

Que 1. Give the functions, types and requirement of steering system.

Ans. Automobiles are controlled by a steering system. Steering system provides the directional change for the movement of an automobile and it maintains in a position as per the driver's decision without much strain on him. The steering system allows the driver to guide the vehicle along the road and turn left or right as desired. The wheels are changed from their straight ahead position for turning the vehicle to one side. It is obtained by mounting the steering wheel assembly suitably on the axle.

REQUIREMENTS OF THE STEERING SYSTEM :

For ensuring proper, smooth operation and performance of the steering system, the steering system of any vehicle should satisfy the following requirements.

1. It multiplies the turning efforts applied on the steering wheel by the driver.
2. The shocks of the road surfaces absorbed by the wheels should not be transmitted to the driver's hands.
3. When the driver releases the steering wheel after completing the turn the wheel should achieve a straight ahead position immediately, called self-rightening effect.
4. It must keep the wheel at all time in rolling motion without rubbing on the road.

5.This system should associates to control the speed. ·

6.It must be light and stable.

7.It must easily be operated with less maintenance.

FUNCTIONS OF THE STEERING SYSTEM :

A good steering system must perform the following functions satisfactorily.

1.It provides wheels swinging to the left or right.

2.It provides vehicle turning as per the will of the driver.

3.it provides the directional stability.

4.It helps to control wear and tear of tyres.

5.it helps in achieving the self-rightening effect.

6.It converts the rotary movement of the steering wheel into an angular turn of front wheels.

7.It multiplies the effort of the driver by leverage to makes wheel easy to turn.

8.It absorbs a major part of road shocks in such a way from being transmitted to hands of the driver.

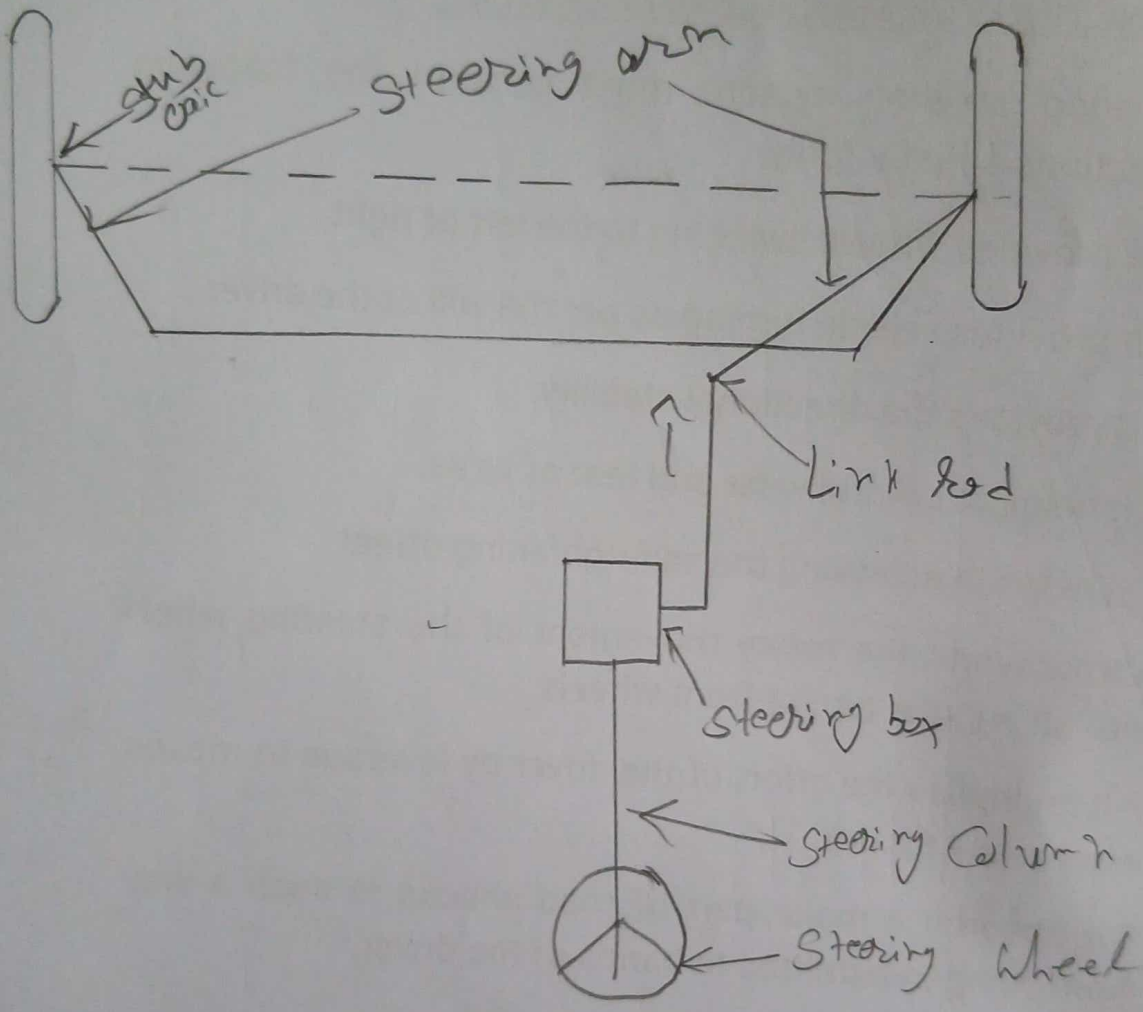
TYPRS OF STEERING SYSTEM:

Two main types of steering system.

1. Linkage or Conventional type(also known as parrallelogram).

2.Rack-and-pinion type.

Linkage types uses a worm gear inside the steering



(Layout steering system)

gear/box , this operates the drop arm, then couples to a centre link , ilder arm , track rods and the steering knuckles.

Rack-and-pinion type uses track rods to couple the rack to the steering knuckles.

Que 2. Write a note on independent type of steering system.

Ans. Steering system is a marvel of engineering all by itself.

There are multiple steering mode using four wheel independent steering. That means that each wheel can turn separately from the others.

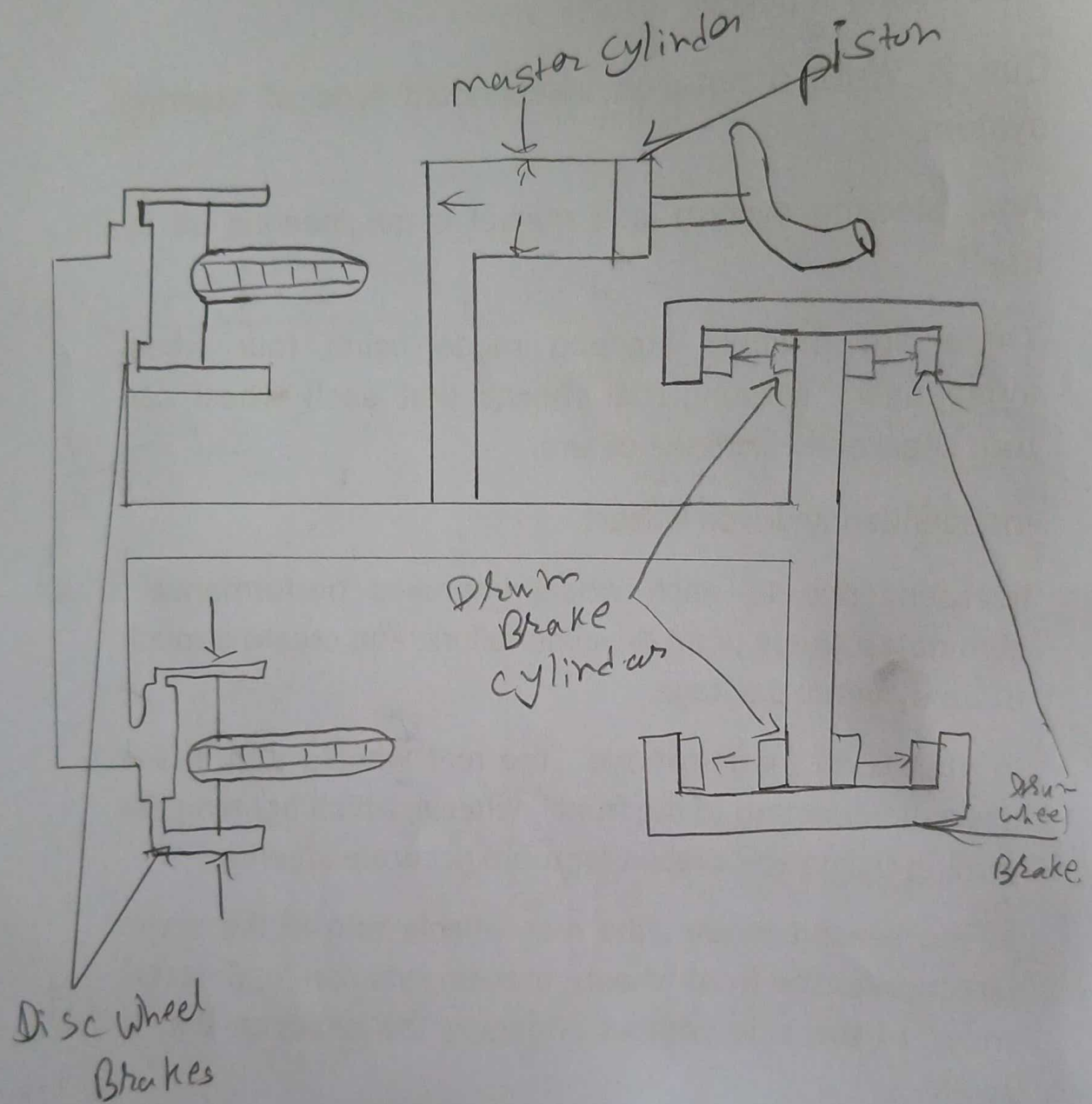
independently driven wheels.

