“Car Engines Inside Out”

By Mohammad Aahil
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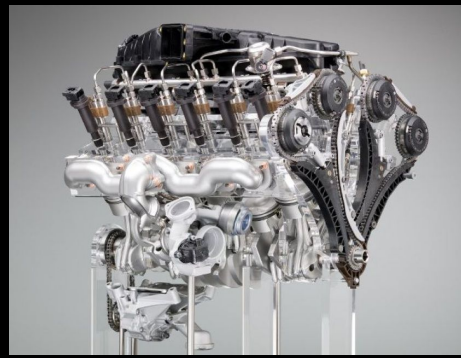
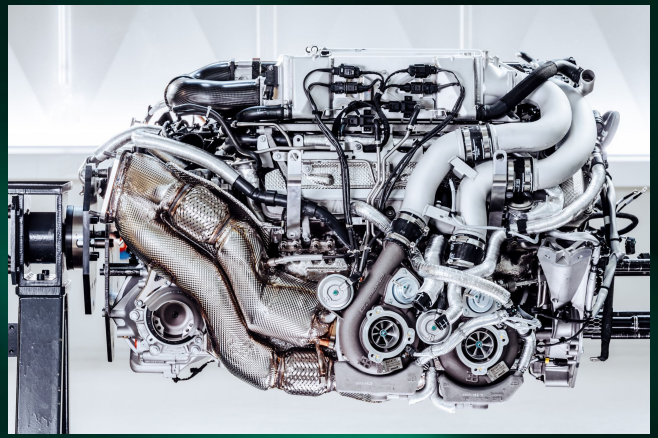


INTRODUCTION

TODAY I WILL BE TELLING YOU ALL ABOUT CAR ENGINES: WHAT A CAR ENGINE IS, HOW IT WORKS, THE PARTS OF A CAR ENGINE, AND WHAT HAPPENS TO A CAR ENGINE AFTER WATER DAMAGE, AND MUCH MORE.

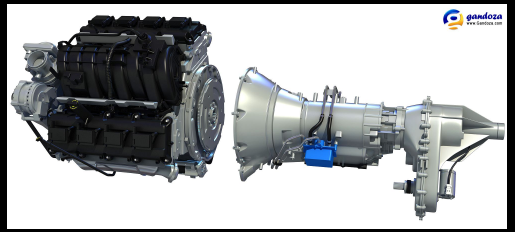


Main research question

How do the design and fuel type of internal combustion engines affect their performance, environmental impact, and risk of failure from water damage and overheating?

HOW DO CAR ENGINE WORK

A car has two main components: the engine and the transmission.[1] A car engine works through internal combustion, where a mixture of fuel and air is compressed in a cylinder, ignited by a spark plug, and the explosion pushes a piston to create power.[2] HowStuffWorks Pistons are connected to a crankshaft, which turns this motion into rotation that spins the wheels.[2] science.howstuffworks.com Valves control air and fuel flow, spark plugs ignite the mixture, and oil and coolant keep the engine running smoothly and prevent overheating.[3] Engines can have 4, 6, 8, 10, 12, or 16 cylinders, with 16 being the largest.[4]Wikipedia

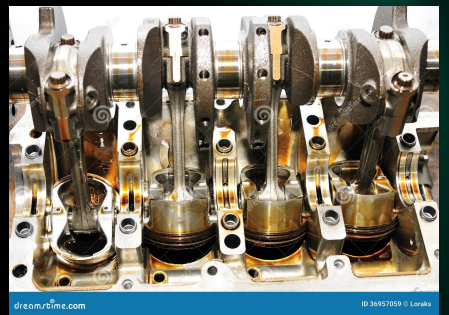


WHY DO WE NEED CAR ENGINE

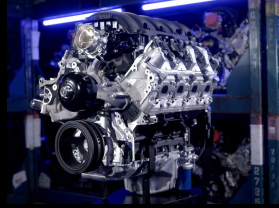
We need car engines because they provide the power that allows cars to move. The engine converts fuel into energy, Which turns the transmission then it turns the wheels and helps the car travel from one place to another. Car engines make transportation faster, easier, and more efficient for people and goods.

