

### 3. Understanding What Makes Your Car Go: The Transmission and Emergency Brake

First, we need to go back to our discussion of how your car engine makes your car move down the road. Recall that we said the crank shaft turned the flywheel which had the capability of attaching to the transmission. Before we get right into the transmission, let's use a bicycle first as a means of understanding how a transmission works.

Think back to the first bike you ever learned to ride. Most likely it was a bike which had one speed. As you pedaled your bike, the chain was aligned with only one sprocket from the pedal back to the rear wheel. You couldn't choose another sprocket and "change gears." Consequently, you were "stuck" with the gear ratio that your bike was built with.

A single-speed bike has one sprocket at the pedals and one sprocket back at the rear wheel. The chain can only "ride" on this one set of sprockets and therefore can't be changed.



As you got older, you may have had the option of getting a “fancier” multi-speed bike which allowed you to change gears. The ability to change gears means you have the opportunity to choose which sprockets (gears) you allow the chain to move upon. Some gears make it easier to climb steep inclines while some gears make it easier to gain great speeds with less effort. This ability to change gears makes your bike much more functional and more enjoyable to use over varying terrain. Note in the photo here that there are multiple sprockets both at the pedal and rear wheel of this multi-speed bike.

A multi-speed bike has multiple sprockets at the pedal and at the rear wheel. This allows for multiple combinations of pathways that the chain can "ride" upon.

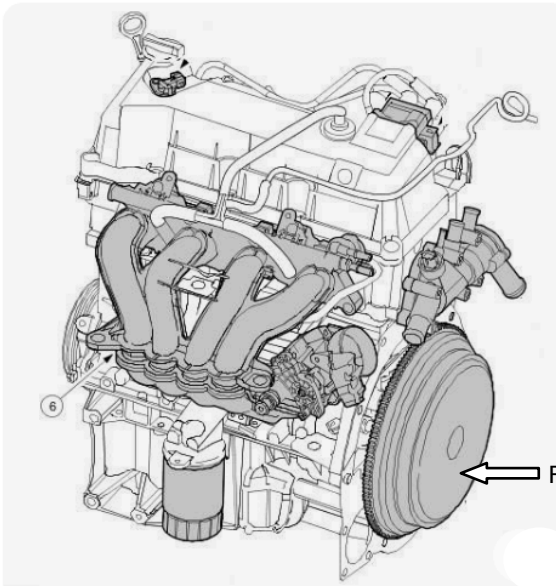


Certain combinations of sprockets (gears) make it "easier" for you to climb steep hills while other combinations make it "easier" for you to go at fast speeds with less effort.

Think now about your car. There are times when your car needs maximum power as when you are pulling away from a complete stop or are attempting to go up a steep hill. And then, like your bike, there are times when you are on a flat surface and would like to gain and maintain greatest speeds with the least amount of fuel. It makes sense, then, to be able to change the gears within your car to attain these goals. The ability to change the gears of a car happens through the use of its transmission.

Basically, the transmission offers an assortment of gears that the flywheel can contact. Recall that the engine of your car, when on, is always turning and therefore, the flywheel is always turning. To change from gear to gear requires that the flywheel be temporarily disconnected from the transmission. Once a new gear is chosen, the flywheel and “new” gear are joined again and

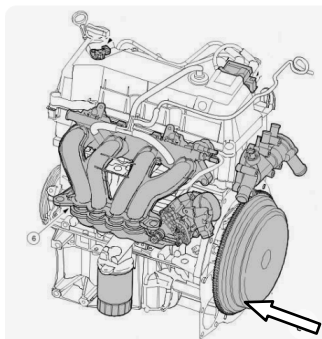




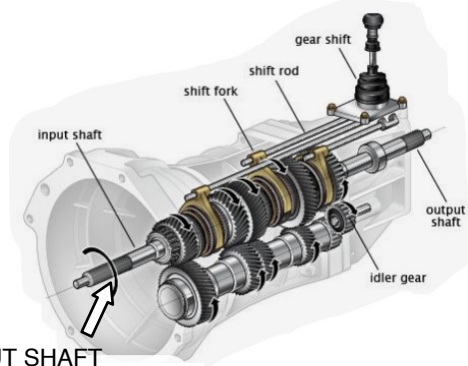
The flywheel is directly connected to the crankshaft of the engine. Because of this, as long as the engine is running, the flywheel is turning at the same speed with a constant amount of power. To enhance this amount of power we utilize an assortment of gears in the transmission.

the car can continue moving. Look at the diagram below. Note that as long as the engine is running, the flywheel is turning.

