Step 1. Identify the following parts on your bicycle:

Shifters

Rear sprockets

Front sprockets
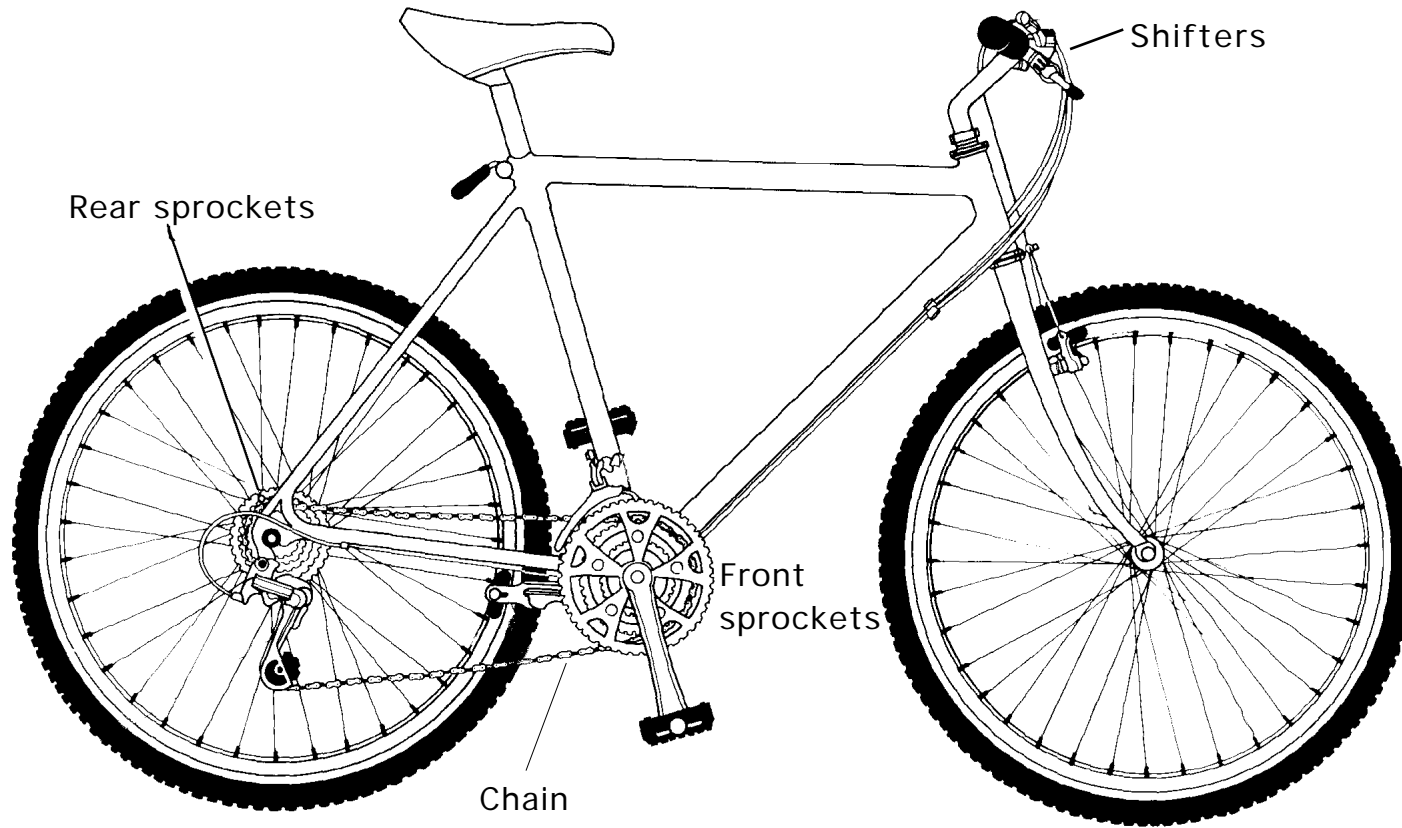
Chain

How many front sprockets are on your bicycle?
How many rear sprockets are on your bicycle?
How many speeds does your bicycle have?

Step 2. Show how the positions of the shifters relate to where the chain is on the sprockets (make sure that you are pedaling as you shift the gears). This is a "birds-eye" view of the bicycle.
      (note, to easily stop the rear wheel, use the right handbrake).

