

burnout

vol : 1.0

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PCCI

(Premixed Charge combustion Ignition)

PCCI combustion seeks to obtain a fully premixed charge before the start-of-combustion, which will result in fully premixed combustion. By injecting very early in the cycle, the air and fuel mix thoroughly such that, upon combustion of the mixture, there are no locally rich regions and little Particulate matter is formed. PCCI combustion differs slightly from pure HCCI combustion in that the direct fuel injection results in minor air-fuel mixture gradients, and thus the mixture is not truly homogeneous. Start-of combustion is initiated by auto-ignition of the mixture when a sufficiently high cylinder temperature is attained during the compression stroke. When the auto-ignition occurs, the combustion takes place nearly instantaneously throughout the cylinder.

Applications of PCCI

The application of PCCI combustion suffers from several practical problems. First, because the mixture combusts almost instantaneously, the heat release is very rapid. If the auto-ignition occurs too far Before Top Dead Center (BTDC), this rapid heat release results in very high cylinder pressure rise rates, and high peak cylinder pressures. In addition, this rapid heat release tends to expose the in-cylinder nitrogen and oxygen to prolonged high temperatures, which can lead to high NO_x formation rates. Second, early injection can result in spray impingement on combustion chamber wall surfaces, since the spray penetration is increased at the low gas densities in the chamber early in the compression stroke. However, perhaps the biggest challenge with PCCI combustion is control. Because the heat release occurs so rapidly after auto-ignition, control of the timing of the auto-ignition event is very important for emissions and appropriate combustion phasing. Even small, cycle-to-cycle variations in cylinder temperatures can have drastic impacts on the auto-ignition timing. This makes emissions control, and overall engine control, very difficult. Thus the precise control of this process is the primary concern in the experiments conducted in the lab which is done using VVA

-- Aswin Karthik
B.tech 4th year





REVS V/S BOOST



Every time while reading some interview or article of a race car driver, a rallyist or an expert of good old times, we frequently find them stating that how the cars of those days were a driver's pure delight. But now with driveraid technologies and "going green" trends, cars are losing out on their driving pleasure. (# That's what they say, I've tried my hands only on some Swifts which I find quite fun to drive, Santros, Zens and M800s without even a power steering!!).

Reasons stated for this:

First, rear wheel drive started losing out to front wheel drive (with this, getting the tail out on a corner can't be thought of), then automatic gearboxes began taking over from manuals and now, turbocharged engines are overhauling naturally aspirated ones. But is there anything wrong with turbos ?? They allow you to produce towering amounts of power from tiny motors. After-market turbo kits are capable of transforming Octavias, Lancers into beasts churning out powers of more than 500 bhp. Turbo-lag can be one issue related with them but continuous developments, turbos can deliver quick responses, a slug of torque from rpm as low as 2000 and a hammering midrange. The legends of Veyron, 911 turbo, GT-R, Ferrari F-40 would not have been possible without turbos.

Technically, the turbos have a slight edge, but not when it comes to driver appeal. Turbo motors have weak top ends. This is where the enthusiasts want to play every time he gets behind the wheel. Turbos fail to deliver the thrill of a naturally aspirated engine at high engine speeds. The power delivery is spiky and is delivered in an unsmooth and non-linear way and they make the motor unnecessarily complex. While naturally aspirated units rev freely all the way to the tachometer redlines in way which turbo equipped units can't match. The snarl of freely revving unit is a melody to a purist's ears. Just like a good two stroke, the faster engine is spun, more alive it becomes. But naturally aspirated motors are on their way out. Manufacturers like BMW, known for their free revving and sublime engines are adopting turbocharged engines for some of their performance models, all in the name of efficiency and emissions. Even Formula 1 is going turbo too. Only Honda (makes some of the best petrol motors), Ferrari, and Lambo have resisted and are likely to resist the temptation to make some easy power.

Going by the saying "keep it simple silly", it's the naturally aspirated that wins over the forced induction. Still there's time before the bosses at the Italian giants muster up courage and we get to see turbo charged Aventadors and 458s but for sure, that is going to be welcomed hesitantly.