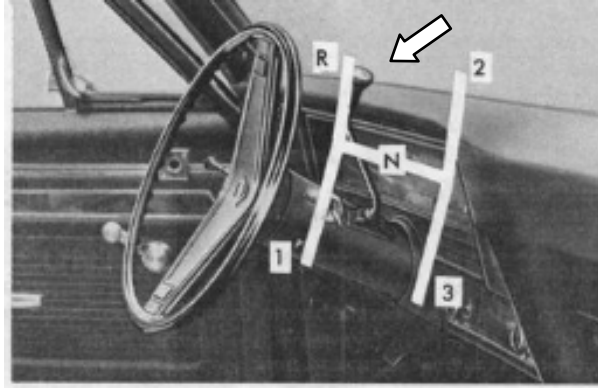
The ability to temporarily separate the flywheel and the transmission is accomplished by a neat invention known as the clutch. In a manual transmission car, the clutch is activated by depressing the clutch pedal on the floor board. When the clutch is depressed, the flywheel moves away from the transmission so a new gear can be chosen. When the clutch pedal is released, the flywheel and “new” gear come back into contact and the car continues onward.



The clutch determines whether the flywheel will engage or not with the input shaft of the transmission.



The process of choosing the new gear happens when the driver moves the gear shift lever inside the car. Sometimes this lever is called the stick shift. It may extend up from the floor of the car between the seats or it may be found (in very old cars or trucks) extending from the right side of the steering wheel column. Look at the photos here.



The gear shift lever for a manual transmission in most modern vehicles extends up from the floor between the driver and the front passenger seat. The right photo was taken from the owner's manual of an old car and shows the gear shift lever extending from the steering column. This method was commonly known as "three on the tree" noting it had three forward speeds. You can see the pathways to shift from gear to gear, including R for reverse, in both styles.

Note on the handle of the stick shift lever that there is often a diagram with numbers showing the driver "where to find" the gears. While depressing the clutch, the driver can move the stick shift to a new position which chooses a new gear. Note also the notation of R. This position is the reverse position which makes the car move backwards.

Reverse (R) is the gear to move backwards or reverse. To safely use this gear, the clutch must be fully depressed and the vehicle at a complete stop. Otherwise, damage to the transmission can occur.

Second gear (2) is where you go next after first gear. Less power than first gear but more speed. Some vehicles work fine starting in second gear when pulling away from a stopped position.



First gear (1) provides greatest power but least amount of speed. Great for starting from stopped position or when pulling something very heavy.

Third gear (3) is the next gear up as you gain speed from being in second gear. It can readily be used as you slow from higher speeds in fourth gear to make a turn.

Fourth gear (4) and fifth gear (5) are gears that you would use to go at highest speeds with least amount of fuel used.

This type of transmission where the driver actively has options to change gears when he or she chooses is called a manual or standard transmission. Note that moving the gear shift without depressing the clutch causes a horrible mess in the transmission. In fact, attempting to change gears without depressing the clutch first can permanently damage your car. We'll look more

closely at how one drives using a manual transmission later in this course. We'll now turn to learning more about the more common automatic transmission.

## THE AUTOMATIC TRANSMISSION

The manual or standard transmission was the first type of transmission used in cars. In the early 1900s the automatic transmission was invented and it's this type of transmission which is most commonly found in cars produced and used in the United States. This isn't the case in other countries where manual transmissions are the most common. The automatic transmission allows the car to change gears on its own. The car has the ability to sense when it needs to change to a lower gear, like when starting from a stop or climbing a steep hill or when it's traveling along a flat highway at high and efficient speed and can shift to a higher gear. Shifting gears is automatic and you, as the driver, don't have to think about doing it at all.

