

1Q

Ans

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a) Invention of Electric Motor

In 1888

The Hungarian Inventor 'Anyos Jedlik' invented an world's first Electric motor and created a first small model car powered by his Electric motor. and Between 1832 and 1839, Scottish inventor Robert Anderson also invented a crude electric carriage. In 1996, the first electric vehicle was a three-wheeler, invented by Scooter's. In 1835 the two Dutchmen sibbrandus Stratingh and christophorus Becker built an electric motor that ~~was~~ powered a small model car. This is the first known practical application of an electric motor.

b) Golden Era of EV

During the early 1906's there was a golden age of electric cars, when they made up more than one-third of car sales in the U.S. In the early 20th century, people looked in their horses for more advanced vehicles that improve transportation allowed the country grow and thrive.

In 1906 is 100 mile Range in single charged electric vehicle is introduced top speed 45.50 Kph

Disadvantage:

EV more popularly

- * No emission
- * Efficient
- * Low cost
- * Easy start

d) Domination of Electric Vehicle by Gasoline cars ②

According to recent employment statistical reports, there is more significant employment rate in the Renewable Energy section. The Indian Labor Organization report stated that the Renewable Energy industry's job opportunities would rise 38 lacks by 2030.

The EV industry will create over 10 million job opportunities in various domains such as designing, testing, manufacturing, wiring, charging infrastructure, sales, services, redesigning existing infrastructure, battery technology, and many more.

d) Coming of New Era in EV

The great smog 5 Dec - 9 Dec 1950 London 12000 people death in the case of smog, and 1960 California 800 new cases/day diseases related to pollution, and then 48% of pollution in automobile.

After the pollution increases 'CARB' in 1970 California Air Resources Board is formed. It is pollution control board state govt.

1991 Low Emission Vehicle I (1993-2003). all manufacturers to provide an EV alternative to market. At that time EV called the ZEV (Zero Emission Vehicle).

Californian manufacture of electric cars, Tesla, motor in 2004 started the development of the Tesla Roadster model which was first delivered to customers in 2008.

c) Introduction to Hybrid Electric Vehicles

A Hybrid Electric Vehicle (HEVs) are powered by an internal combustion engine in combination with one or more electric motors that use energy stored in batteries. HEVs combine the benefits of high fuel economy and low tailpipe emissions with the power and range of conventional vehicles.

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Ans

- a) Series Hybrid Electric Vehicles
- b) Parallel Hybrid Electric Vehicles
- c) Series Parallel Hybrid Vehicles
- d) Plug in Hybrid Electric Vehicle
- e) Fuel Cell Electric Vehicle

Disadvantages

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- * The many energy conversion leads to a low overall system efficiency
- * Needs two electric machines and two sets of power electronics.

Industrial Application

eg: BMW i3

- * 1. Trucks and locomotives
- 2. Large vehicles

- * ICE engine is 1.2L 2 cylinder engine
- * It has range extended option.