-Ranit Monga

EBD

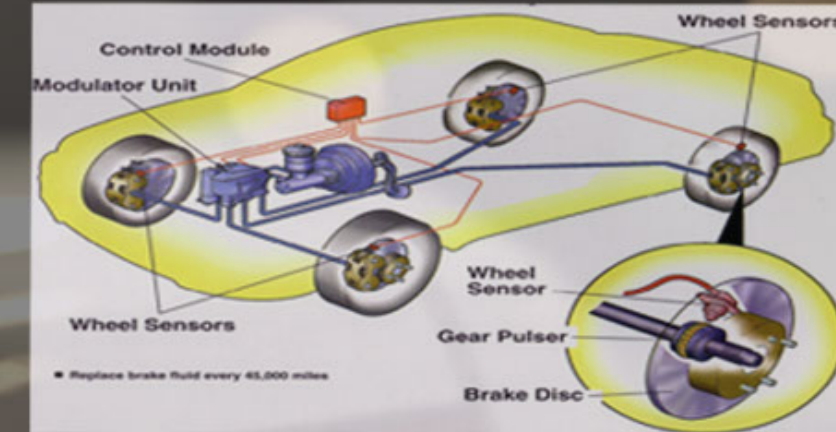
(Electronic Brake Force Distribution)

- Shubham Bhardwaj
B.tech, 2nd year

Driving safety has been major focus of the automotive industries in the past few years. Some of the important safety involves braking. The ability to stop a car as fast as possible is really a big challenge in automotive industry. Antilock Braking System is found almost in all the cars. One of the recent refinement in the Antilock Braking System is Electronic Brake Force Distribution. Electronic Brake Force Distribution works on the principle that weight being supported by the car is not evenly distributed. Hence the wheels carrying more load requires more brake force to stop the car without affecting the stability of the car. Hence EBD not only determines the amount of weight carried by each wheel but also changes the amount of braking power sent to each wheel at each and every instant.

It is only friction between the roads and wheels which is responsible for the motion of a car when you accelerate and when you press the brake pedal it is friction between tires and roads which slows your car down. Hence it is important for the driver's safety to maintain the friction between tires and road. There are various ways in which friction is lost. One is accelerating the car on the icy surface and the other reason is if you brake too hard. The forward momentum of the car is responsible for the speed of the car which is significantly greater than the speed at which the tires are spinning. This is called Wheel lock. Wheel lock is the major cause of road accidents because wheel lock results in the skidding of the car. Therefore in order to avoid this skid there is a term called slip ratio. Slip ratio is defined as the difference between the speed at which the car is moving and the speed at which the wheels are rotating. Anti lock Braking System senses the slip ratio of the individual tires and modulate the brake force required at individual tires so that the slip ratio remains within a safe range. There are following components required for the purpose of EBD.

1. Speed Sensors: To Determine the slip ratio of the wheel, EBD requires two set of information. One is the speed at which wheel is rotating and the other is speed of car. Hence there are sensors placed at individual wheels which senses the speed at which the wheels are rotating.
2. Brake force modulators: The EBD can modulate the amount of brake fluid going into each wheel. If a wheel carries more load and hence requires more brake force to stop the wheel, more brake fluid will be sent. If a wheel carries less load and hence requires less brake force to stop the wheel, less brake fluid will be sent.
3. Electronic Control Unit (ECU): This is a small computer embedded in a Anti lock Braking System. It receives the information from the speed sensor and calculates the slip ratio of the wheels and uses the Brake force modulators to apply the appropriate force and to keep the slip ratio of each wheel within a reasonable range.



Benefits Of Electronic Brake Force Distribution

1. It decreases the stopping distance after brakes are applied.
2. It prevents wheels from skidding by keeping the slip ratio in the safe range.
3. It also prevents Understeer and Oversteer and hence increases the stability of a car.
4. The sensors are so sensitive and the actuators are so quick that the system may correct the direction even before the driver reacts.



Aerodynamics

The Dominant Force

What do you think people research about the vehicles? I mean, the companies have been investing billions of dollars in improving the quality of vehicles, we use but can there be a way that can improve the performance parameters, without having to alter too much in the anatomy of the vehicle? Can you believe that there exists a black magic that can not only improve the overall performance of the vehicle but can also provide extra stability if employed correctly. Can you believe that this black magic can make a vehicle more efficient without any considerable investment?

