

# AUTOMOBILE ENGINEERING TECHNICIAN

## Second Year

### Paper-II: Auto Chassis and Body Engineering

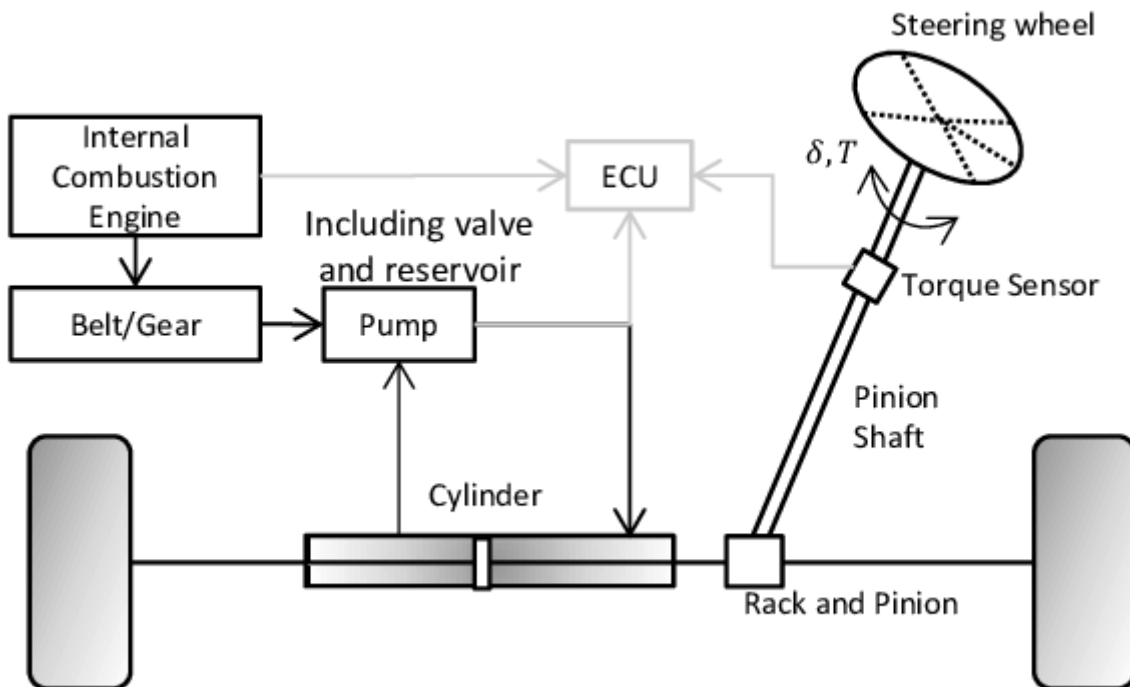
Time: 3hr

Max.Marks: 50

#### Section - I

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#### 1. Overhauling of steering system.



#### Aim:

The aim of this practical is to perform a comprehensive overhaul of the steering system in order to ensure optimal functionality and safety of the vehicle.

#### Materials:

- Steering components kit
- Lubricants and grease
- Replacement seals and gaskets
- Cleaning solvents
- Safety gloves and goggles

**Tools:**

Wrenches and sockets  
Screwdrivers  
Pliers  
Hydraulic jack and stands  
Torque wrench  
Steering wheel puller  
Bearing puller

**Procedure:**

## Vehicle Preparation:

- a. Lift the front of the vehicle using a hydraulic jack and secure it with stands.
- b. Disconnect the battery to ensure safety during the procedure.

## Disassembly:

- a. Remove the steering wheel using a steering wheel puller.
- b. Disassemble the steering column, inspecting and labeling each component.

## Component Inspection:

- a. Inspect the steering rack for any signs of wear or damage.
- b. Check the steering pump and hoses for leaks or cracks.
- c. Examine tie rods and ball joints for wear and tear.

## Replacement and Lubrication:

- a. Replace damaged or worn components with the new ones from the kit.
- b. Apply lubricants and grease to appropriate components for smooth operation.

## Reassembly:

- a. Assemble the steering components in the reverse order of disassembly.
- b. Torque all bolts to manufacturer specifications using a torque wrench.