Shifters

full rearward   full forward

Left Shifter

REAR OF BICYCLE

FRONT OF BICYCLE

Front Sprockets

Rear Sprockets

Right Shifter

full rearward   full forward

HIGH GEAR

LOW GEAR

Rear Sprockets   Front Sprockets   Rear Sprockets   Front Sprockets

| Step 3	• With the bicycle on the stand, shift your bicycle into *HIGH* gear (shown above). • Observe the speed at which the rear wheel rotates as you turn the pedal at one revolution per second.	Step 4	• Shift your bicycle into *LOW* gear (shown above). • Observe the speed at which the rear wheel rotates as you turn the pedal at one revolution per second.

Step 5	Which gear made the rear wheel spin faster? (circle one answer)
	                    HIGH LOW
	Which gear would you expect to allow you to travel further per revolution of the front sprocket?
	                    HIGH LOW		

The next experiment will let you quantify your observations!

HIGH GEAR

Rear Sprockets   Front Sprockets
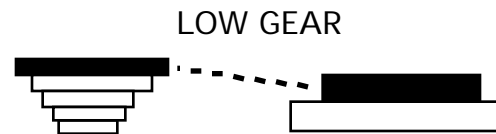
LOW GEAR

Rear Sprockets   Front Sprockets

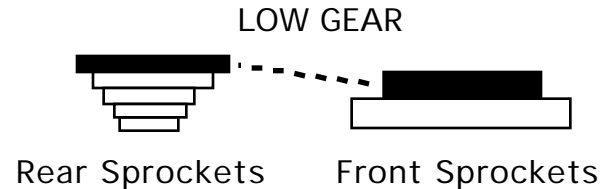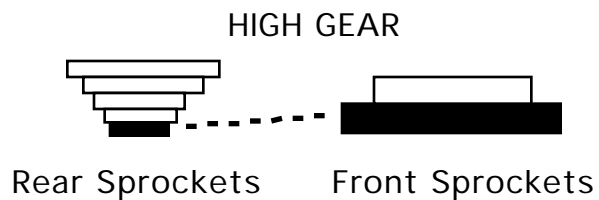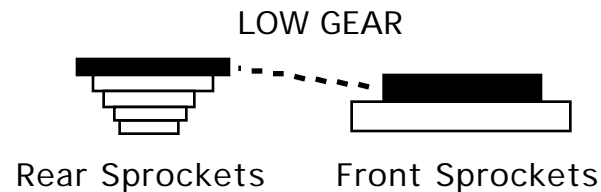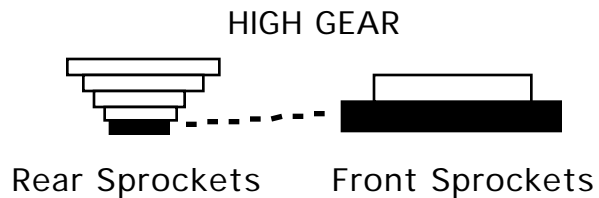| Step 6 | • Count the number of teeth on the Front sprocket ($N_{front\ sprocket}$) when in high gear. Use chalk to mark a starting point.

$N_{frontsprocket}$ = _____

• Count the number of teeth on the rear sprocket ($N_{rear\ sprocket}$) when in high gear.

$N_{rearsprocket}$ = _____

• Use the number of teeth information to find out how many times the rear sprocket goes around for 1 revolution of the front sprocket.

NUMBER OF TIMES:

• (check your answer with a quick experiment). The ratio of $N_{front\ sprocket}/N_{rear\ sprocket}$ is commonly referred to as the "gear ratio" | Step 7 | • Count the number of teeth on the Front sprocket ($N_{front\ sprocket}$) when in low gear.

$N_{frontsprocket}$ = _____

• Count the number of teeth on the rear sprocket ($N_{rear\ sprocket}$) when in low gear.

$N_{rearsprocket}$ = _____

• Use the number of teeth information to find out how many times the rear sprocket goes around for 1 revolution of the front sprocket.

NUMBER OF TIMES:

• (check your answer with a quick experiment) |

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HIGH GEAR   LOW GEAR

Rear Sprockets   Front Sprockets   Rear Sprockets   Front Sprockets

Step 8	• Calculate the circumference of the rear wheel C= • Find the distance D that the bicycle moves during one revolution of the front sprocket when in HIGH Gear by doing the following math.: $C * N_{front\ sprocket}/N_{rear\ sprocket} =$ $\qquad\qquad D =$	Step 9	• Find the distance D that the bicycle moves during one revolution of the front sprocket when in LOW Gear by doing the following math: $C * N_{front\ sprocket}/N_{rear\ sprocket} =$ $\qquad\qquad D =$?
Step 10	If the HIGH gear allows you to travel farther, can you think of a reason why you would even need to have another speed on your bicycle?		