What makes car engine go bad Water Damage

Water damage can cause a car engine to go bad when water enters the engine through flooding or deep puddles. When water gets inside the engine cylinders, it can cause hydrolock, which bends or breaks engine parts because water cannot be compressed like air. Water can also mix with engine oil, reducing lubrication and causing more friction and wear. Over time, moisture leads to rust and corrosion on metal parts and can damage electrical components such as spark plugs and sensors. Because of this, water damage often results in severe engine failure and expensive repairs or even engine replacement.



Types of car engine



There are several types of car engines, based on how they work and what fuel they use. some common types include:

1. **petrol (gasoline) engine – uses gasoline as fuel and is very common in cars.**

2. **diesel engine – uses diesel fuel and is more fuel-efficient, often used in trucks and buses.**

3. **hybrid engine – combines a petrol/diesel engine with an electric motor for better fuel efficiency.**

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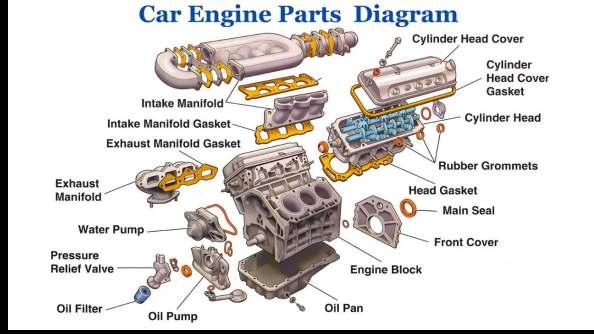
Parts of a car engine



A car engine has several important parts that work together to make the car move. the cylinder is where fuel and air mix and burn, while the piston moves up and down to create power. the crankshaft turns this motion into rotation to spin the wheels. valves control the flow of air, fuel, and exhaust, and spark plugs ignite the fuel mixture. the camshaft helps the valves work at the right time, oil lubricates the parts, and coolant prevents overheating. all these parts are held together by the engine block and connected with a timing belt or chain to keep everything in sync.

Engine System Comparison Table

System	Energy Source	Power Delivery	Efficiency
Naturally Aspirated	Fuel + Air	Smooth / Linear	Standard
Turbocharged	Exhaust Gas	High (Boosted)	High (Uses waste heat)
Supercharged	Belt / Crankshaft	Instant / Aggressive	Lower (Uses engine power)
Electric	Battery / Electrons	Instant Torque	Highest (No heat loss)

Advantages

- Car engines allow vehicles to move and transport people and goods easily.
- They save time by helping people travel long distances faster.
- Car engines provide power to carry heavy loads.
- They make daily activities like going to school, work, or shopping more convenient.
- Modern car engines are more fuel-efficient and reliable than older ones.
- Engines help emergency services like ambulances and fire trucks reach places quickly.

Disadvantages

Pollution: Most car engines burn fuel, which releases harmful gases like carbon dioxide and nitrogen oxides. These gases cause air pollution and contribute to climate change.

Fuel Costs: Gasoline and diesel engines need fuel to run, and fuel can be expensive, especially when prices go up.

Maintenance and Repairs: Car engines have many moving parts that wear out over time. Oil changes, repairs, and part replacements can cost a lot of money.

Noise: Engines can be loud, especially older or poorly maintained ones, which adds to noise pollution.

Environmental Damage: Oil leaks, fuel spills, and exhaust emissions can harm soil, water, animals, and plants.

Fun Facts

The first car engine was built in 1885 by Karl Benz.

A typical car engine has over 200 moving parts working together.

Car engines can spin at the max revolutions per minute (RPM) or more.

A Formula 1 engine can cost over $10 million.

Most engines waste more than half of their fuel energy as heat.

Some car engines are small but powerful—modern 1.0L engines can be stronger than older big engines

How much is it to fix a car engine

Fixing a car engine can be **very expensive**, and the cost depends on how serious the problem is and what kind of car it is. Small engine repairs, like replacing sensors or simple parts, can cost around **$150 to $500**. Medium repairs, such as fixing belts or gaskets, usually cost **$500 to $1,500**. Major engine problems, like a damaged head gasket or timing issues, can cost **$1,000 to $3,500 or more**. If the engine is badly damaged, it may need to be rebuilt or replaced. An engine rebuild can cost **$2,500 to $6,000**, while replacing the engine with a used one can cost **$2,000 to $6,000**. A brand-new engine is the most expensive option and can cost **$6,000 to $15,000 or more**. Overall, engine repairs can be costly, which is why regular maintenance is very important.