Besides needing no clutch (or clutch pedal), the lever to change options of the automatic transmission is different from the manual stick shift lever. The automatic transmission lever has a position labeled as P which stands for park, and R which stands for reverse, an N which stands for neutral, a D which stands for drive and then a possible set of numbers which may have a D in front of them (such as 1 or 2 or D1 or D2). Look here at the shift lever for a vehicle with an automatic transmission.

In this photo, you can see the gear shift lever for a vehicle with an automatic transmission.

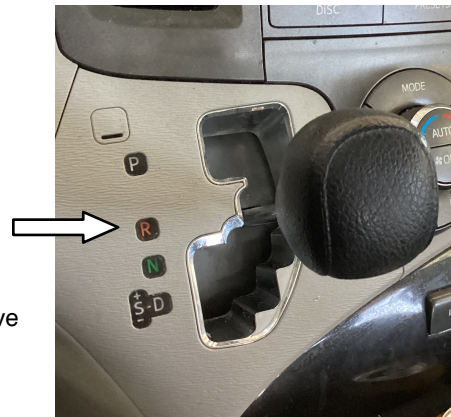


When the shift lever is in the P, or park, position, the wheels of the car are unable to move in any direction. The wheels are locked and this is the condition your car must always be left in after you're finished driving. Note in the photo here how this car is in park.



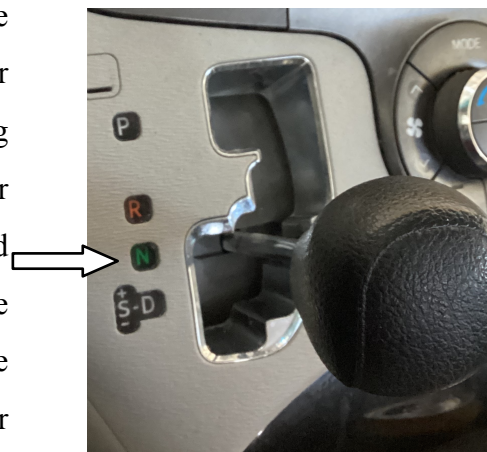
This gear shift lever is in the park position. In this position, the wheels cannot move forward or backwards.

When the shift lever is placed into the R or reverse position, the engine is engaged with the transmission so that the car can only go in the backwards or reverse direction. Note here that this car is now in reverse.

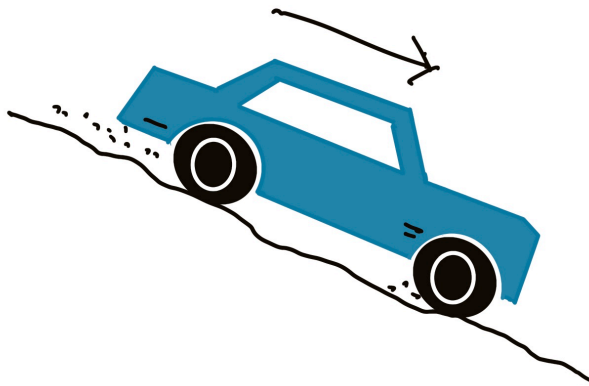


This gear shift lever is in the reverse position. In this position, the wheels will move backwards.

When the shift lever is in the N or neutral position, the wheels of the car are not engaged in any way to the transmission. The car's wheels can move in either direction (forward or reverse) with the engine having no effect. This position is used at times when the car needs to be pushed, pulled (usually by hand) or towed by another vehicle or tow truck. The wheels are free to move independently from the engine. Note that the neutral position can be potentially dangerous as your car is free to roll. If your car is parked on a hill and if left in neutral, it can freely roll down the hill.