**Precautions:**

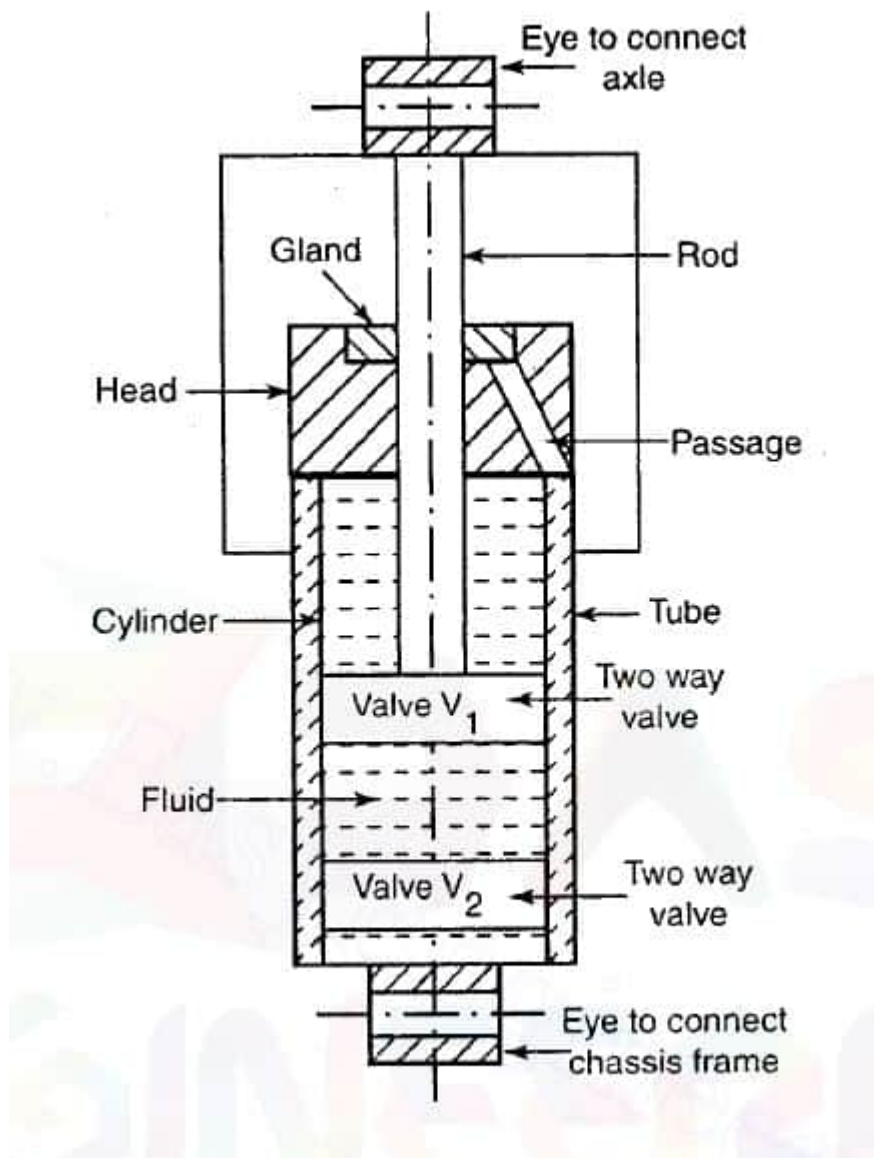
Ensure the vehicle is securely lifted and supported on jack stands.  
Use safety gloves and goggles to protect against potential hazards.

Follow the vehicle manufacturer's guidelines for torque specifications.  
Dispose of old fluids and components in an environmentally friendly manner.

**Result:**

Upon completion of the steering system overhaul, the vehicle exhibited improved steering responsiveness and smoother operation, ensuring enhanced safety and driving experience.

**2. Overhauling of hydraulic shock absorber.**



**Aim:**

The aim of this practical is to demonstrate the overhauling process of a hydraulic shock absorber, ensuring its optimal performance and longevity.

