gears5. Calculate the gear ratio and compare this to the number of revolutions in step two.
27/06/2021	I did an experiment using my bike and recorded my observations in my notebook. My father helped measure the back wheel turns.

Date	Remarks																																				
	<p>Elephant Science Awards 2021 Bike Gear teeth on the driver. In the gear train on a bike.</p> <p>Equipment and Materials</p> <ul style="list-style-type: none"> • Bike with 7 gears • Bright Chalk • Pencil (any type) • Paper or notebook (white paper) <p>Risks and Hazards</p> <ul style="list-style-type: none"> • finger get caught in cogs and wheels so only touch the pedals and do not touch wheels when moving. <table border="1" style="margin-left: auto; margin-right: auto;"> <tr> <td>28</td> <td>22</td> <td>18</td> <td>14</td> </tr> <tr> <td>1</td> <td>3</td> <td>5</td> <td>7</td> </tr> <tr> <td>2.8</td> <td>2.7</td> <td>1.8</td> <td>2.05</td> </tr> <tr> <td>1.84</td> <td>1.44</td> <td>1.51</td> <td>1.98</td> </tr> <tr> <td>1.35</td> <td>1.52</td> <td>1.77</td> <td>2.33</td> </tr> <tr> <td>1.42</td> <td>1.48</td> <td>1.77</td> <td>2.32</td> </tr> <tr> <td>1.3</td> <td>1.43</td> <td>1.72</td> <td></td> </tr> <tr> <td>1.24</td> <td></td> <td></td> <td></td> </tr> <tr> <td>1.18</td> <td colspan="3">* driver gear 32 teeth</td> </tr> </table>	28	22	18	14	1	3	5	7	2.8	2.7	1.8	2.05	1.84	1.44	1.51	1.98	1.35	1.52	1.77	2.33	1.42	1.48	1.77	2.32	1.3	1.43	1.72		1.24				1.18	* driver gear 32 teeth		
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3/07/2021	I put my experiment data onto the computer with help from my father.																																				
4/07/2021	I typed up my scientific report with help from my father.																																				
10/07/2021	I typed up my scientific report with help from my father.																																				
11/07/2021	I typed up my scientific report with help from my father.																																				
17/07/2021	I typed up my scientific report with help from my father.																																				

References

Australian Primary Oxford Dictionary, Fourth edition, Oxford University Press, 2015

Website: DynamicScience.com.au/tester/solutions1/hydraulicus/gears.htm

DK Children's Encyclopedia, First edition, DK Australia, 2019