If the shift lever is left in the N or neutral position, your vehicle can roll in any direction. If left on a hill, your car can readily roll down the hill! Always leave your car in the P or park position to lock the wheels.

When the shift lever is in the D or drive position, the engine is engaged with the transmission. Your car is able to move forward powered by the engine. This is the position you use when you're driving in a forward direction.

The numbered, or D1 or D2, positions are used for special circumstances when the car is being used to pull things like trailers or has to travel long distances down or uphill. These are lower gears.



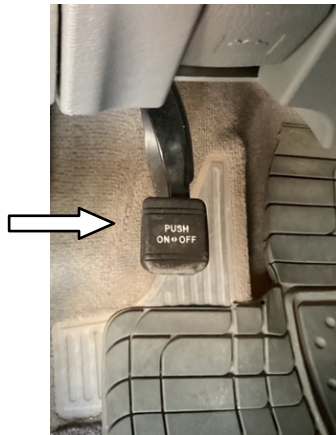
To shift from park to these other positions requires that the brake pedal be depressed. Note, also, that you should not force your car to go immediately from a forward to reverse direction of travel without first coming to a complete stop. We'll discuss these processes in greater detail later when we begin our exploration of basic driving maneuvers.

## THE EMERGENCY BRAKE

Before we move away from our discussion of pedals we find on the floor board of your car, we need to learn about a special part of the brake system which is known as the emergency brake. The emergency brake can be a small pedal found on the floorboard of your car (usually very far to the left) or can be a hand-activated lever found to the right of the driver seat, often in the space between the seats if your car has bucket seats.

The emergency brake, as its name implies, is designed to be used when the "regular" brakes of





The emergency brake can be activated by pressing the emergency brake pedal on the floorboard or lifting the emergency brake lever between the seats depending upon how your car is designed.



your car have failed or cannot be used since the car is turned off. This pedal or hand lever has a metal cable attached to it which goes directly to the braking mechanisms down at the wheels of your car. It bypasses the “regular” hydraulic system and allows *you* to apply direct pressure to the wheels to stop them. So, should your “regular” brakes fail while you are driving, you can still have some control over braking by pressing the pedal or lifting the hand lever to at least get yourself to a stop before seeking help.

The emergency brake is more frequently used in cars with a manual transmission, not for emergency stops, but as a means to hold the car in place after it has been turned off. Recall that cars with a manual transmission do not have a park position on the gear shift like those with an automatic transmission (which locks the wheels in one place when the car is turned off).

Instead, when you turn off a car with a manual transmission you may leave the car in a low gear (1st or 2nd) or in the reverse position. Even with the gear shift in these positions, the wheels can still move slightly forward or reverse and, if parked on an incline, can move forward or reverse quite a bit! To combat this unwanted rolling action, the emergency brake is applied each and every time before you turn off the car. This will prevent the car from rolling away after you leave it and will enable you to start it safely upon your next trip. We’ll discuss this again in a later lesson on starting your car. Our discussion so far has explained the basics of how cars are able to move us forward and backwards. Let’s look now at how a car can be steered to the right or left.

## LESSON 3 REVIEW QUESTIONS

Fill in the blank with the appropriate word or phrase. Check your work by referring to the answer key found in the appendix.

1. The transmission offers the flywheel an assortment of \_\_\_\_\_ which it can engage to transfer its energy.
2. The transmission transmits its energy to the \_\_\_\_\_ which connects the transmission to the wheels of your car.
3. Gears are handy because they can enable your car to have great \_\_\_\_\_ when it needs to pull something heavy or go up a steep hill. They also enable your car to go at high \_\_\_\_\_ using lower amounts of fuel.
4. Transmissions in cars come in two types: the \_\_\_\_\_ transmission where the car shifts gears for you and the \_\_\_\_\_ or \_\_\_\_\_ where you have to shift the gears.
5. The P position on the gear shift level stands for \_\_\_\_\_ and means your car will be \_\_\_\_\_ in one place.
6. The D position on the gear shift lever stands for \_\_\_\_\_ and means your car will move \_\_\_\_\_.
7. If you desire to go backwards in your car, you should set your gear shift lever to the \_\_\_\_\_ position.
8. Your car's wheels will not be locked nor engaged with your car's transmission when the gear shift lever is in the \_\_\_\_\_ or \_\_\_\_\_ position.
9. The component in your car which allows you to apply the brakes without using the brake pedal normally used on the floor board of your car is the \_\_\_\_\_.
10. The \_\_\_\_\_ is frequently used in cars with a manual or standard transmission to keep the car from rolling after it has been turned off.
11. "Three-on-the-tree" refers to a gear shift lever found on the \_\_\_\_\_ of your car.

