Name:_____

Always remember to reduce to the lowest common denominator. Gear ratios are written **Driven** gear to **Driving** gear, so if gear 1 has 10 teeth and is driving gear 2 having 5 teeth, the ratio is 5:10, or more correctly, 2:1.

What is the gear ratio between gears 1 and 2 if:
Gear 1 has ____A___ teeth and gear 2 has ____B___ teeth.

	RATIO		**HOW MANY TIMES**
A= 10; B=20	_____	If A turns one time, B will turn	_____.
A= 10; B=40	_____	If A turns two times, B will turn	_____.
A= 3; B=27	_____	If B turns one time, A will turn	_____.
A= 10; B=200	_____	If B turns one time, A will turn	_____.
A= 12; B=48	_____	If A turns one time, B will turn	_____.
A= 26; B=130	_____	If A turns five times, B will turn	_____.
A= 5; B=55	_____	If B turns one time, A will turn	_____.

In Gear-trains with multiple gears the ratio will change from set to set, but ends as a ratio from the first to the last.

Example: A has 10 teeth; B has 50 teeth; C has 40 teeth; the ratio for A:B is 50:10, or 5:1; the ratio for B:C is 40:50 or 4:5. Multiply 5:1 x 4:5 and you have 4:1. *Simpler to ignore all idler gears. C:A - 40:10 - 4:1*

If the first gear has ____A___ teeth and gear 2 has ____B___ teeth, and gear 3 has ____C_____ teeth

	RATIO		**HOW MANY TIMES**
A= 10; B=20; C=10	___**1:20:1**_=_**1:1**___	If A turns one time, C will turn	_____**1**_____.
A= 10; B=40; C=5	_____	If A turns one time, C will turn	_____.
A= 3; B=27; C=3	_____	If C turns one time, A will turn	_____.
A= 10; B=200; C=200	_____	If B turns one time, C will turn	_____.
A= 12; B=48; C=6	_____	If A turns one time, C will turn	_____.

Now look at the ratios between the first and last gears. Is it necessary to factor in the middle gear?

What are the purposes of an idler gear? Idle gears give space.

Idler gears allow greater distance between driven and driving gears without changing the size of either.

They can also affect the direction of the gear rotation.

Name:_____

Always remember to reduce to the lowest common denominator. Gear ratios are written **Driven** gear to **Driving** gear, so if gear 1 has 10 teeth and is driving gear 2 having 5 teeth, the ratio is 5:10, or more correctly, 2:1.

Gear Ratio Worksheet:

Define mechanical advantage:

What advantage do you gain from using gears?

What is a ratio?

How do you determine the ratio between two sets of gears?

How are gear ratios written?

Why is torque important?

What are the relationships between speed, torque, wheel size, and RPMs?

Name:_____

Always remember to reduce to the lowest common denominator. Gear ratios are written **Driven** gear to **Driving** gear, so if gear 1 has 10 teeth and is driving gear 2 having 5 teeth, the ratio is 5:10, or more correctly, 2:1.

Gear Ratio Worksheet:

Define mechanical advantage:

An increased force, and the benefits of that increase created by using a machine to transmit force.

What advantage do you gain from using gears?

Gears allow you to change rotational direction. Gears allow you to transfer rotary energy from one axis to another, as well as change rotary motion into linear motion. Gears allow for increases and decreases in speed, torque, or total rotations between different axis.

What is a ratio?

Ratio is a relationship between the size of two gears in terms of proportionality. Two gears of equal proportion would be the same size, and have the same number of teeth and have a relationship of 1 to 1, or a ratio of 1:1. If one gear was twice the size, with twice as many teeth, it would have a relationship of 2 to 1, or a ratio of 2:1.

How do you determine the ratio between two sets of gears?

Ratios in gears are determined by the number of teeth between the driving and driven gears. (example 2:1) 1 being the driving gear, 2 being the driven.

How are gear ratios written?

Driving gear to driven gear, separated by a colon. (example 2:3)

Why is torque important?