b) Parallel Hybrid Electric Vehicles

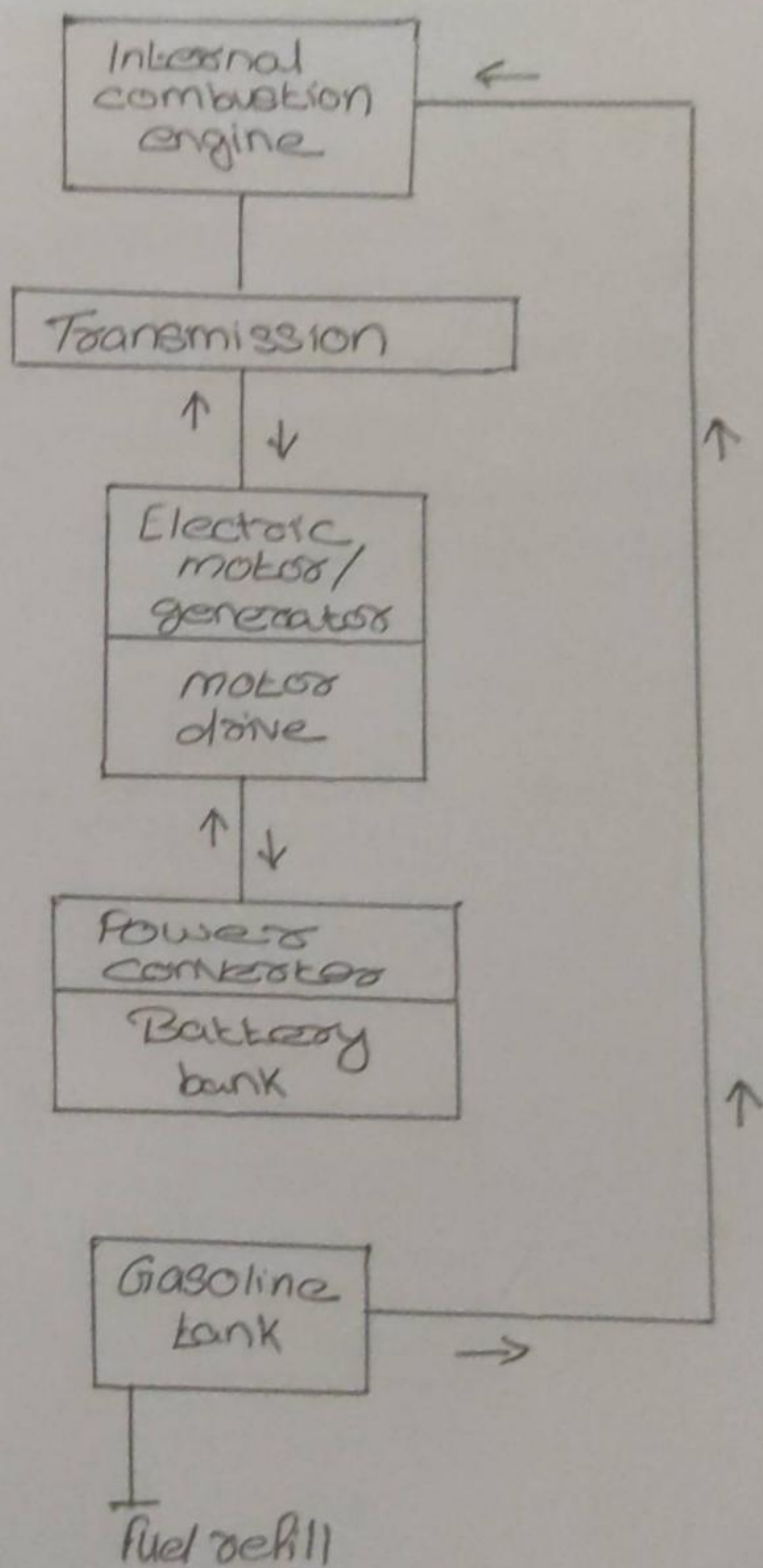
The engine and electric motor work in tandem to generate the power that drives the wheels. Parallel hybrids tend to use a smaller battery pack than series drivetrains, relying on regenerative braking to keep it recharged.

Disadvantage

- * It has a complex design
- * ICE is not decoupled with the wheels so it cannot be charged at standstill.

Advantages

- * Parallel hybrids tend to use a smaller battery pack than series drivetrains.
- * Relying on regenerative braking to keep it recharged



