

SECTION

3

Enrichment

The Bicycle

A machine multiplies either speed or force but never both at the same time. When you ride a bicycle, the gears increase your force or decrease your force. This change in force results in slower speeds or faster speeds.

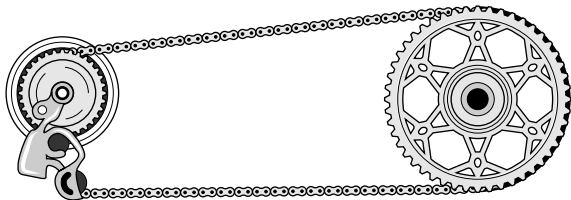
For a bicycle, the mechanical advantage (IMA) is the number of times the applied force is multiplied. The speed advantage (ISA) is the number of times that the machine multiplies the speed. If a bicycle multiplies the force of your legs by two, the speed is divided by two.

Procedure

- Use the figure below to estimate the number of teeth shown in the two gears. Use the following formulas to find IMA and ISA for the gears shown.

$ISA = \text{number front teeth} / \text{number rear teeth}$

$IMA = \text{number rear teeth} / \text{number front teeth}$



Rear gears

Front gears

Questions

- What gear combination produces the greatest ideal mechanical advantage in the ten-speed bike? The mountain bike? _____

- What gear combination produces the greatest speed advantage in the ten-speed bike? The mountain bike? _____

- Explain why the gear combinations in a ten-speed bike are made for maximum speed advantage, while the combinations in a mountain bike are made for maximum mechanical advantage?

- Obtain a ten-speed bike. Count the teeth in the front and rear gears in speeds 1, 5, 6, and 10. Record your data in the table and calculate the ISA and the IMA for each speed.

10-Speed Bike				
Speed	Front	Rear	ISA	IMA
1				
5				
6				
10				

- Obtain a mountain bike and count the teeth in the front and rear gears in speeds 1, 6, 13, and 18. Record your data in the table and calculate the ISA and the IMA.

Mountain Bike				
Speed	Front	Rear	ISA	IMA
1				
6				
13				
18				