Torque is a measurement of power produced in a twisting or turning, which is measured in two characteristics; effort and rate. To increase torque, one must either increase either effort or rate. This can be accomplished by either applying more force, or increasing the length of a lever arm. Gears are wheels with teeth, and wheels are levers rotating around an axle (fulcrum), so increasing the size of the gear is equivalent to the later.

What are the relationships between speed, torque, wheel size, and RPMs?

There are several. Generally speed and torque are opposed to each other. With a small gear (More speed, less torque) turning a larger gear (less speed, more torque) you sacrifice speed to gain the torque. With the large to small driving arrangement, you give up torque to acquire speed. Large wheels take longer to reach optimum speed, but travel greater distances per revolution than smaller wheels.

Name:_____

Always remember to reduce to the lowest common denominator. Gear ratios are written **Driven** gear to **Driving** gear, so if gear 1 has 10 teeth and is driving gear 2 having 5 teeth, the ratio is 5:10, or more correctly, 2:1.

What is the gear ratio between gears 1 and 2 if:
Gear 1 has ____A___ teeth and gear 2 has ____B___ teeth.

	RATIO	HOW MANY TIMES
A= 10; B=20	**1:2**	If A turns one time, B will turn **1/2**.
A= 10; B=40	**1:4**	If A turns two times, B will turn **1/2**.
A= 3; B=27	**1:9**	If B turns one time, A will turn **9**.
A= 10; B=200	**1:20**	If B turns one time, A will turn **20**.
A= 12; B=48	**1:4**	If A turns one time, B will turn **1/4**.
A= 26; B=130	**1:5**	If A turns five times, B will turn **1**.
A= 5; B=55	**1:11**	If B turns one time, A will turn **11**.

In Gear-trains with multiple gears the ratio will change from set to set, but ends as a ratio from the first to the last.
Example: A has 10 teeth; B has 50 teeth; C has 40 teeth; the ratio for A:B is 50:10, or 5:1; the ratio for B:C is 40:50 or 4:5. Multiply 5:1 x 4:5 and you have 4:1. *Simpler to ignore all idler gears. C:A - 40:10 - 4:1*

If the first gear has ____A___ teeth and gear 2 has ____B___ teeth, and gear 3 has ____C_____ teeth

	RATIO	HOW MANY TIMES
A= 10; B=20; C=10	**1:20:1 = 1:1**	If A turns one time, C will turn **1**.
A= 10; B=40; C=5	**1:8:2 = 1:2**	If A turns one time, C will turn **2**.
A= 3; B=27; C=3	**1:9:1 = 1:1**	If C turns one time, A will turn **1**.
A= 10; B=200; C=200	**20:20:1 =20:1**	If B turns one time, C will turn **1**.
A= 12; B=48; C=6	**1:8:2 1:2**	If A turns one time, C will turn **2**.

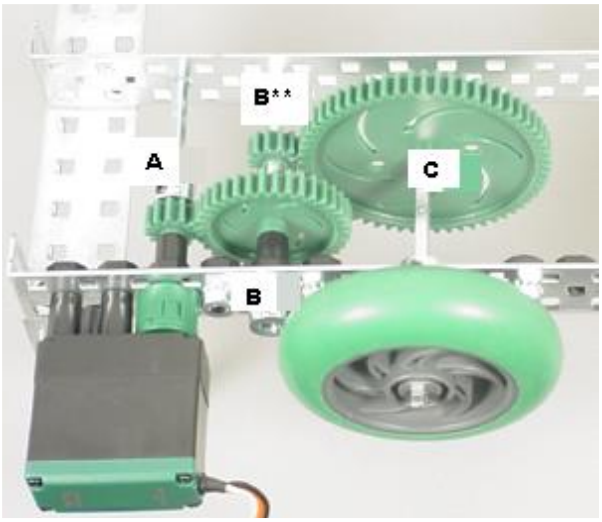
Now look at the ratios between the first and last gears. Is it necessary to factor in the middle gear?

What are the purposes of an idler gear?