Gas vs Diesel

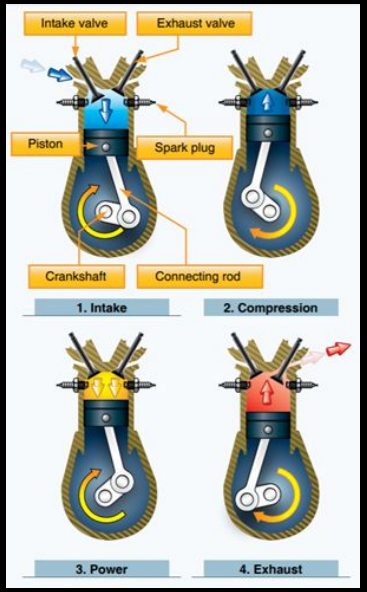
Gas and diesel engines both power cars, but they have important differences. A gas engine uses gasoline and is usually quieter, lighter, cheaper to buy, and easier to maintain, making it better for everyday driving. However, gas engines use more fuel and produce more carbon dioxide, which increases pollution. A diesel engine uses diesel fuel and is more fuel-efficient and powerful, producing more torque, which makes it better for trucks and heavy vehicles. Diesel engines often last longer but are louder, heavier, cost more to buy, and can be more expensive to repair, and they also produce harmful emissions.

Gas vs Electric

A **gas car** uses gasoline to make the car go. It can drive for a long time and you can fill it up quickly at a gas station, but it makes smoke that can make the air dirty. An **electric car** uses electricity from a battery to move. It is very quiet and does not make smoke, which helps keep the air clean. Electric cars need time to charge, but they are better for the environment.

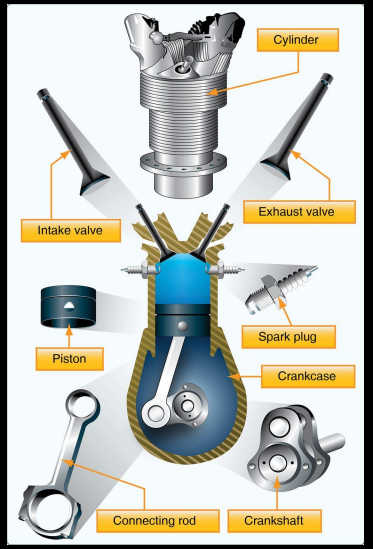
Safety features related to engines part 1

Car engines have safety features that protect the engine itself. **Warning lights** tell the driver when there is a problem, such as low oil or overheating. **Automatic engine shut-off** can turn the engine off if it gets too hot or oil levels are too low, preventing serious damage or fires. The **cooling system** helps control engine temperature so it does not overheat.



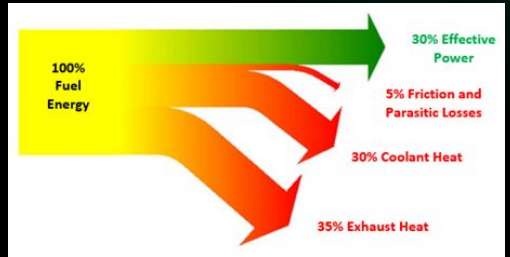
Safety features related to engines part 2

Some safety features help keep the car under control while driving. Traction control and stability control work with the engine to reduce power if the wheels start to slip. Anti-lock braking systems (ABS) work with the engine and brakes to help the car stop safely. These systems help prevent skidding and keep the driver and passengers safe.