**Materials:**

Hydraulic shock absorber  
New seals and gaskets  
Hydraulic fluid  
Cleaning solvent  
Rag or shop towels

**Tools:**

Wrench set  
Screwdrivers  
Vice grips  
Seal puller  
Hydraulic press (if available)  
Torque wrench  
Clean container for fluid disposal

**Procedure:****Disassembly:**

- a. Remove the shock absorber from the vehicle.
- b. Use appropriate tools to disassemble the shock absorber, carefully noting the order of components.

**Cleaning:**

- a. Clean all parts thoroughly with a solvent to remove old fluid and contaminants.
- b. Inspect for wear, corrosion, or damage.

**Replacement:**

- a. Replace worn-out seals and gaskets with new ones.
- b. Ensure the replacement parts match the specifications of the original components.

**Reassembly:**

- a. Reassemble the shock absorber in the reverse order of disassembly.
- b. Torque all bolts to the manufacturer's specifications.

Refill:

- a. Fill the shock absorber with the recommended hydraulic fluid.
- b. Bleed any air from the system according to the manufacturer's instructions.

### Precautions:

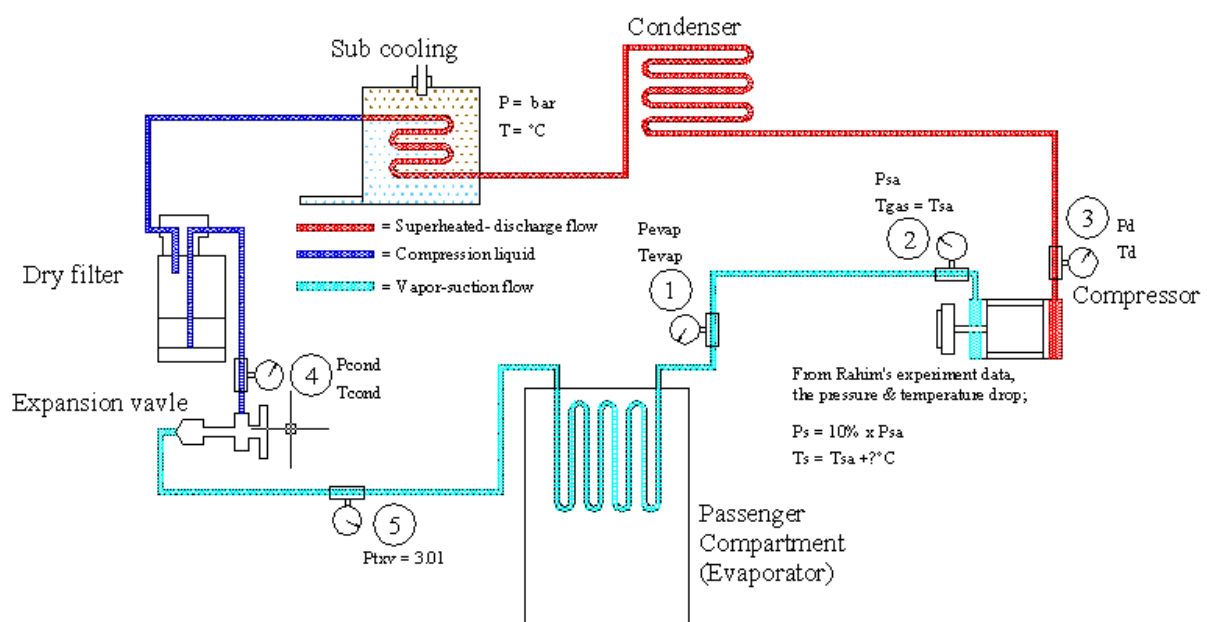
Work in a well-ventilated area to avoid inhaling fumes from cleaning solvents. Use proper safety gear, such as gloves and safety glasses, to protect against chemicals and sharp edges.

Follow the manufacturer's guidelines for torque specifications and fluid type.

### Result:

Upon completion of the overhauling process, the hydraulic shock absorber should exhibit improved damping performance and reliability, contributing to a smoother and safer ride.

### 3. To check car air conditioning system.



### Aim:

To assess the functionality of a car's air conditioning system.