Industrial Application

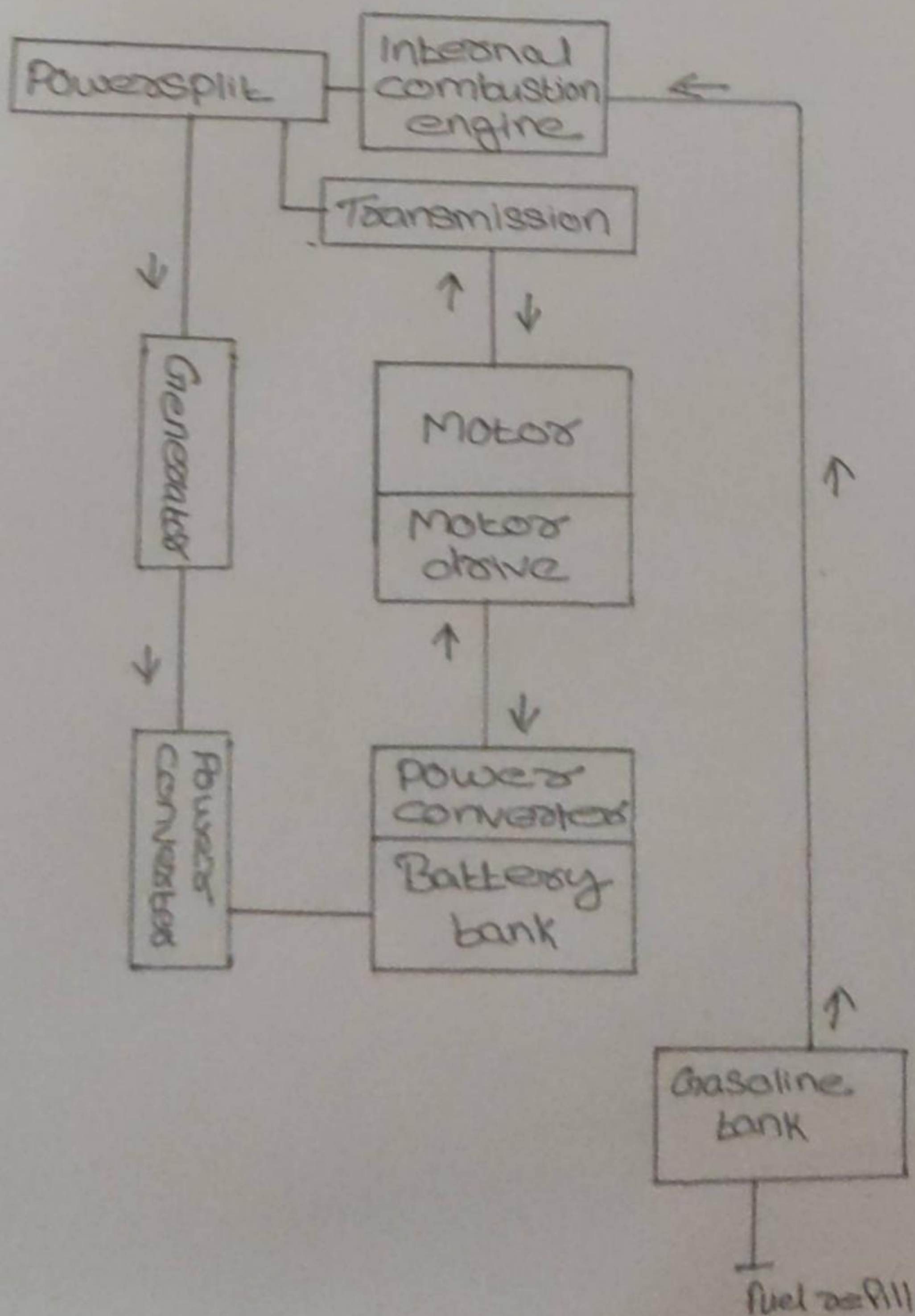
eg:- BMW i8

* It has 2L 3cylinder engine

1. Urban passenger cars

c) Series Parallel Hybrid Vehicles

The power-split hybrid or series-parallel hybrid are parallel hybrids that incorporate power-split devices, allowing for power paths from the ICE to the wheels that can be either mechanical or electrical. The main principle is to decouple the power supplied by primary source from the power demanded by the drives.



Advantages

- * Smaller
- * more efficient engine and greater use of electric power
- * Zero emission operation possible

Disadvantages

- * very expensive system
- * control complexity
- * complex space

Application

- * Passenger cars
- * light duty vehicles

d) Plug in Hybrid Electric Vehicle

A plug-in hybrid electric vehicle (PHEV) is a type of hybrid electric vehicle that combines a gasoline or diesel engine with an electric motor and a large battery, which can be recharged by plugging it into an electrical outlet or charging stations.