Engine efficiency

Engine efficiency means how well an engine turns fuel into useful power to move the car. When fuel burns inside the engine, only part of the energy moves the car forward, while the rest is lost as heat and noise. More efficient engines use less fuel to travel the same distance, which saves money and reduces pollution. Modern engines are made more efficient by using fuel injection, better cooling systems, lighter materials, and computer controls. Hybrid and electric vehicles are even more efficient because they use less fuel or electricity and waste less energy



Engine maintenance Part 1

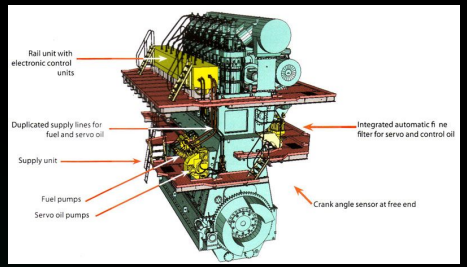
Regular **engine maintenance** is very important to keep a car running smoothly. The **oil and oil filter** should be changed every **5,000–10,000 km** to keep the engine lubricated. The **air filter** should be replaced every **15,000–30,000 km** so the engine can breathe properly. **Spark plugs** need changing every **30,000–50,000 km** to ensure smooth ignition, and the **coolant** should be checked or replaced every **40,000–60,000 km** to prevent overheating.

Engine maintenance Part 2

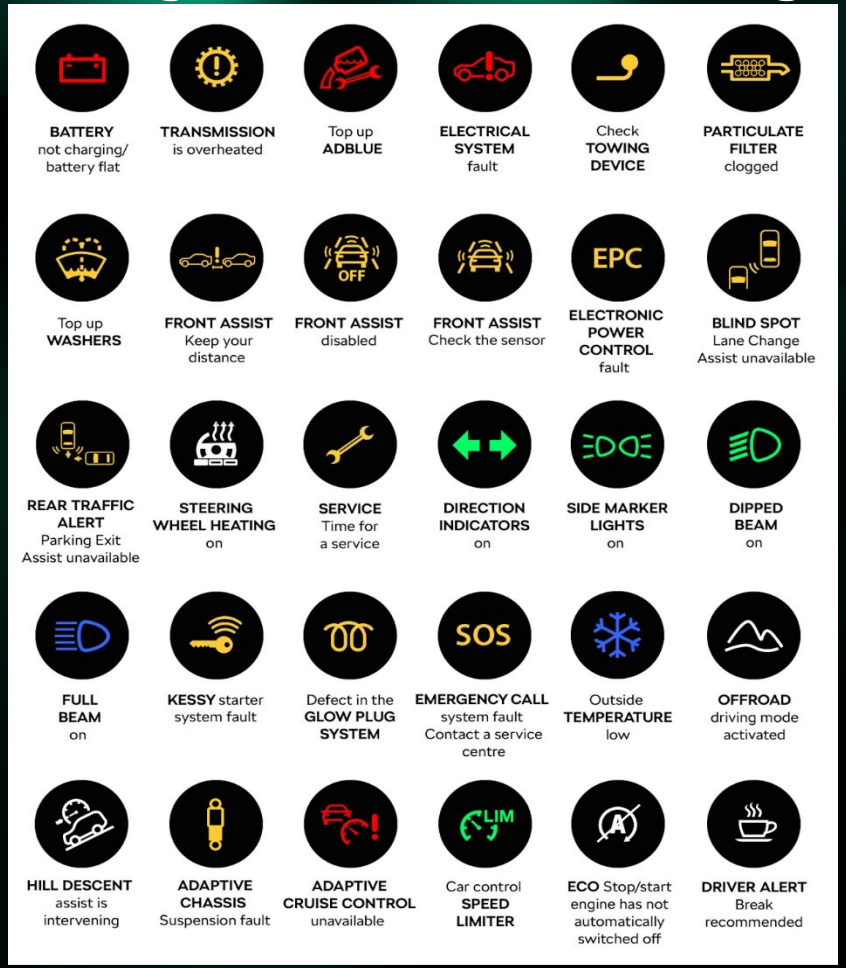
Other important maintenance includes the **timing belt**, which should be replaced every **60,000–100,000 km** to avoid engine damage, and the **fuel filter**, which should be changed every **40,000–80,000 km** to keep fuel clean. The **battery** should be checked or replaced every **50,000–100,000 km** to make sure the car starts reliably. Regular maintenance helps prevent breakdowns, saves money, and keeps the engine running efficiently for a long time.