Independence to each wheel improves performance , eliminates single point driveline failure, and create a much more dynamic package.

In standard steering mode , the rear wheels turn in the opposite direction to the front wheels, which tightens the turning radius and makes for more accurate steering.

In the second mode , the rear wheels turn in the same direction as the front wheels, meaning yiu can "crab-steer" move to the side without changing the direction that it faces.

In a third mode,utilizing the "zero steer" mechanism, allows all for wheels to "toe-in" and changes the drive direction to each wheel so that they alternate.



(Layout of Braking System)

The result? The car has a turning radius of zero. The car can actually rotate in place.

Another mode, utilizing the "brake steer" mechanism allows all four wheels to "toe-in" as your car is moving forward allowing you to brake and slow down your car, like when you "snowplow" slowing down on downhill skis. Regenerative braking will always be offered.

Que 3. Give the function, types and requirement for automobile brakes.

Ans. A brake is a mechanical device that inhibits motion by absorbing energy from a moving system. It is used for slowing or stopping a moving vehicle, wheel, axle, or to prevent its motion, most often accomplished by means of friction.

FUNCTIONS OF THE AUTOMOBILE BRAKING SYSTEM :

below are the functions of braking system used in automobile engine

1. A brake system helps to stop vehicle within the smallest possible distance. This is achieved by converting the kinetic energy of the vehicle into heat energy.

2. It also functions on mechanical device where motion occurs, the brake is applied to stop it within a short period of time.

COMPONENTS OF BRAKING SYSTEM:

Below are the components used in the automobile braking system:

1.Brake pedal: The components of a brake system is used to activate the brake by pressing down by foot. It's located in the middle of the accelerator and clutch pedal inside the vehicle.

2.Fluid Reservoir : The fluid reservoir is the housing where the brake fluid or brake oil is store.

3.Fluid Lines: The fluid lines are the pipes through which the brake fluid flows in the vehicle.

4.Brake Pads: The brake pad is a steel backing plate employed on disc brakes. It's often made of ceramic metal, or other hard-wearing composite materials.

5.Brake Shoes: Brake shoes are two pieces of sheet steel - joined together so it can carry the brake lining.

6.Brake Drum: The brake drum is a rotating drum-shaped component used in the drum brake system.

7.Rotor: The rotor is the cast-iron brake disc connected to a wheel or axle, sometimes made of reinforced carbon-carbon, ceramic-matric, or some other composite.

TYPES OF BRAKING SYSTEM:

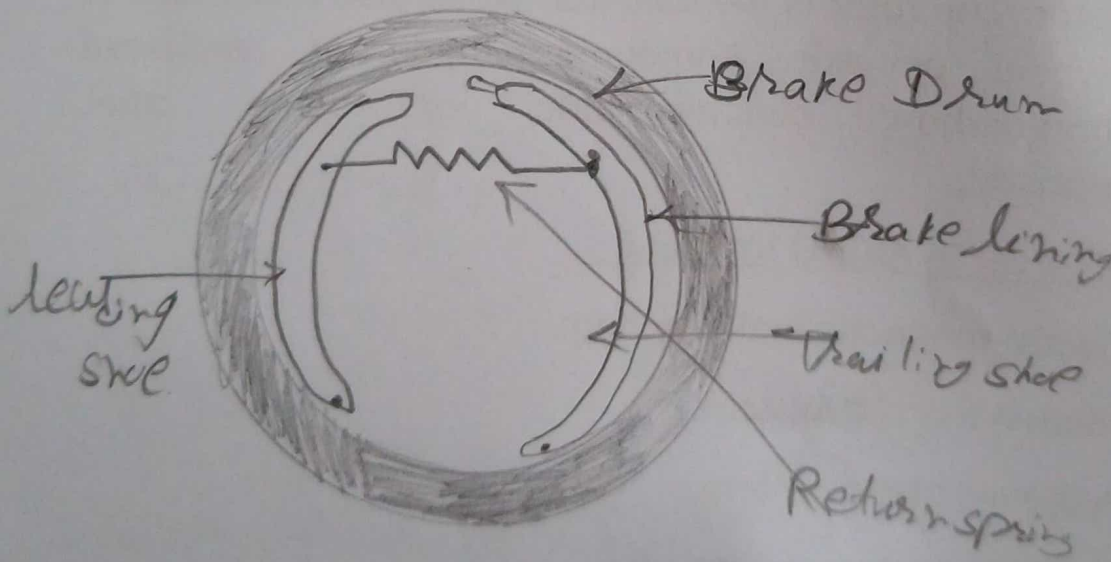
1.Electro magnetic brake system.