This black magic is known as aerodynamics! Aerodynamics is the study of how air moves -- especially how it interacts with solid, moving objects. Just as a speedboat leaves the sharp line of a wake trailing behind it on the water, an automobile creates an aerodynamic impact as it slices through the air. And it all started with the prestigious F1.

In the late 1940's F1 used to be a symbol of national pride for European countries. The British in blue, Germans in silver and the Italians in red, used to compete in that turbulent era for national pride. And compared to professionalism of Mercedes (read Germans) rest of the teams looked like hobby racers as the gap between the winner and the "rest" was used to about 12 minutes!! The trend continued till 1960s when Ferrari (read Italians) dominated the sport through their horse power. Such a long phase of humiliation for a nation that once ruled the earth!!! The British then knew that due to lack of development of vehicle industry in their country, they had to find new ways to beat the trend and regain the national pride, and although Britain was not so good at vehicles, but it had a good aerospace industry, and hence a collaboration of engineers began between the two totally different fields. And there came in the effect of aerodynamics. Aerodynamic design was first brought in by the British in the 1960's and others named them as garagists literally meaning the people who assemble cars in garage for hobby racing. But these garagists turned the F1 from a race of horse power, to a race of efficiency, and they became invincible, until other teams realized and adapted aerodynamics in their models and thus starting a new phase in F1, that continues even today.

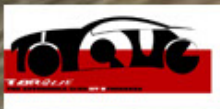
In the world of auto racing, it might be more important to augment the downward force the air exerts on the car's wheels. This downforce (or the negative lift) is the key to maintaining traction through the tight and constant turns of a short-track race. It was

discovered in 1980 when the black lotus team suddenly became the unbeatable in F1, which they had accidentally generated by blocking the air's path to escape from the side-ways of the bottom of the car by providing a curtain and gave an excellent control of the car due to the downforce generated, hence the car was faster on the turns than the others. When the funda became clear, it was banned have curtains below the chasis.

Nowadays, the search for aerodynamics has reached to an extent that the engineers of these teams constantly hunt for methods to gain leverage of even 0.001 second of the lap. Soon following the success at F1, the model was then brought to passenger segment of the cars. But it took a long time for the manufacturers to realize that implementing this simple feature in the design, can help in saving millions of dollars spent in fuel apart from the research for increasing the efficiency of IC engines, which for past 40 years has been of order of 30%. Passenger cars have become more shapely over the years as manufacturers discovered how streamlining can increase fuel efficiency, allowing a car to travel at the same speed using less horsepower. These designs reduce air resistance, or aerodynamic drag. The modern, curvaceous designs minimize the force that air creates against the car's motion, and the result is a sleeker, faster car. For highway driving conditions, it is estimated that driveline uses about 15% of the total energy to required to push your vehicle down the highway, tire rolling resistance represents about 25%, and air drag is about 60%! While the traditional sources advocate saving fuel by driving less or driving slower, there are greater gains that can be made by modifying the aerodynamics, engine, and rolling resistance of the vehicle.

Here are things that can be done to improve your vehicle's aerodynamics:

- **Lower the car** - Lowering the car reduces the effective frontal area, increasing efficiency. Note that this only works up to a certain point. There will be an ideal ride height for each car. According to Mercedes, "Lowering the ride height at speed results in a 3-percent improvement in drag."
- **Remove that wing** - Many "sports" cars have a non-functional wing on the back. Removing it will improve the fuel economy. The exceptions are the small rear fairings that are designed to detach the airflow from a rounded trunk.
- **Clean up the underside of the car.** - Installation of a "body pan", while a labor intensive operation, will provide a significant improvement in mileage.
- **Clean up the front of the car.** Basically the smoother the better. If the car has a large air intake under the bumper, it may not need that opening above the bumper (they are often just styling cues). An aerodynamic plastic, composite, or foam and duct tape panel can be built to cover the opening.
- Remove the side view mirrors and instead use a remote camera system.
- Replace large whip antennas with smaller powered antennas.
- Vehicles with steep windshields can benefit from a hood fairing to help smooth the transition of air between the hood and windshield.
- A small "tail cone" can be affixed the the rear bumper to help transition the air from under the car.