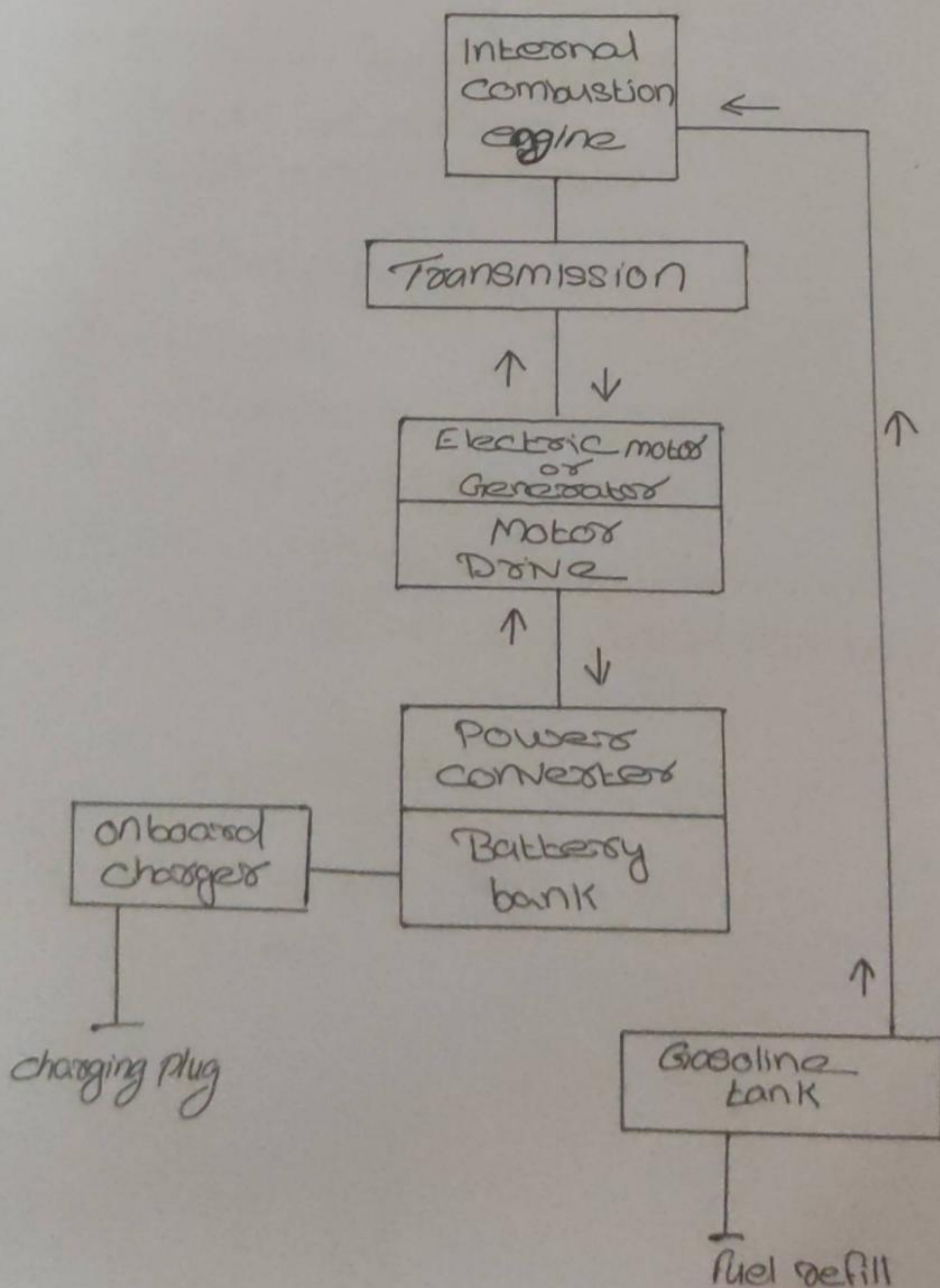
Disadvantages

- * The ICE. The internal-combustion engine in a hybrid or PHEV can be an advantage and disadvantage
- * Two drive trains
- * Poorer fuel efficiency and handling
- * Battery recycling

- * Technologically complex
- * Fewer recharging stations

Advantages

- * Higher efficiency
- * Home/work place charging
- * many refueling stations



e) Fuel Cell Electric Vehicle

Fuel cell electric vehicles are powered by hydrogen. They are more efficient than conventional internal combustion engine vehicles and produce no tailpipe emissions they only emit water vapor and warm air. FCEVs and the hydrogen infrastructure to fuel them are in the early stages of implementation.