2.Frictional brake system.

3.Hydraulic brake system.

4.Air brake system.

5. Perking and emergency brake system.



(View of drum brake)

6. Servo brake system.

7. Pumping brake system.

WORKING

The working of a brake system is quite complex, but with the explanation of its components and types am sure you are familiar with the terms used. These two kinds of brake system; disc brake and drum brake. The disc brakes are used on the front wheels of automobiles while drum brakes are mounted on rear wheels. Though some modern high-end cars have disc brakes on the four wheels.

The driver presses the brake pedal and causes a force to be generated which is then boosted by the vacuum from the engine. Boosting allows the brakes to respond more quickly and effectively.

The force from the vacuum booster pushes the piston inside the master cylinder, caliper and brake cylinder through the fluid lines.

4. Discuss in detail : Drum brakes.

Ans. Drum brakes have a brake drum that rotates with the wheels.

Brake shoes fitted with the brake linings which press against the drums from the inside to generate braking force are set inside of the drums. With this system, friction is generated by pressing the brake linings against the inside surfaces of the drums. This friction converts kinetic energy into thermal energy. Drum rotation helps to press the shoes and the lining against the drum with more force, offering superior braking force in comparison with

disc brake. On the other hand, it is very important to design the components so that the heat from the thermal energy is dissipated efficiently into the atmosphere.

There are three types of drum brakes depending on how the brake shoes are pressed on to the drums; leading/trailing shoe type, leading shoe type and duo-servo type.

STRUCTURE OF DRUM BRAKES :

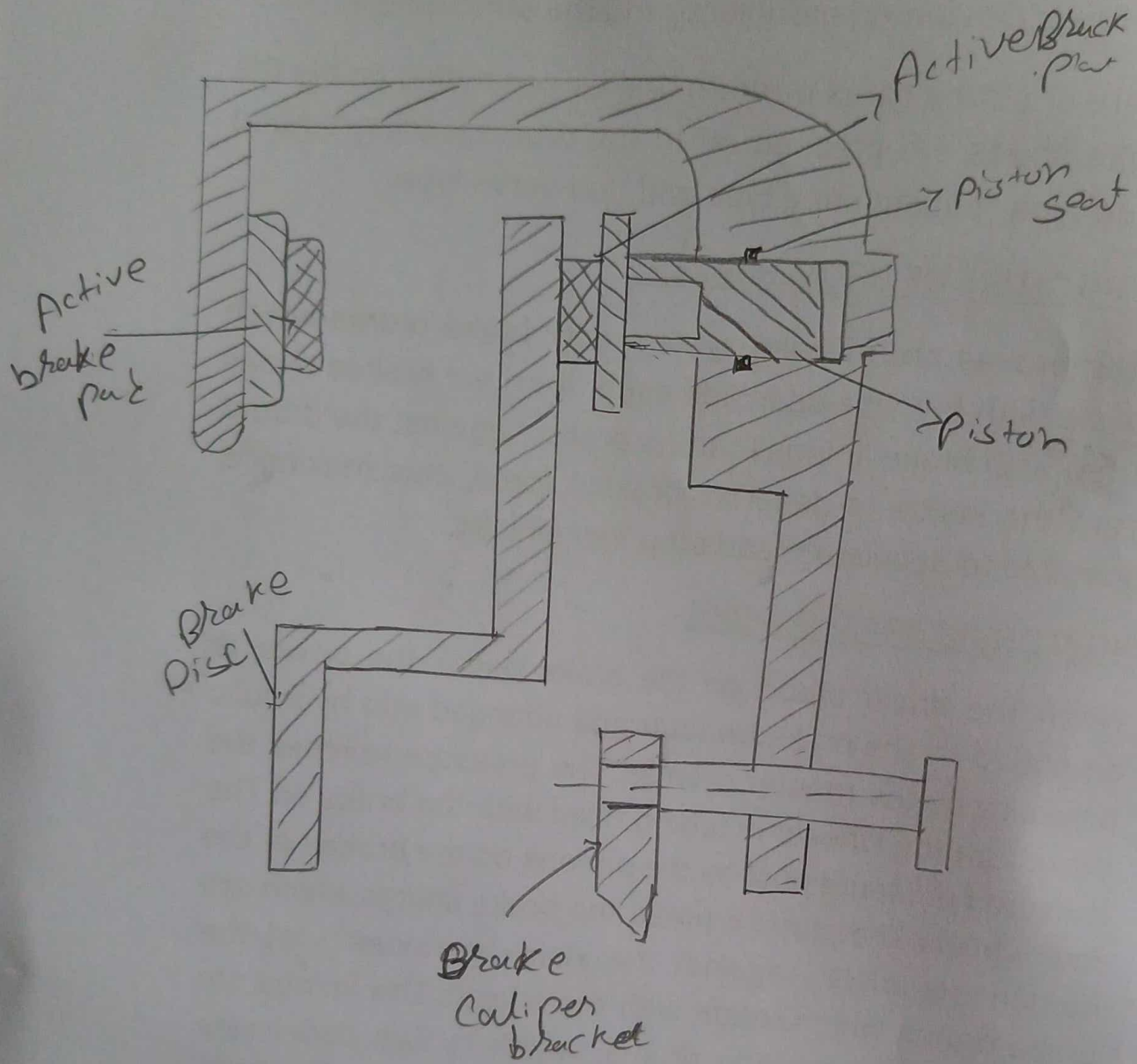
Drumbrakes are a brake system with brake drums which rotate with the wheels. Inside each drum are brake shoes fitted with brake linings. Pistons press against the drum from the inside to generate braking force, thus making it possible to decelerate and stop the vehicle.