Engine safety

Engine safety includes features that protect the engine and keep the car safe. **Warning lights** alert the driver to problems like low oil or overheating, and some cars have **automatic engine shut-off** to prevent damage or fires. **Cooling systems** keep the engine from getting too hot, while **traction control**, **stability control**, and **ABS brakes** help the car stay under control and stop safely. These systems work together to protect the engine and keep passengers safe.



Engine safety and warning signs



Car engine safety and warning signs help drivers know when the car needs attention. Warning lights can show problems like battery or electrical faults, overheating, engine control issues, or the need for service. Other alerts warn about safety systems, low fluids, or driving conditions. Paying attention to these signs helps keep the car safe, prevents breakdowns, and avoids serious engine damage.

Some parts and meanings

Piston: Moves up and down inside the engine cylinder to create power.

Cylinder: The space where the piston moves and fuel is burned.

Crankshaft: Turns the up-and-down motion of the pistons into spinning motion.

Connecting Rod: Connects the piston to the crankshaft.

Camshaft: Controls when the engine valves open and close.

Valves: Let air and fuel in and exhaust gases out of the engine.

Spark Plug: Creates a spark to ignite fuel in gas engines

Some cars and what kind of engine they have

Make: BMW

Model: M760Li xDrive

Engine: 6.6L Twin-Turbo V12

Model Year Used: 2022

Make: Mercedes-Benz

Model: AMG CLS 63

Engine: 5.5L Twin-Turbo V8

Model Year Used: 2018

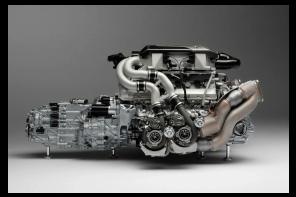
Make: Audi

Model: S3

Engine: 2.0L Turbo v6

Model Year Used: 2023

Make: Bugatti



Model: Chiron

Engine: 8.0L Quad-Turbo W16

Model Year Used: 2022

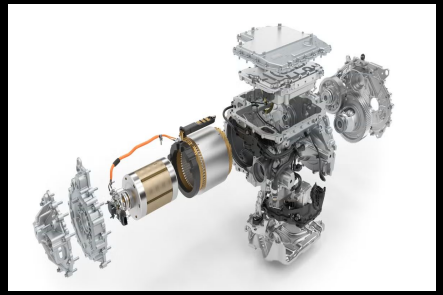
Make: Toyota

Model: Camry

Engine: 2.5L 4-Cylinder (A25A-FKS)

Model Year: 2022

Why Car Engines Are Slowly Being Replaced by Electric Motors



Car engines are slowly being replaced by electric motors because electric cars are better for the environment, cheaper to maintain, and easier to run. Gas engines burn fuel and release pollution, while electric motors do not produce exhaust when driving. Electric motors also have fewer moving parts, so they break down less and do not need oil changes. They provide instant power, making cars smoother and quicker, and they are much quieter. As technology improves and governments support cleaner transportation, electric motors are becoming more popular for the future of cars.

Internal Combustion Engines

Internal combustion engines produce power by burning fuel inside the engine's cylinders. A mixture of fuel and air is compressed and ignited, creating an explosion that pushes the pistons. This motion turns the crankshaft, converting up-and-down movement into rotational motion that moves the vehicle. Gasoline and diesel engines are the two main types of internal combustion engines, and they use key parts such as cylinders, pistons, valves, spark plugs, oil, and coolant to work properly. These engines are widely used because they provide reliable power and quick refueling, but they also produce emissions and can fail due to problems like overheating or water damage.

“Why Car Engines Fail: From Tiny Problems to Big Breakdowns”

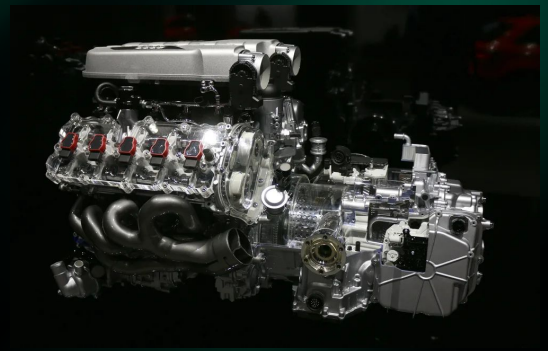
Car engines can wear out or fail if they are not properly maintained. Problems like water getting into the engine, dirty or old oil, worn-out parts, or overheating can slowly damage even the strongest engines. Since engines have hundreds of moving parts, small issues can quickly turn into big breakdowns. Regular maintenance—like changing oil, checking coolant, replacing worn parts, and keeping the engine clean—helps engines last longer, run smoothly, and avoid expensive repairs. Understanding how engines fail and how to care for them is key to keeping cars reliable.