Sedan before aerodynamic modifications.



Sedan after aerodynamic modifications.

Or if you are good in modelling and simulation software, you can model your own car and then perform the analysis and do the design and simulation and do the modifications according to results.

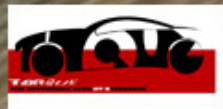
This sedan was featured in Ansys Advantage, where a driver approached the company to improve the fuel efficiency of the car. His friend at Ansys simulated it for aerodynamic performance on FLUENT, and then the design was altered to make it more aerodynamic efficient. According to the magazine, the car used 3.34 litres lesser fuel to drive 160 km than it would have had!! And also the driver won the race, thanks to the better stability provided due to aerodynamic advantage.



So that's enough about the aerodynamics and the wonders created by it in the vehicular segment. Next time you see a vehicle, think of ways to make it better... aerodynamically !



-- Vatsalya Sharma
M.Tech, 1st year
Thermo-Fluid Engineering.



UNDERSTANDING THE SPORT: FORMULA 1



- 1. What is DRS-** It stands for Drag Reduction System, introduced in 2011 to make racing closer. It aims to boost top speed by reducing drag generated by the rear wing by moving its upper element. Hence, it aids overtaking possibilities and provides for the engagement of the device on parts of tracks allowed by FIA.
- 2. What is KERS-** Kinetic Energy Recovery System takes the waste energy generated under braking and turns it into additional power. This is then made available to the driver in fixed quantities per lap via a steering wheel mounted 'boost button'. System is capable of providing additional 84 bhp for 6.67s per lap.
- 3. What is dirty air-** Due to the huge amount of downforce on F1 cars, the leading car disrupts the airflow and makes it difficult for the car following behind to follow close enough to try an overtaking manoeuvre.
- 4. Installation lap-** These are slow (comparatively!) laps usually done during practice and qualifying, intended to gain data and telemetry for the driver or team rather than setting a competitive time.
- 5. What is chicane-** A tight combination of two corners in opposite direction is known as chicane, lined with kerbs and designed to slow down cars.
- 6. What is racing line-** In racing sports, the racing line is the route the vehicle must take in order to minimize the time taken to complete the course.
- 7. What is drive-thru penalty-** A penalty applied by race officials while the race is underway, in which the driver is directed to drive through the pit lane and exit the pits at pit lane speed, consequently losing significant track position in the process.
- 8. What is flat spot-** When a wheel locks under braking, or the driver loses control and spins the car, it leaves a flat spot on the tyre that was touching the tarmac at that time. Tyre needs to be changed as the handling of the car is compromised due to surface irregularities.



- 9. What engines do the F1 cars use-** F1 cars are powered by bespoke 2.4 litre V8 engines. Despite their small size, they make in excess of 700 bhp. But from 2014, 1.6 litre turbocharged engines will be used.
- 10. What is the performance of F1 car-** Depending on gearing and aerodynamic setup, an F1 car can reach 100 kmph in under 2.8 sec and is capable of hitting top speeds in excess of 350 kmph.
- 11. What is Nomex-** It is the registered name of a fibre made by DuPont for a flame retardant material, partly used in shoes, gloves, and overalls for racing drivers and pit-crew in general to protect them in events of fire. Driver can survive for 11 sec in temperatures of 840 celsius while in overalls made of this fibre.
- 12. Who is a backmarker-** A slow car that is a lap behind the leading cars in a race is called a backmarker. It is usually shown a blue flag to let the cars on the lead lap pass.
- 13. What is Parc Ferme-** Parc Ferme is an area in which F1 cars enter after they have qualified for the race, where they are not allowed to be worked upon by mechanics unless under the observation of the stewards. If team make any changes, the car will have to face a penalty of losing its grid spot at the start of race.
- 14. What are tyre marbles-** The tyres disintegrate into fine pieces of rubber which accumulate on outside of the racing line, making driving tough in those regions due to less availability of traction.
- 15. What are tyre warmers-** F1 tyres are very sensitive to temperatures and operate best within a certain range. Whilst stationary, tyres are heated up by specially shaped electric blankets known as tyre warmers.
- 16. What is 'Aquaplaning' -** Aquaplaning or hydroplaning by the tyres of a F1 car occurs when a layer of water builds between the wheels and the track surface, leading to a loss of traction that prevents the vehicle from responding to control inputs. If it occurs to all wheels simultaneously, the vehicle becomes, in effect, an uncontrolled sled.