HOW DRUM BRAKES WORK:

When the driver steps on the brake pedal, the power is amplified by the brake booster and changed into hydraulic pressure by the master cylinder. The pressure reaches the brakes on the wheels via tubing filled with the brake oil. The delivered pressure pushes the pistons on the brakes of the four wheels. The pistons press the brake linings, which are friction materials, against the inside surfaces of the brake drums which rotate with the wheels. The linings are pressed on the rotating drums, which in turn decelerate the wheels, thereby slowing down and stopping the vehicle.

Que.5 Write a note on disc brake.

Ans. Disc brakes are generally used in passenger cars, but due to their stable performance at higher speed and resistance to brake fade, they are gradually spreading into the commercial vehicle segment, where drum brakes were



(Schematic diagram of disc brake)

traditionally chosen for their longer service life. There is increasing demand from customers for longer service life and higher quality, and Akebono is committed to meeting them through further development of the disc brake's reliability. There are two types of disc brakes.

The "opposed piston type disc brake" has pistons on both sides of the disc rotor, while the "floating type disc brake" has piston on only one side. Floating caliper type disc brakes are also called sliding pin type disc brakes.

DISC BRAKE CONSTRUCTION:

The brake rotor which rotates with the wheel, is clamped by brake pads fitted to the caliper from both sides with pressure from the piston and decelerates the disc rotation, thereby slowing down and stopping the vehicle.

HOW DISC BRAKES WORK:

When the driver steps on the brake pedal, the power is amplified by the brake booster and changed into a hydraulic pressure by the master cylinder. The pressure reaches the brakes on the wheels via tubing filled with brake oil. The delivered pressure pushes the piston on the brakes of the four wheel. The piston in turn presses the brake pads, which are friction material against the brake rotor which rotates with the wheels. The pads clamp on the rotor from both side and decelerates the wheels, thereby slowing down and stopping the vehicle.

MAIN COMPONENTS OF DISC BRAKES:

shim, pad boots ring, piston boots, piston, piston seal, bleeder cap, bleeder screw, cylinder body, guide pin, lock

- pin , pin boots ,mounting brackets and pad clip.

Que 6. Give types of front axle.

Ans. The front axle is used to support the weight of the front of the vehicle as well as to facilitate steering and absorbs shocks due to changes in the road surfaces. It must be fair and robust in construction.

The front axle is usually hot -forged steel with 0.4% carbon steel or 1-3% nickel steel. It consists of an I-section in the central part , while the ends are circular or elliptical. With this construction, it withstands bending loads due to vehicle load. Also ,the middle portion of the pair sags downward. The different components of the front axle are the beam , the spindle, the pivot pin and the track rod.