### Materials:

Car with air conditioning system  
Refrigerant pressure gauge

Thermometer  
Safety goggles  
Refrigerant leak detector  
Car owner's manual

**Tools:**

Screwdrivers  
Wrenches  
Voltmeter  
Service manual for the car model  
UV dye injection kit (optional)

**Procedure:**

Safety Precautions:

- Ensure the car is parked in a well-ventilated area.
- Wear safety goggles to protect eyes.

Visual Inspection:

- Check for visible signs of refrigerant leaks (oil stains or hissing sounds).
- Inspect the condition of belts and hoses.

Check Refrigerant Pressure:

- Connect the refrigerant pressure gauge to the low-pressure port.
- Compare the pressure reading with the specifications in the owner's manual.

Temperature Check:

- Start the car and turn on the A/C to the maximum setting.
- Use a thermometer to measure the air temperature at the vents.

Electrical System Inspection:

- Use a voltmeter to check the A/C clutch and compressor operation.
- Refer to the service manual for specific electrical tests.

Optional UV Dye Test:

- If available, inject UV dye into the A/C system to detect leaks.

Consult Owner's Manual:

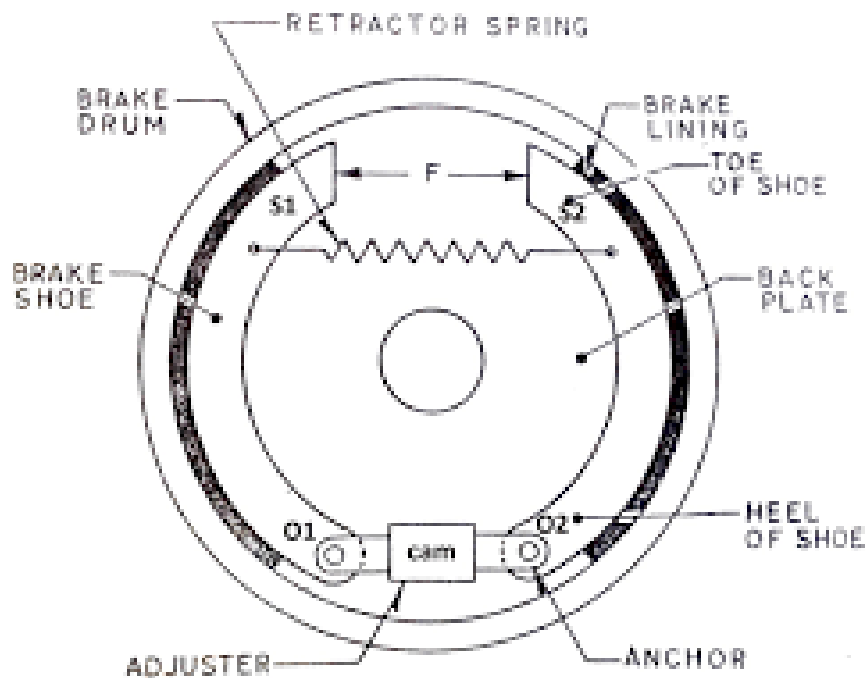
- Review the car owner's manual for any specific maintenance recommendations.

**Precautions:**

- Avoid direct contact with refrigerant; wear gloves if handling refrigerant.
- Follow safety guidelines outlined in the car owner's manual.

**Result:**

Upon completion of the inspection, a well-functioning air conditioning system will exhibit normal refrigerant pressure, deliver cool air at the vents, and show no signs of leaks or unusual noises. Any deviation from these parameters may indicate potential issues that require further investigation and repair.

**4. Overhauling of mechanical breaks.****Aim:**

To overhaul mechanical brakes, enhancing their performance and ensuring optimal functionality.

**Materials:**

- Brake overhaul kit
- Brake cleaner
- Lubricating grease
- Brake fluid
- Replacement brake pads

**Tools:**

- Jack and jack stands
- Lug wrench
- C-clamp

Wrench set  
Screwdriver set  
Brake caliper tool  
Brake bleeder kit  
Brake piston compressor tool

### **Procedure:**

Lift and Secure Vehicle:

- Use a jack to lift the vehicle and secure it on jack stands.

Remove Wheels:

- Utilize a lug wrench to remove the wheels and expose the brakes.

Disassemble Brake Components:

- Unbolt the caliper, remove brake pads, and detach the caliper bracket.