-- Ranit Monga



Whenever we wish to buy a car, we will look at many categories in choosing a car, like company, SUV, small cars, petrol or diesel fuel car but we never realize why we are using two different kinds of fuel when both of them are used to convert the chemical energy available in them to mechanical energy. Even though both engines have the same Rudimentary principles to convert the chemical energy available in fuel into mechanical energy through a series of small explosions or combustions. Petrol engines will have a spark plug extra which will be reason for explosions during the four strokes that occur in engines.

The main difference between diesel and petrol is the way these explosions happen. In a petrol engine, fuel is mixed with air, compressed by pistons and ignited by sparks from spark plugs. In a diesel engine, however, the air is compressed first, and then the fuel is injected. Because air heats up when it's compressed, the fuel ignites.

1st stroke (Intake stroke): In a diesel engine the intake valve opens with piston moving down allowing air to enter the combustion chamber. In case of a petrol engine air fuel mixture is allowed which is already mixed in a place called Carburetor in the inlet manifold.

2nd stroke (Compression Stroke): In this stroke both engines have almost same function, both of them the piston now moves up compressing the air in diesel engine and air-fuel mixture in the petrol engine.

3rd Stroke (Combustion or power stroke): In diesel engine, just before the piston reaches the top of the cylinder completing its 2nd stroke, fuel is injected directly into hot compressed air and gets ignited which causes the temperature to raise and pushes piston down. Petrol engine is also similar, but the air and fuel is already mixed in carburetor and spark plug is used to ignite this mixture. The timing of fuel injection and sparking is crucial for the performance of an engine.

4th Stroke (Exhaust stroke): In this stroke both are similar, sending the remains from the combustion through a exhaust valve.

A diesel engine is heavy and bulky due to the high compression ratio (1: 25 maximum) it needs to handle and has a direct fuel injection system, delivering fuel at high pressure into the combustion chamber.

A petrol engine is comparatively light and uses a spark plug for ignition of the fuel.

As we have seen above, the differences between the engines four strokes is the main reason for different types of construction

-- A. Manikanth



ENGINE

Fire it...!!



Concept Cars

The automotive industry is one of the fastest growing industries in the recent times. Since the dawn of the millennium, new ideas were being pitched in regarding the technology, the design, ergonomics, and fuel efficiency for the enhancement of automobiles. These speculated as to how the car of the near future will be. The thinking process of the designers and engineers had found a new path for the production of 'The ultimate vehicle'. These popularly came to be known as 'concept cars'.

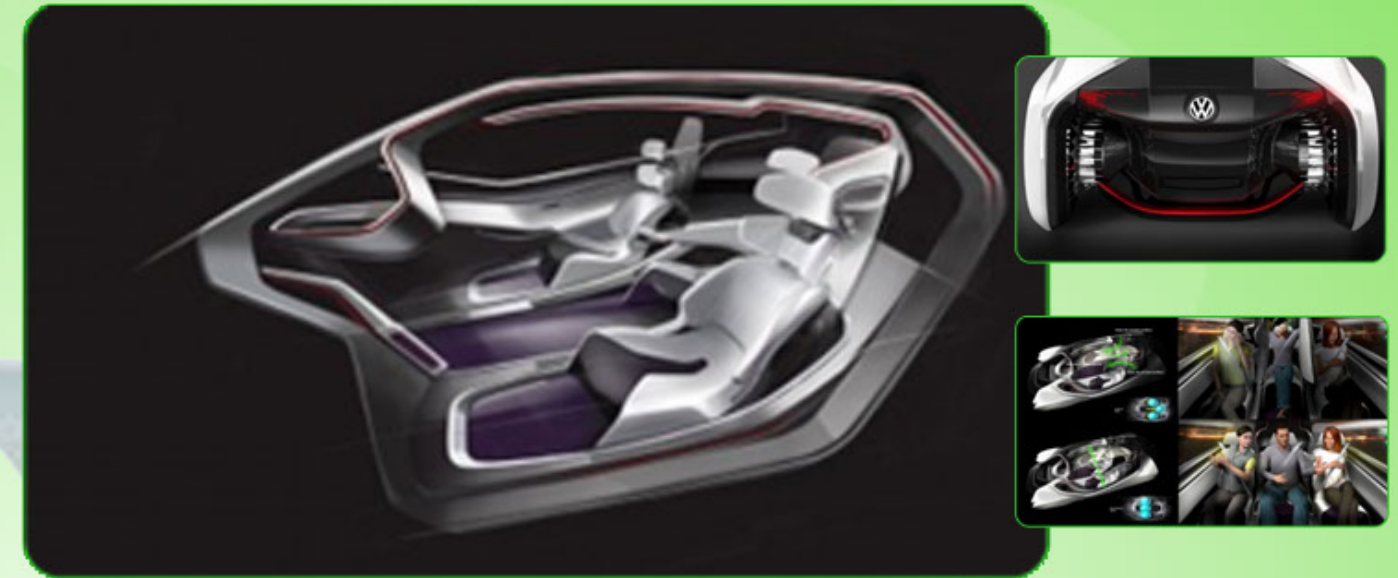
These cars have a certain purpose. Enhancements such as fluidic design, power efficiency, to be an engineering marvel are the benchmarks of such automobiles. Production of these cars is limited. If the technology to mass produce them will exist in the near future, you may pretty soon find one of these concept cars standing in your garage.