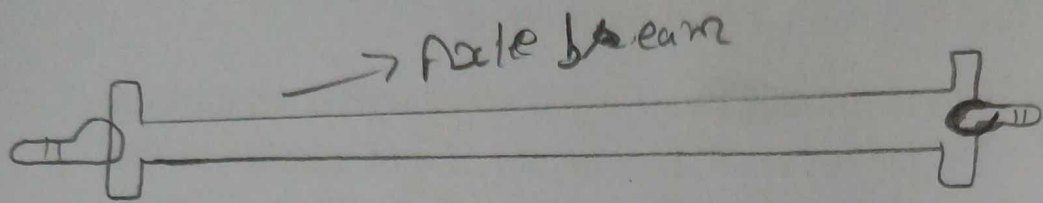
TYPES OF FRONT AXLES:

Usually there are two main types of front axle:

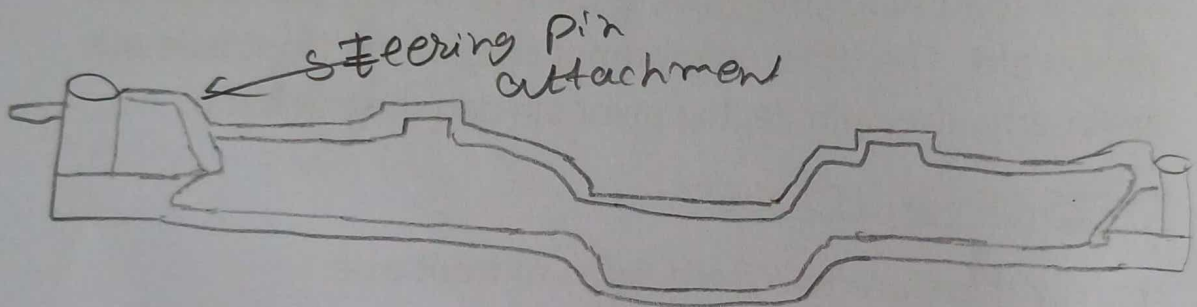
1. Live front axle
2. Dead front axle

Front axles are usually dead axle because they don't rotate , in contrast, to live axle which are used in the rear axle to transmit power to the rear wheels. A live front axle, with respect to the dead axle , has the additional functions of transmitting the driving force drawn by a reduction gear to the front wheels wheels having a different rotation mechanism.

Live front axles although they resemble shifter axles have some differences at the end of the axle shafts where the wheels are mounted .A dead front axle has enough



(i) Straight axle



(b) Double drop axle.



fully drop axle.

stiffness and strength to carry the weight of the vehicle from the springs to the front wheels.

The ends of the axle beam are suitably formed to assemble the sprindle. To accommodate a pivot pin that connects the sub-axis portion of the assemble, the ends of the beam are as usually shaped like yoke or flat surface with a hole.

The illustrations shows the components of the front axle with the steering linkage. The wheels are fixed on the sprindles which are usually hinged. From the stub axle , the inclined steerind arm are connected to the ends of the track rod, and a third steering arm is attached to a tie rod.

Some vehicle have a drag link positioned transversely rather than forward and in place to allow for a more compact vehicle design. It is often used in independent wheel suspension systems. The drag link connects the steering link to the steering gear release arm.

Que 7. Give the function, types and requirement of suspension system.

Ans. A suspension system is a set of a mechanical connections, springs , and dampers that connect the wheels to the chassis. It has traditionally performed two functions: managing the vehicle's handling and braking for safety, and keeping passenger comfortable from bumps, vibrations ,and other factors. It is a mechanical system of springs or shock absorbers connecting the wheel and axle to the chassis of a wheeled vehicle.

It also aids in maintaining proper vehicle height and

alignment. It also control the vehicle's orientation and must keep the steering wheel perpendicular to the ground for maximum greep.The suspension also helps .to safeguard the car and its contents from damage and wear.The front and rear suspensions of a car may be designed differently.

The suspension system of your car is in charge of smoothing out the ride and keeping the vehicle in control.To offer steering stability and good handling,the suspension system increases the friction between the tires and the road.

FUNCTIONS:

The suspension system is an automobile serves the following functions :

- * Shock forces are reduced as much as possible.
- *Maintain the proper ride height of your car.
- *Maintain proper alignment of the wheels.
- *Serves as weight support for the vehicle.
- *Maintain tire contact with the road.
- *Controls the vehicle's travel direction.
- *To eliminate transmission to car component road shocks.
- *To maintain a solid grip on the road while driving,cornering ,or braking.
- *To maintain the correct steering geometry.
- *To achieve a specific body structure and height.