Inspect and Clean:

- Inspect brake components for wear, clean with brake cleaner, and check for any damage.

Replace Worn Parts:

- Replace worn-out brake pads, damaged caliper components, and any faulty hardware.

Lubricate Moving Parts:

- Apply lubricating grease to caliper slides, pins, and any moving parts for smooth operation.

Reassemble Components:

- Reassemble the caliper, bracket, and new brake pads. Ensure proper torque on all bolts.

Bleed Brake System:

- Bleed the brake system to remove air and ensure proper fluid pressure.

Check Brake Fluid:

- Top up brake fluid to the recommended level and verify there are no leaks.

Test Drive:

- Conduct a test drive to ensure the brakes function effectively.

### **Precautions:**

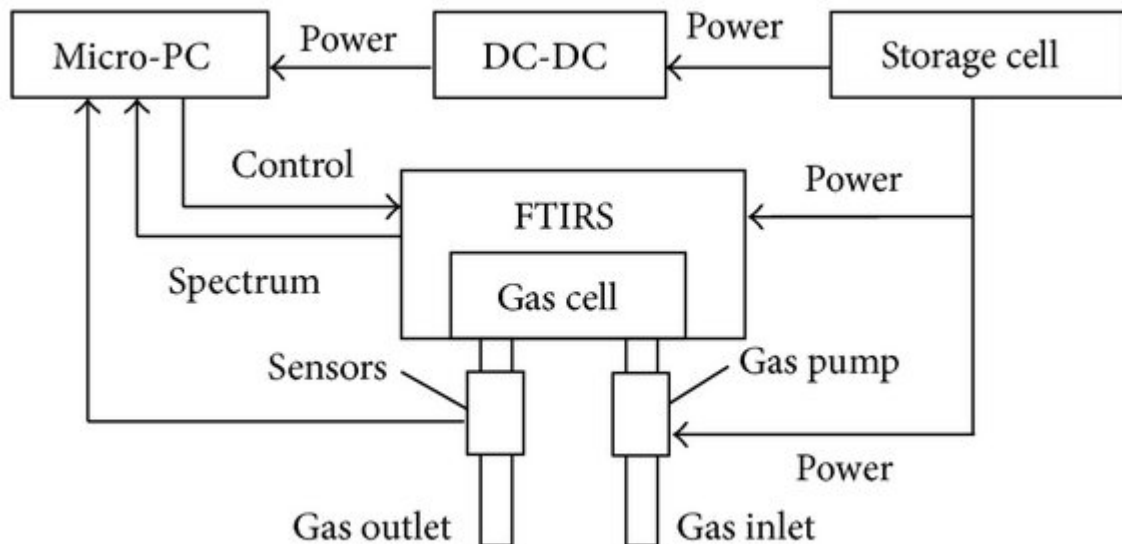
- Ensure the vehicle is securely lifted and supported on jack stands.
- Use proper safety gear, including gloves and eye protection.
- Follow manufacturer specifications for torque settings and brake fluid type.
- Take precautions to prevent brake fluid spills and contamination.

### **Result:**



After overhauling the mechanical brakes, a noticeable improvement in braking performance was observed. The brakes responded more efficiently, and the overall system exhibited smoother operation, contributing to enhanced safety and reliability.

### 5. Measurement of air pollution with help of exhaust gas analyser.



#### Aim:

The aim of this experiment is to measure air pollution using an exhaust gas analyzer, assessing the composition of vehicle emissions to evaluate environmental impact.

#### Materials:

- Exhaust Gas Analyzer
- Sample collection containers
- Gas sampling probes
- Safety goggles
- Gloves
- Vehicle exhaust outlet adapter
- Stopwatch
- Data recording sheets

#### Tools:

- Exhaust gas analyzer device
- Screwdriver (for adjusting probe)
- Sample containers for collected gases