Indicate whether the statements below are true or false. Check your work by referring to the appendix.

\_\_\_\_\_ 1. All cars in the United States have automatic transmissions unlike other countries which have both automatic and manual or standard transmissions.

\_\_\_\_\_ 2. Cars need more power when they are pulling away from a dead stop or moving up a steep incline.

\_\_\_\_\_ 3. A car with the gear shift lever in the D position will move forward when the accelerator is pressed.

\_\_\_\_\_ 4. A car with the gear shift lever in the N position will have its wheels locked in place and cannot be pushed forwards or backwards.

\_\_\_\_\_ 5. A car with an automatic transmission will have to have its gears changed by you as you gain speed on a road.

\_\_\_\_\_ 6. If you get into a car and find the numbers 1-4 and letter R on the knob of the gear shift lever, you know you're in a car with a manual or standard transmission.

\_\_\_\_\_ 7. The only time you'll find a clutch pedal on the floor board of a car is if the car has an automatic transmission.

\_\_\_\_\_ 8. When you leave your car (assuming it has an automatic transmission) you should always put it into the park or P position.

\_\_\_\_\_ 9. The D1 or D2 positions on your car (with an automatic transmission) are for when you want to drive at super high speeds down an interstate highway.

\_\_\_\_\_ 10. You should never attempt to force your car to go into a reverse position without first bringing it to a complete stop first.

\_\_\_\_\_ 11. Key fobs are inexpensive plastic gadgets that can easily be replaced at most convenience stores.

\_\_\_\_\_ 12. The emergency brake is useful to prevent your car from rolling downhill when you are leaving it parked.

\_\_\_\_\_ 13. If the "regular" brakes in your car should fail for some reason, you can use your emergency brake to help you stop your car.

\_\_\_\_\_ 14. Unlike cars, bikes are only made with one set of gears.

Read each question below. Choose the one best response.

1. The transmission in your car, whether standard or automatic allows you to
  - a. choose the best gear to accomplish your desired task with your car.
  - b. provide great power to your wheels when needed.
  - c. attain high speeds using relatively low amounts of fuel.
  - d. all of these are good choices.
  
2. The automatic transmission
  - a. requires you move from gear to gear as you gain speeds moving down a highway.
  - b. usually has the markings of 1, 2, 3, 4 and R on the lever.
  - c. shifts gears for you.
  - d. was invented before the manual or standard transmission.
  
3. Which component of your car allows you to disengage or separate the turning of your car's engine and the transmission?
  - a. brake
  - b. clutch
  - c. accelerator
  - d. review mirror
  
4. When driving a car with a standard or manual transmission and you desire to change to a new gear, you must first
  - a. step on the brake.
  - b. increase the RPMs of the engine.
  - c. step on the clutch.
  - d. come to a complete stop.
  
5. When you're done driving your car you should always
  - a. put it in park or P to prevent it from rolling away.
  - b. put it in a lower gear or reverse if it has a standard transmission.
  - c. set the emergency brake if it has a standard transmission.
  - d. all of these are suitable choices.
  
6. Jimmy's brakes in his car have suddenly failed. Jimmy should
  - a. call his parents immediately.
  - b. use the clutch to slow down to get off the side of the road.
  - c. use the emergency brake to carefully come to a stop on the side of the road.
  - d. jam his car into park so he doesn't cause an accident with another vehicle.

