Engineering Blizzard Bag

Observing Mechanisms – Day 3

Purpose

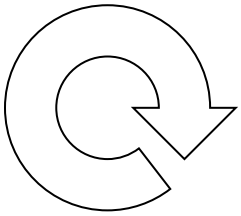
When you are riding a multi-speed bicycle up a steep hill, what do you do? Most likely you shift gears so you can get more power with the same amount of effort. Sometimes when a standard shift or four-wheel drive vehicle is being driven up a steep incline, the driver will downshift or engage the four-wheel drive so he or she can get more torque. Can you think of other examples where force or torque is changed to make a task easier?

This activity provides a review of the demonstration your teacher gave you on forces and torque. It will also give you an opportunity to review the calculation of gear ratios.

Procedure

A force travels in a straight line.

Torque travels in a circular direction.



1. Gears turn in a circular direction. There is a relationship between torque and speed in gearing. A ten-speed bicycle has ten different gear selections. When you pedal up a hill, you use a gear train that provides more torque (turning force) but, in doing so, less speed.

   When you pedal on flat land, you use a gear train that provides more speed, but in doing so, less torque within the gear train.

The gear train in which diagram provides more torque? _____

The gear train in which diagram provides more speed? _____

2. Fill in the diagram below to show the relationship between torque and speed in gear trains.

More torque

More speed

3. Complete the chart below showing the relationship between drive gear and driven gear in a simple gear train.

	Driven Gear Size
To increase torque	
To increase speed	

4. Calculate the following gear ratios.

# Teeth Gear 1	**# Teeth Gear 2**	**Gear Ratio**	**Explanation**
8	40	40/8	A small gear must turn 5 times to move larger gear once.
4	36		
6	48		
16	20		

Conclusion

1. What would cause the gears to lose some of their efficiency?

2. How could the effect be minimized?