“Turbochargers & Superchargers: How Car Engines Get Extra Power”

Car engines make power by burning fuel in cylinders, which moves pistons and turns the crankshaft. **Turbochargers** use exhaust gases to push more air into the engine, while **superchargers** are connected directly to the engine to give an instant boost. Both allow engines to produce much more horsepower without being bigger. Supercars like the Bugatti Chiron use these systems to safely reach extreme power and speed, turning even a small engine into a high-performance machine

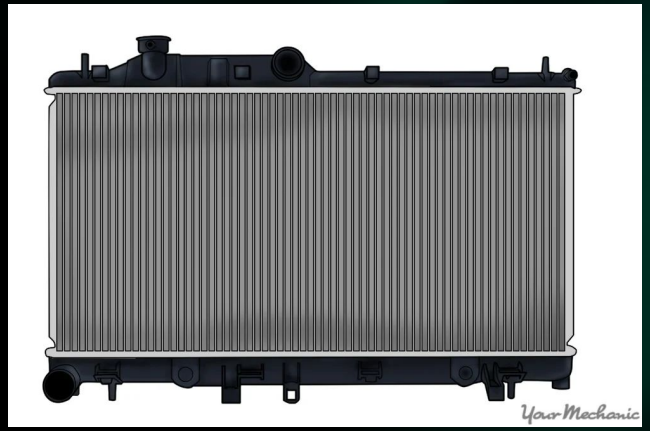
How Horsepower is Created

Horsepower in car engines comes from **controlled explosions** inside the cylinders. When fuel and air are ignited, pistons move and turn the **crankshaft**, sending power to the wheels. More cylinders and faster explosions create more horsepower. Engineers increase power using **turbochargers, superchargers, fuel injection, and high compression**. Supercars like the **Bugatti Chiron W16** use advanced materials, cooling, and precise assembly to handle extreme heat and pressure, turning thousands of tiny explosions into smooth, powerful motion.



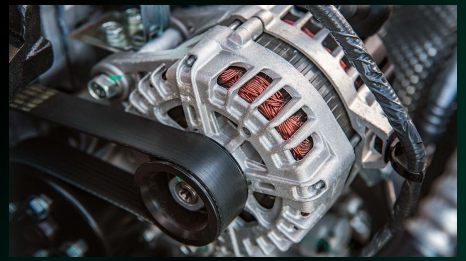
Cooling Systems

Car engines produce a huge amount of heat from thousands of tiny explosions per minute, so they need a cooling system to prevent overheating. Most cars use a liquid cooling system, where coolant flows through the engine, absorbs heat, and passes through a radiator to release it. Key parts include the **water pump, thermostat, radiator, and cooling fan**. High-performance engines, like those in the Bugatti Chiron, use extra radiators and advanced cooling to handle extreme horsepower, keeping the engine safe and running smoothly.



“Alternator and Battery: Powering Your Car”

The battery stores electricity to start the car and run electronics, while the alternator produces power once the engine is running, keeping the battery charged and all systems working. Without the alternator, the battery would drain, and the car’s electronics would fail. High-performance cars like the Bugatti Chiron have alternators designed to handle extra electrical load while the engine delivers massive power.



Conclusion

In conclusion, car engines are complex machines that turn fuel into power and help run important systems like the alternator. Through this project, I learned how engine parts such as pistons, cylinders, and turbochargers work together to affect performance and efficiency. I also learned that the best engine depends on its purpose: smaller or hybrid engines are better for fuel efficiency and the environment, while larger or turbocharged engines are better for high performance, like in supercars. I would like to thank my teachers for their guidance and support in completing this project.

Resources

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And thank u to Hadi FOE GIVING ME THIS INFORMATION

The End and thank you for looking at my science Fair JAK