Advantages

- * Simplest fuel cell system
- * Good load response
- * zero-emitting system

Disadvantages

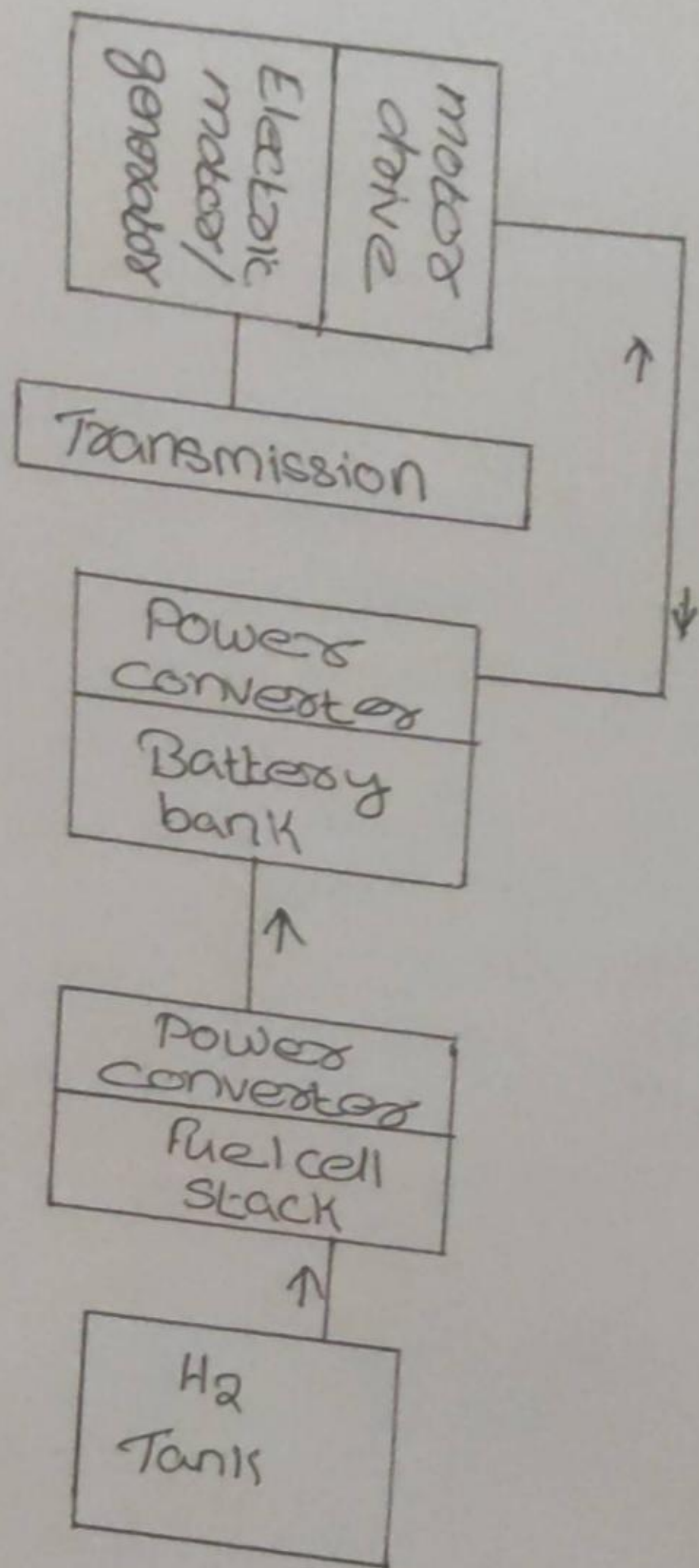
- * High cost
- * Perceived as unsafe
- * Range / refuelling issues
- * No existing infrastructure
- * No effective on-board storage