Volkswagen Trimaran Concept

The recent focus in the automotive industry is to design and develop autonomous vehicles. The Trimaran concept is one such attempt towards this goal. This automobile is also a vision in which 'car sharing' is a possible reality.

INTERIOR-

The unique feature of this car is its flexible and yet beautifully modelled interior that offers a variety of options. The seating offered by the car can be described by two modes-'isolation' and 'participation'. The isolation mode is for the passengers to have their own space, and to make passengers feel comfortable. This makes the car sharing practically possible. The participation mode allows the passengers to ride the car together, side by side in the vehicle cabin.



Passengers can switch from isolation mode to participation and vice versa due to the flexibility made possible by the components of the cabin such as specially designed cocoon structure, circular partitions and the clever geometry of the floor.

EXTERIOR-

The exterior design of the Trimaran concept impresses the aesthetic sense of the Volkswagen brand. The concept car has a wonderful aerodynamic shape and represents a true future car. Due to its centered driving position, door cut lines run into the roof to widen the opening and improve ingress and egress.

-- Sharang Kulkarni
B.Tech, 2nd year



A close-up photograph of a classic car's front end, focusing on the headlight and grille. The car is a dark color, possibly black or dark blue. The headlight is prominent on the left side, and the grille is visible in the center. The background is slightly blurred, showing other parts of the car and possibly other vehicles in the distance.

CLUB ACTIVITIES

Torque, the automobile club of IITH, was started by a bunch of “gearheads”, with a vision, to inculcate and nurture the infatuation with automobiles, in the students of IITH. Being one of the most active technical clubs, Torque attracts quite a lot of students, from all streams of engineering.

As a tradition, which was started last year, Torque kick-started this semester with the “Torque Trivia”. Participation as expected came from all batches, irrespective of stream, resulting in fourteen teams. Two rounds; preliminary and finals were held. Preliminary round consisted of 23 questions from all aspects of automobiles, be it fun-facts, logos, automobile history, etc. Questions were carefully tailored so as not to sound too technical. Six teams made it to the finals. The finals were something completely out-of-the box, with a diverse variety of rounds, ranging from audio-visuals to odd-one-out to Cluedo!! On the whole, the quiz was very entertaining and enlightening, especially for the freshers.

The second session of Torque was a lecture-cum-discussion-cum-FAQ session arranged specially for the freshers, so as to introduce them to the technicalities of an automobile as well as clear their doubts and misconceptions. The topic of this session was “Manual Transmissions System”. Each and every topic was clearly presented and thoroughly discussed by using videos and animations. Advanced concepts like Power and Torque characteristics were also covered for the senior batches. After the lecture, a FAQ session was held, to clear the doubts in the minds of freshers, regarding automobiles and their various components and functionalities. To increase participation from the audience, papers were distributed so that they could pen down their doubts, which were answered at the end of the session. This session was quite fruitful for the freshers, as we were successfully able to clear most of their doubts and impart some useful knowledge in the field of automobiles.