Idler gears allow greater distance between driven and driving gears without changing the size of either. They can also affect the direction of the gear rotation.

Name:_____

Always remember to reduce to the lowest common denominator. Gear ratios are written **Driven** gear to **Driving** gear, so if gear 1 has 10 teeth and is driving gear 2 having 5 teeth, the ratio is 5:10, or more correctly, 2:1.
In Gear-trains with multiple gears the ratio will change from set to set. If there are two sets of gears on a given shaft, both spin at the same RPM. The ratio from gear set to gear set is calculated separately then multiplied together. Gear 1 meshes with 2a, and Gear 2b meshes with Gear 3. If the first gear has ____A___ teeth; gear 2a has ____B___ teeth; gear 2b has ____B**___ teeth; and gear 3 has ____C_____ teeth



*Example: A has 10 teeth; B has 40 teeth; the ratio for the A:B is 40:10, or 4:1. B** has 10 teeth; C has 50; the ratio for B**:C is 50:10, or 5:1. Multiply 5:1 x 4:1 and you have 20:1*

	RATIO	**HOW MANY TIMES**
A= 10; B=20; B**= 5;C=10	**_2:1_x_2:1_=_4:1__**	If A turns one time, C will turn ____**1/4**_____.
A= 10; B=40; B**= 5; C=5	**_4:1_x_1:1_=_4:1__**	If C turns one time, A will turn _____**4**_____.
A= 3; B=27; B**= 3; C=9	**_9:1_x_3:1_=_27:1__**	If C turns one time, A will turn ____**27**_____.
A= 10; B=200; B**= 5; C=200	**_20:1_x_40:1_=_800:1__**	If B turns one time, C will turn ___**1/40**_____.
A= 12; B=48; B**= 8; C=6	**_4:1_x_3:4_=_3:1__**	If A turns six times, C will turn _____**2**_____.

Rotation is measured in the number of times an item makes a 360 degree movement turning completely around to where it started, within a given time frame. Revolutions per minute, or RPM is the standard and is considered a measurement of speed.

If a motor turns a gear on a shaft at the speed of 10 RPM, then the gear, whether it bears 10 teeth or 100 teeth will spin ten times in one minute. That is one revolution every 6 seconds. Half of a revolution every 3 seconds.

Given: A motor turns a shaft with a 24 tooth gear 8 ½ times in 10 seconds. That gear is meshed to a gear having ___A____ teeth which is connected to a second shaft.

How fast is the shaft on the motor turning? ___**51 rpm**____

Name:_____

Always remember to reduce to the lowest common denominator. Gear ratios are written **Driven** gear to **Driving** gear, so if gear 1 has 10 teeth and is driving gear 2 having 5 teeth, the ratio is 5:10, or more correctly, 2:1.

A= 24 How fast is the second gear turning? ___**51 rpm**____

A= 48 How fast is the second gear turning? ___**25.5 rpm**____

A= 8 How fast is the second gear turning? ___**204 rpm**____

A= 12 How fast is the second gear turning? ___**102 rpm**____

A= 96 How fast is the second gear turning? ___**12.75 rpm**____

Torque is relative to speed, gear ratio, and all the info we have been discussing. Therefore, torque can be talked about reference to it's formula t = f * l (torque equals force times lever arm length {radius of gear}). It can also be looked at reference gear ratio too.

Example: if a motor can lift 10 lbs, and it is geared to a second shaft that has a 2:1 ratio, it can by using this setup lift 20 lbs.

Given: A motor turns a shaft with a 24 tooth gear. That gear is meshed to a gear having ___A____ teeth which is connected to a second shaft. The motor can lift 8 lbs direct. If:

A= 24 How much can the second shaft lift? _____**8 lbs**_____

A= 48 How much can the second shaft lift? _____**16 lbs**____

A= 8 How much can the second shaft lift? _____**2.67 lbs**____

A= 12 How much can the second shaft lift? _____**4 lbs**_____

A= 100 How much can the second shaft lift? _____**33.33 lbs**___