**Procedure:**

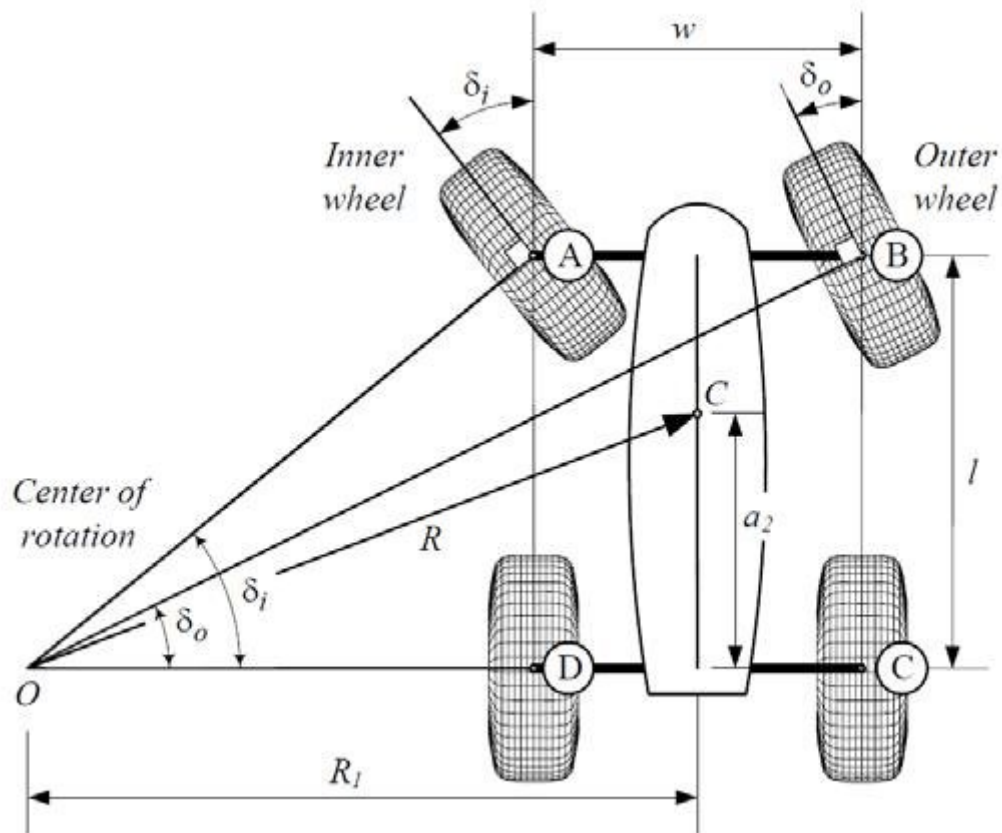
Ensure safety equipment is worn, including goggles and gloves.  
Set up the exhaust gas analyzer according to manufacturer instructions.  
Position the sampling probe securely in the vehicle exhaust outlet.  
Start the vehicle and allow it to run until a stable reading is obtained.  
Record the values of pollutants such as carbon monoxide (CO), hydrocarbons (HC), nitrogen oxides (NO<sub>x</sub>), and oxygen (O<sub>2</sub>).  
Repeat the process for different vehicles and under varying conditions.  
Note the type of vehicle, fuel used, and any modifications made.  
Analyze and compare the collected data to assess air pollution levels.

**Precautions:**

Operate the exhaust gas analyzer in a well-ventilated area.  
Handle the sampling probe carefully to avoid damage.  
Wear appropriate personal protective equipment to minimize exposure.  
Follow safety guidelines provided by the analyzer manufacturer.  
Ensure the vehicle is in a stable condition during testing.

**Result:**

The exhaust gas analyzer measurements revealed varying levels of pollutants in vehicle emissions, providing valuable data for assessing air quality. Results indicated higher concentrations of certain pollutants in older vehicles and those with incomplete combustion, emphasizing the need for emissions control measures.

**6. Adjustment of steering geometry.****Aim:**

To adjust the steering geometry for optimal performance and stability.

**Materials:**

Wheel alignment machine  
Wrenches and sockets  
Turntables  
Jack and jack stands

**Tools:**

Camber gauge  
Caster gauge  
Toe gauge  
Level

## Procedure:

Lift the vehicle using a jack and secure it with jack stands.  
Place turntables under the wheels for ease of rotation during adjustments.  
Connect the vehicle to the wheel alignment machine.  
Using the camber gauge, adjust the camber angle to specifications.  
Set the caster angle with the caster gauge and adjust as needed.  
Adjust toe-in or toe-out using the toe gauge.  
Ensure all adjustments are within manufacturer specifications.  
Tighten all bolts and nuts securely.