*Torque and braking reflexes must be resisted.

*Maintaining vehicle's stability while traveling over uneven terrain or turning in order to reduce the tendency for rolling, pitching or vertical movement.

*To protect passengers from road shocks and give a comfortable ride.

*To reduce the strains caused by road shocks on the motor vehicle's mechanism and offer a cushioning effect.

*While traveling over tough, uneven terrain, keep the body absolutely level. The up and down movements of the wheels should be proportional to the movement of the body.

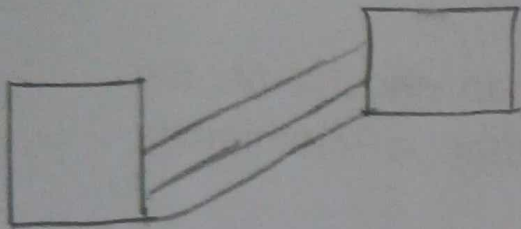
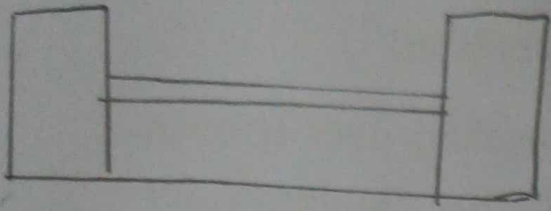
COMPONENTS OF THE SUSPENSION SYSTEM :

Suspension system have the following components:

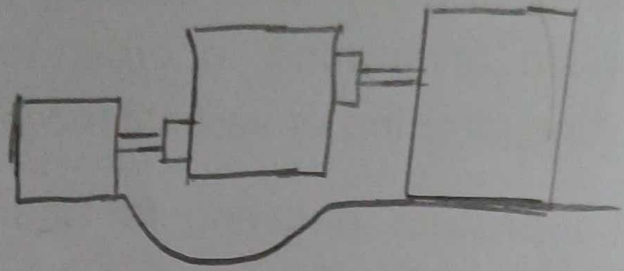
1. Knuckle or upright.
2. Linkages.
3. Shock absorber or Springs.

TYPES OF THE SUSPENSION SYSTEM:

1. Independent suspension system.
2. Double wishbones.
3. Macpherson strut.
4. Dependent suspension system.
5. Solid axle.



Dependent



Independent.

[Suspension system

6. Semi-independent suspension system.

7. Twist beam.

REQUIREMENTS OF A SUSPENSION SYSTEM :

- * Deflection should be kept to a bare minimum.
- * It should be as light as possible.
- * It should be low-maintenance and low-cost to operate.
- * It should have the least amount of tire wear possible.
- * It should have a low start-up cost.

WORKING OF SUSPENSION SYSTEM:

A suspension works on the principle of force dissipation which involves converting force into heat thus removing the impact that force would have made. It uses springs, dampers and struts to achieve this. A spring will hold the energy while a damper will convert it into heat.

Que 8. What are the various type of rigid suspension? Explain all.

Ans. The suspension system is composed of springs, which can either be a coil or a leaf spring. Links/ arms and shock absorbers also make up the system and keep the wheel on the ground. However there are various setups and some aren't as simple as a coil and a spring attached to the wheel. There are two general classifications of suspension systems known to date; dependent and independent.

A dependent suspension system connotes that there is a

beam or axle that connects the left wheel to the right so they work in tandem with each other. This classification of suspension can be sprung by either a combination of leaf springs and shock absorbers. This simple structure is what makes it rugged and cheap, allowing manufacturers to put it in mass-market vehicles that demand durability and affordability.

1. TORSION BEAM:

Also known as twist beam suspension, the torsion beam suspension system is simple and manufactured at a low cost. Commonly found at the rear, the system uses trailing arms integrated with a cross member that twists as the wheels move. If we are to plot it on a chart, it would be in the middle of a solid axle and an independent suspension, and in most cases, it's classified as a semi-independent suspension system because of how the beam twists in response to force. The design allows for a roomier cabin as the suspension system is more compact and simpler. It is also relatively cheap to produce and rigid at the same time. It is often found on more affordable and smaller sedans and hatchbacks like the Honda City.

Some older cars like the boxier generations of the Nissan Sentra were front-wheel drive and featured independent suspensions in the front, but a dead axle in the rear. This is one end of the extreme since the axle at the back features no flex and behaves more like a live-axle suspension system. One wheel will move in relation to the other in a dead axle system.