Application

- * Passenger cars
- * buses

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Application

- * Boats
- * Motorcycles
- * Vehicles
- * Buses

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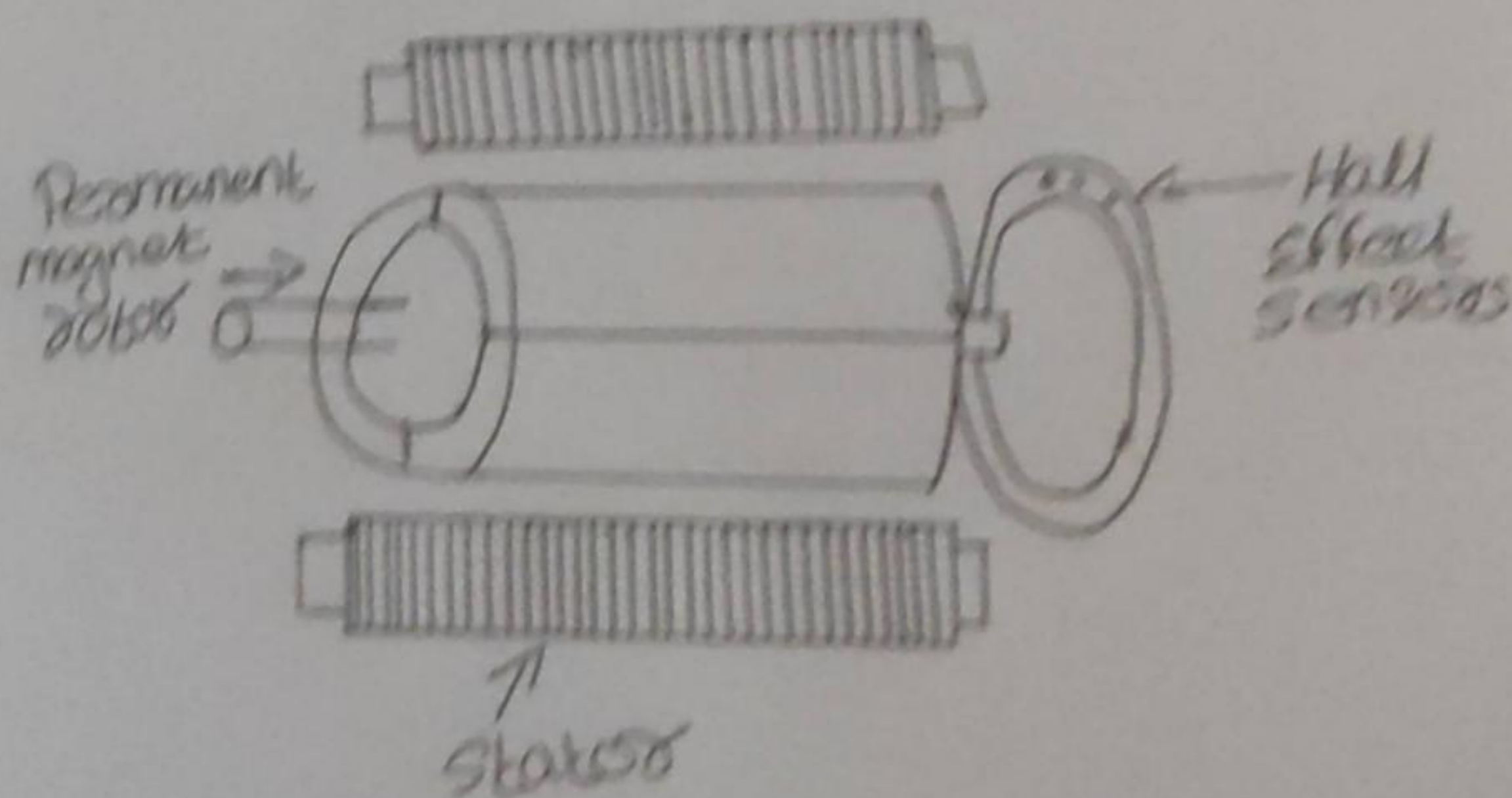
Ans

(12)

Construction and Working of Brushless DC Motor

Construction

BLDC motors have many similarities to AC induction motors and brushed DC motor in terms of construction and working principles respectively. Like all other motors, BLDC motor also have a rotor and a stator. BLDC motors can be constructed in different physical configurations. Depending on the stator windings, these can be configured as single phase, two-phase, or three-phase motors. Three-phase BLDC motors with permanent magnet rotor are most commonly used.



Working Principle

BLDC motor works on the principle similar to that of a Brushed DC motor. The Lorentz force law which states that whenever a current carrying conductor is placed in a magnetic field it experiences a force. As a consequence of reaction force, the magnet will experience an equal and opposite force. In the BLDC motor, the current carrying conductor is stationary and the permanent magnet is moving.

When the stator coils get a supply from source it becomes electromagnet and starts producing the uniform field in the air gap. Though the source of supply is DC, switching makes to generate an AC voltage waveform with trapezoidal shape. Due to the force of interaction between electromagnet stator and permanent magnet rotor, the rotor continues to rotate.

With the switching of windings as high and low signals, corresponding winding energized as North and South pole. The permanent magnet rotor with North and South poles align with stator poles which causes the motor to rotate.