-- Nilesh Negi

Amazing Facts !!

1. The engine bay of a McLaren F1 road car is gold plated because it's the best material for reflecting heat.
2. The Bugatti Veyron's gearbox took 50 engineers five years to perfect.
3. The propeller blades in low inertia turbochargers can spin at up to 250,000rpm.
4. In the film Gone in 60 Seconds, Christopher Ecclestone's character doesn't drive as the actor doesn't have a driving license.
5. The first car was the three-wheeled Benz Patent Motorwagen, built in 1885.
6. The onboard computer in a typical modern car is more powerful than the one used to send astronauts to the moon in the 1960s and 1970s.
7. The fastest time for removing a car engine, and replacing it, is 42 seconds for a Ford Escort, on 21 November 1985
8. Porsche is the world's most profitable car manufacturer.
9. The world's widest road is the Monumental Axis in Brazil, which has enough space for 160 cars to drive side by side !
10. The world's longest car is the 100 foot limousine built by Jay Ohrberg of Burbank, California. The car features a king-size waterbed and a swimming pool, complete with diving board.
11. On August 20 2004, 21 people squeezed into a Mini Cooper in Athens, Greece, setting a new world record.
12. Back in 1904, the first speeding ticket was given in Dayton, Ohio. The driver was "speeding" 12 miles per hour..!
13. The first cars used a lever (some people call it a joystick) instead of a steering wheel.
14. It is illegal to slam your car door in Switzerland.
15. Goldman Sachs has predicted that India will have the maximum number of cars on the planet by 2050 which will even overtake the US
16. Jamshedji Tata was the first Indian to own a car. He bought a car in 1901.
17. World's first motor-accident was in 1769. The vehicle is still preserved in the Conservatoire Nationale des Arts et Metiers in Paris
18. According to statistics, most car accidents occur within three miles of the person's home.
19. The world's longest traffic jam was between Paris and Lyon in 1980 on the French Autoroute. Traffic was backed up for 110 miles.
20. No two-cycle engines are allowed in Singapore. The license fee for a new car is low, about \$5.00, but as the vehicle gets older, this fee increases. When the automobile reaches 8 years old, it is no longer allowed on the streets. While strict, Singapore's auto law has virtually wiped out air pollution in the country.
21. An airbag takes only 40 milliseconds to inflate after an accident. They kill 1 person to 22 lives they save.
22. The automobile is the most recycled consumer product in the world today!
23. The United States has almost one car per person. Even babies!

-- V. Karthik



REV UP YOUR BRAINS

Pick the Odd-One from each of the given set:

1. **Tata-Hitachi, Ingersoll Rand, Terex-Vectra, MAN, Caterpillar, Hyundai**
2. **Renault Duster, Mahindra Scorpio, Premier Rio, Mahindra Bolero**
3. **Mahindra Pantero, Honda CB Twister, Hero Passion-X Pro, TVS Jive, Honda Dream Yuga**
4. **Limited Slip, Standard Carrier, Lockable, Pitman Arm**
5. **Mercedes Benz CLS, Audi A7, Porsche Panamera, Aston Martin Rapide, BMW 7 Series**
6. **Indigo Marina, Baleno Altura, Tata Estate, Ertiga, Corsa Swing**

- Ranit Monga

Answers will be published in next edition.



Petrosexual!
[Chaitanya Kulkarni]

Currently driving: Hyundai i10. The best Value for Money car in the hatchback segment in India.

Greatest Racing Driver: Michael Schumacher

Top five Cars if I had unlimited budget: Ferrari 458 Italia, Bugatti Veyron SS, Lamborghini Aventador, Lamborghini Sesto Elemento, Koenigsegg Agera and also a Jaguar F-type.

With last litre of petrol: Sell it and buy all the above cars just for the sake of watching them parked in my garage!

Fastest ever driven: Around 150 kph on the Aurangabad-Pune National Highway

Switch Careers: Become an F1 driver or a test-driver for Ferrari.

Favourite Road: Mumbai-Pune Expressway

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