HIGH GEAR

Rear Sprockets   Front Sprockets

LOW GEAR

Rear Sprockets   Front Sprockets

| Step 11	• While pedaling, put your bicycle in *HIGH* gear. • Place a 2x4 on top of the rear wheel in order to create resistance. • Note how difficult it is to get to pedaling at a rate of one revolution per second. • Continue pedaling and go on to Step 15.	Step 12	• While pedaling, put your bicycle in LOW gear. • Note how difficult it is to get to pedaling at a rate of one revolution per second. • Repeat Steps 14 & 15 with the other members of your team.
Step 13	Which gear felt easier to pedal in? (circle one answer) HIGH LOW		
Step 14	Which gear allows you to go further per revolution of the front sprocket? (circle one) HIGH LOW		
Step 15	Which gear would you rather use when climbing a hill or starting? (circle one) HIGH LOW Why?		
Step 16	Which gear would you rather use when zooming down a hill? (circle one) HIGH LOW Why?		

Step 17
Take any necessary measurements of the bottom bracket in low and high gears to complete FBD's as part of Special Problem #4.

Low Gear　　　　High Gear

Front Sprocket　　Pedal　　　Front Sprocket　　Pedal
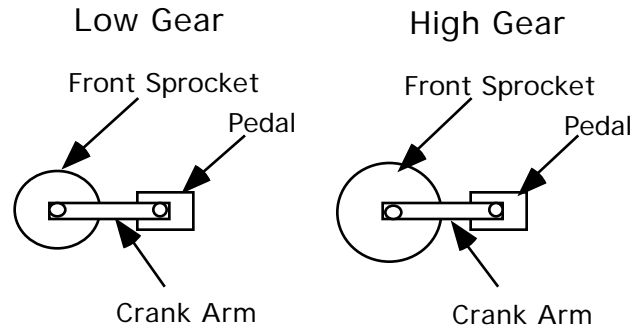
Crank Arm　　　Crank Arm

Step 18
Take any necessary measurements of the rear wheel/hub in low and high gears to complete FBD's as part of Special Problem #4.

Low Gear　　　　High Gear

Rear Tire　　Rear Sprocket and Hub　　Rear Tire　　Rear Sprocket and Hub
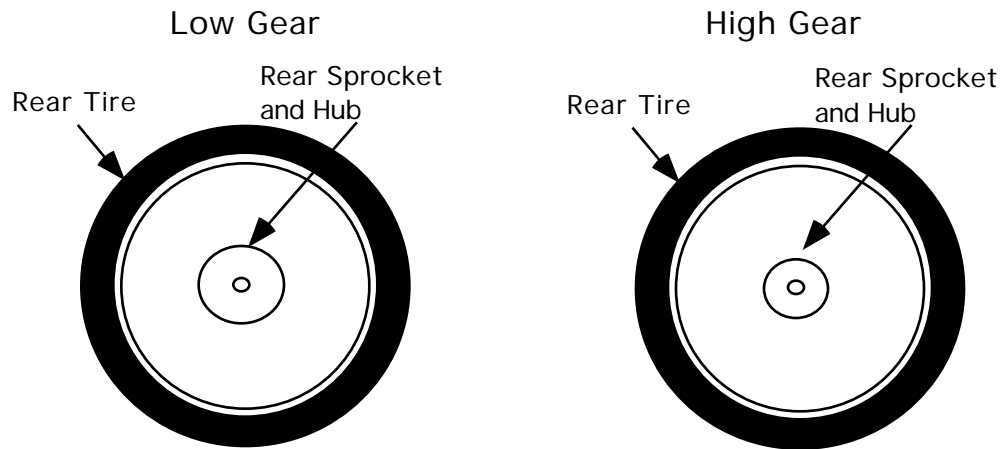
Step 19
The crank arm can be considered to be a cantilever beam. Make a sketch of the crank arm. Take any necessary measurements that will allow you to calculate the maximum bending stress in the crank arm.

Step 20
The chain is a series of links. Make a sketch of a segment of chain. Take any necessary measurements that will allow you to calculate the maximum tensile stress in the chain.