2. LIVE AXLE:

A live axle is simply a driven solid axle . Meaning it transmits power to the rear wheels, unlike it's torsion beam counterpart which has no power being fed to the wheels. Live axle rear suspensions are commonly found on buses, light trucks, and some light and medium-duty SUVs and pickups. The system can either be sprung by coil springs or leaf springs. It's also important to note that since the system is more rugged ,it is more reliable with the concern to heavy load capacities.

Que 9. What are the various type of independent suspension system ? Explain all.

Ans. Unlike its counterpart , this type of suspension system does not feature a bar connecting both wheels. Rather , each wheels is given its own spring and shock combo, which gives a more comfortable riding experience. That's because a bump or a pothole that affects one wheel won't influence the other--meaning , when one wheel is pushed upwards by a bump, the adjacent wheel will stay on the ground unaffected. Independent suspension systems can be used either in front or rear , with the former being common nowadays to keep the front wheels on the ground and pointing the car in the right direction.

There are different variation of independent suspension system. With consisten technological advancement, the automotive industry now has a handfull on its list and each one has it advantages and disadvantages. Without further delay , here are three common form of independent suspension systems

1. MACPHERSON STRUT:

This type of independent suspension system uses either a wishbone or a substantial compression link that is stabilized by a secondary link. Some people refer to it as a shock absorber built inside a coil spring. It is commonly found under front-wheel-drive cars, like the Kia Soluto. A MacPherson strut is among the most cost-effective independent suspension systems as it uses fewer parts, meaning it's simpler and easier to manufacture.

The MacPherson struts are one of the common types among the independent suspension systems. Due to its simplicity, it does not take up much space, making it an ideal option for smaller and more compact vehicles. The simplicity of its structure also means it's easier to manufacture and troubleshoot than other kinds of independent suspensions.

2. DOUBLE-WISHBONE:

As the name suggests, there are two wishbone-like arms connected to the wheel. Each of those has different mounting positions: one at the wheel and one at the vehicle's frame. The wishbones on this system are similar to the MacPherson strut's wishbone, as they also feature coil springs and shock absorbers. There are several configurations of double wishbone suspension, but we'll save that for a more in-depth article.

One great thing about double wishbones is the increase in negative camber due to vertical movement of the upper and the lower arms. In that context, the outside wheel of

your car when cornering will retain optimal contact on the road –resulting in better grip and handling and performance. Meaning, when your car leans over to one side in a corner , the wheel remains perpendicular to the road, which gives your tire the maximum amount of contact with the ground.

3.MULTI-LINK:

If double wishbone suspension use two links connected to the wheel and vehicle frame,a multi-link suspension utilizes at least three lateral arms and one or more longitudinal arms. The multi-link independent suspension system is relatively more expensive than the two aforementioned setups , as well as more complex and intricate in its structure . Despite that, it has become common to modern cars, which set up involves front MacPhern struts and multi-link suspension on the rear. However , due to the cost of manufacturing such systems, it is mainly found on more expensive cars, or cars belonging to the premium category.

Due to more links connected to the wheel, this suspension system is able to move more freely than the other two, as it can cover various angles. Another thing is, with its structure ,it offers more options to attain various wheel alignments. You may find multi-link suspensions on off-road vehicles, sedans, or sports cars.

Que 10. Write a note on rigid type steering system .

Ans. The rigid type steering system consists of several components, including the steering wheel, steering column, steering gear, and tie rods. Each of these

components plays a critical role in the function and working of the steering system.

The steering wheel is the part of the system that the driver uses to control the direction of the vehicle. When the driver turns the steering wheel, it rotates the steering column, which transmits the motion to the steering gear.

The steering gear is responsible for converting the rotational motion of the steering column into linear motion that moves the wheels. In a rigid type steering system, the steering gear is a simple rack and pinion mechanism that translates the rotation of the steering column into linear motion that moves the tie rods.

The tie rods connect the steering gear to the wheels and transmit the motion from the steering gear to the wheels. When the driver turns the steering wheel, the tie rods move the wheels in the desired direction, allowing the vehicle to turn.

The advantage of a rigid type steering system is that it provides direct and immediate feedback to the driver, giving them a better sense of control over the vehicle. It is also a simpler design, with fewer parts than other types of steering systems, making it easier to maintain and repair.

However, one of the disadvantages of a rigid type steering system is that it can be less forgiving on rough or uneven surfaces, transmitting vibrations and shocks more directly to the driver. Additionally, it can be more difficult to turn the wheels at low speeds, making parking and maneuvering more challenging.

Overall, the function and working of the rigid type steering system rely on the direct connection between the steering wheel and the wheels. This design provides immediate feedback to the driver and a more direct control of the vehicle, but it can also make the system less forgiving on rough surfaces and more challenging to turn at low speeds.