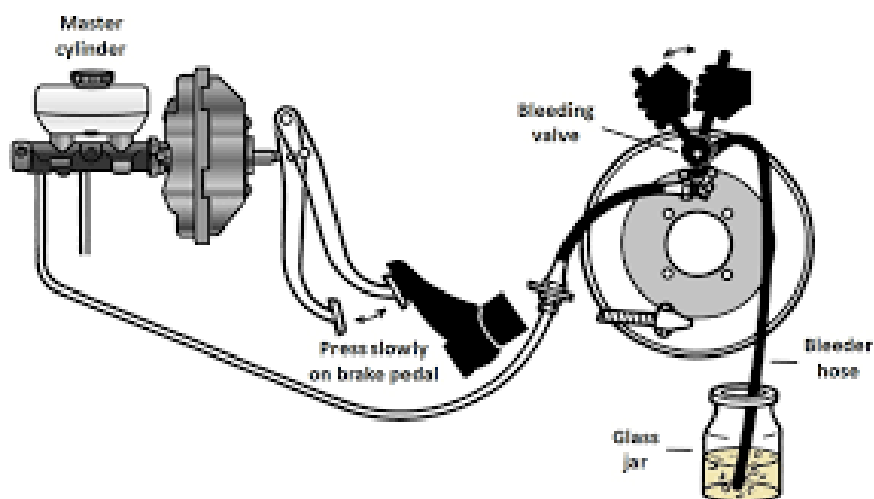
## Precautions:

Ensure the vehicle is on a level surface.  
Follow manufacturer guidelines for adjustments.  
Double-check readings before making any changes.  
Use appropriate safety gear, such as gloves and safety glasses.

## Result:

After adjustments, the steering geometry is optimized, enhancing vehicle stability, tire wear, and overall handling performance.

## 7. Bleeding of brakes.



## Aim:

The aim of this brake bleeding practical is to remove air bubbles from the brake system, ensuring optimal brake performance and responsiveness.

## Materials:

- Brake fluid
- Clear plastic tubing
- Brake bleeder kit
- Wrench
- Brake fluid reservoir cap

**Tools:**

- Jack and jack stands
- Brake fluid catchment container
- Torque wrench
- Vehicle owner's manual

**Procedure:**

Lift the vehicle and secure it on jack stands.

Locate the brake bleeder valve on each brake caliper.

Connect clear plastic tubing to the bleeder valve and place the other end in the brake fluid catchment container.

Have an assistant pump the brake pedal several times and hold it down.

Loosen the bleeder valve, allowing air and fluid to escape. Close the valve before the brake pedal is released.

Repeat the process until no air bubbles are visible in the tubing.

Tighten the bleeder valve to the recommended torque.

**Precautions:**

- Always refer to the vehicle owner's manual for specific instructions and torque values.
- Use the appropriate brake fluid recommended by the vehicle manufacturer.
- Avoid getting brake fluid on painted surfaces, as it can damage the finish.

**Result:**

Upon completion of the brake bleeding procedure, a firm brake pedal feel and the absence of air bubbles in the tubing indicate successful removal of air from the brake system, ensuring optimal brake function and safety.

**8. Gas filling of car air conditioning.**

**Aim:**

The aim of this practical is to refill the refrigerant gas in a car's air conditioning system to restore optimal cooling performance.

**Materials:**

- Refrigerant gas (appropriate for the car's AC system)
- Pressure gauge
- Refrigerant dispenser with hose
- Safety gloves and goggles
- Service manual for the car

**Tools:**

- Wrench or screwdriver (for accessing the AC service port)
- Refrigerant manifold gauge set
- Thermometer (for measuring air temperature from the vents)

**Procedure:**

Preparation: Ensure the car is parked in a well-ventilated area. Put on safety gloves and goggles.

Locate Service Port: Refer to the car's service manual to find the AC service port. Typically, it is located near the AC compressor.

Connect Gauges: Attach the refrigerant manifold gauge set to the service port. Connect the dispenser hose to the low-pressure side of the gauge set.

Start the Engine: Turn on the car and set the AC to maximum cooling with the blower on high.

Refrigerant Dispensing: Follow the gauge readings and add refrigerant as needed. Monitor the air temperature from the vents using a thermometer until it reaches the desired level.

Pressure Check: Ensure the pressure readings are within the manufacturer's recommended range.

Sealing: Disconnect the dispenser and securely close the service port.

**Precautions:**

Safety Gear: Always wear safety gloves and goggles to protect against refrigerant exposure.

Ventilation: Perform the procedure in a well-ventilated area to disperse any leaked refrigerant.

Pressure Limits: Adhere to manufacturer's pressure specifications to avoid damage to the AC system.

Follow Guidelines: Refer to the car's service manual for specific instructions and precautions.

Professional Assistance: If uncertain, seek professional help to avoid mishandling refrigerants.

**Result:**

Upon successful completion, the car's air conditioning system should demonstrate improved cooling efficiency, with air temperature from the vents meeting the desired specifications.

This practical provides a comprehensive guide for safely refilling the refrigerant gas in a car's air conditioning system, ensuring optimal performance and adhering to necessary safety precautions.

**9. To check up steering defects.**

**Aim:**

To identify and diagnose steering defects in a vehicle.

**Materials:**

Vehicle with suspected steering issues  
Jack and jack stands  
Wrenches and screwdrivers  
Flashlight  
Wheel chocks  
Steering system diagram (vehicle manual)

**Tools:**

Tire pressure gauge  
Alignment gauge  
Hydraulic jack  
Multimeter  
Lubricants  
Safety gloves and goggles

**Procedure:**

Vehicle Inspection:

- a. Ensure the vehicle is on a level surface.
- b. Check tire pressure and condition.

- c. Inspect for visible damage or wear on steering components.

#### Lifting and Support:

- a. Safely lift the front of the vehicle using a hydraulic jack.
- b. Secure the vehicle on jack stands and chock the rear wheels.

#### Steering Components Examination:

- a. Inspect steering linkage, tie rods, and ball joints for any play or looseness.
- b. Check power steering fluid levels and condition.

#### Alignment Check:

- a. Use an alignment gauge to assess wheel alignment.
- b. Compare the readings with the vehicle's specifications.

#### Electrical System Check:

- a. Use a multimeter to check the electrical components of the steering system.
- b. Inspect the steering column and wiring for any faults.

#### **Precautions:**

Ensure the vehicle is securely supported on jack stands.  
Follow safety guidelines and wear appropriate protective gear.  
Keep hands away from moving parts during inspection.  
Use wheel chocks to prevent the vehicle from rolling.

#### **Results:**

Upon completion of the inspection, any identified steering defects should be documented. Addressing and rectifying these issues promptly will enhance vehicle safety and overall performance.

### **10. Practicing of manual painting procedure.**

#### **Aim:**

To practice the manual painting procedure, enhancing skills in brushwork and color application.

#### **Materials:**

Canvas or painting surface



Acrylic or oil paints  
Palette for mixing colors  
Paintbrushes of various sizes  
Palette knife  
Easel  
Water or solvent for cleaning brushes  
Rags or paper towels  
Apron or protective clothing

**Tools:**

Flat brushes for broad strokes  
Round brushes for details  
Palette knife for texture  
Mixing palette for blending colors  
Easel to hold the canvas

**Procedure:**

Set up the easel and canvas on a stable surface.  
Choose a subject or reference for the painting.  
Apply a base layer of paint, using broad strokes.  
Gradually add details using smaller brushes.  
Use the palette knife for texture and depth.  
Allow the layers to dry between applications.  
Clean brushes and palette regularly.  
Step back to assess and make necessary adjustments.

**Precautions:**

Work in a well-ventilated area.  
Use appropriate protective clothing.  
Avoid ingestion of paints or solvents.  
Dispose of waste materials responsibly.  
Keep brushes and tools clean to prevent color contamination.

**Result:**

The practice of the manual painting procedure enhances artistic skills, allowing for the creation of visually appealing and textured artworks with a keen sense of color and detail.