

# UNIT 11: Powertrain Traction

## --- VOCABULARY

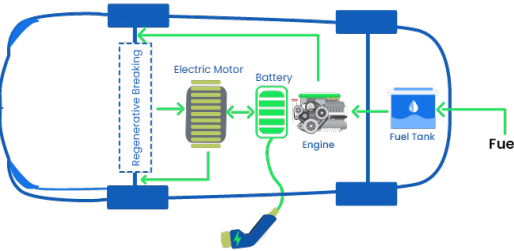
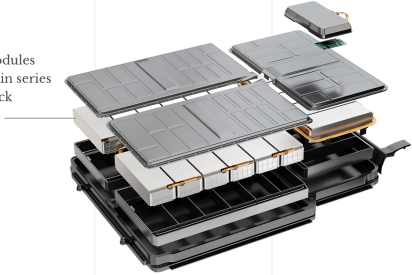
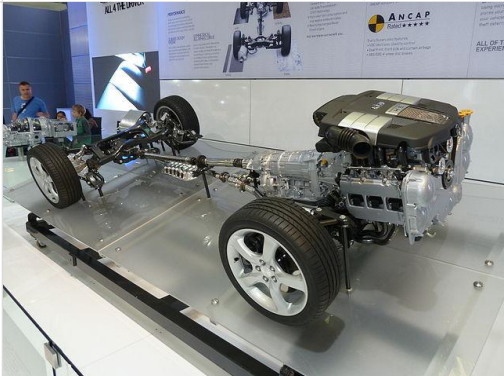


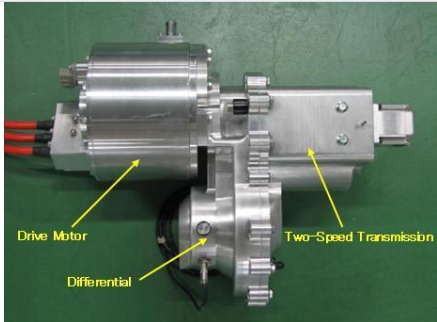

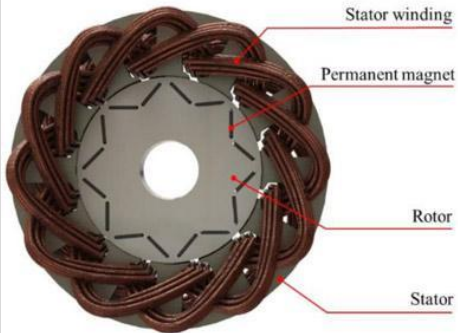
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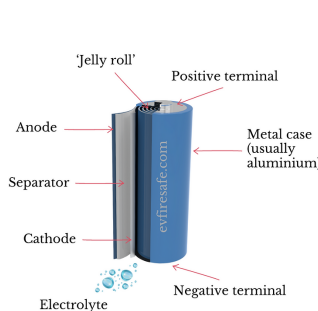
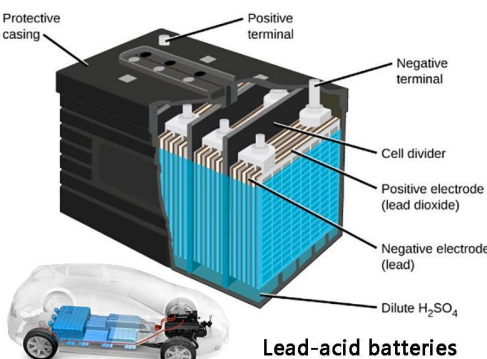
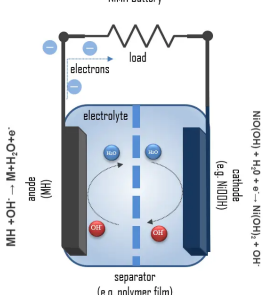


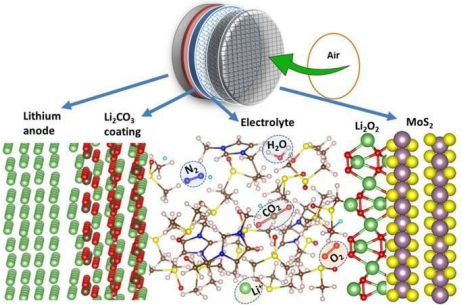
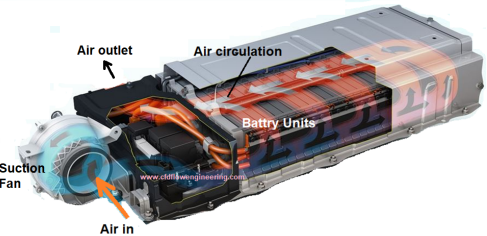
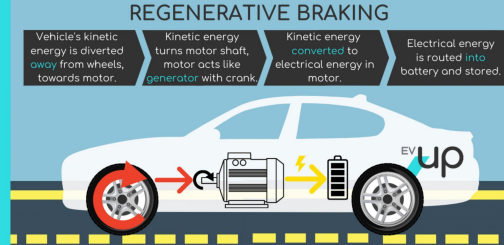
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Term	Description	Image
<p><b>Rear-wheel drive</b></p>	<p>Rear-wheel drive is a form of engine and transmission layout used in motor vehicles, in which the engine drives the rear wheels only. Rear-drive cars typically offer better handling and balance, especially in sporty driving and performance situations, because the weight of the engine is balanced with the drive wheels. This setup can improve traction and stability during acceleration.</p>	<p style="text-align: center;"><b>Rear-Wheel Drive System</b></p>
<p><b>Front-wheel drive</b></p>	<p>Front-wheel drive cars have the engine's power directed to the front wheels. This setup generally improves traction in slippery conditions, offers better fuel efficiency, and usually costs less to produce.</p>	<p style="text-align: center;"><b>Front-Wheel Drive System</b></p>
<p><b>Hybrid vehicles</b></p>	<p>Hybrid electric vehicles are powered by an internal combustion engine and one or more electric motors, which uses energy stored in batteries. A hybrid electric vehicle cannot be plugged in to charge the battery. Instead, the battery is charged through regenerative braking and by the internal combustion engine.</p>	

<p><b>Plug-in hybrid technology</b></p>	<p>In a plug-in hybrid, the electric battery is the primary power source for the car. When the battery runs down, the internal combustion engine takes over. In a full hybrid, the battery only provides enough power for driving the car at slower speeds — in residential areas and cities, for example.</p>	 <p>The diagram illustrates the energy flow in a plug-in hybrid vehicle. A Fuel Tank provides energy to an Engine. The Engine can power an Electric Motor, which in turn powers the wheels. The Battery is connected to both the Electric Motor and the Engine. Regenerative Braking is shown as a process where the wheels drive the Electric Motor, which then charges the Battery. The Fuel Tank also provides energy to the Battery.</p>
<p><b>Propulsion</b></p>	<p>Propulsion is the force that moves something forward. In vehicles, propulsion refers to the system that powers the movement, like the engine or motor that makes the wheels turn, allowing the vehicle to move.</p>	<p>x</p>
<p><b>Battery Pack</b></p>	<p>An EV traction battery is rechargeable energy storage that supplies power to the electric motor very quickly, giving EVs high performance &amp; rapid acceleration. Multiple individual lithium ion battery cells are connected to make a battery module. A group of connected battery modules is contained within an enclosed battery casing with underbody protection. This is known as a battery pack.</p>	 <p>Battery modules connected in series create a pack</p>
<p><b>Drivetrain</b></p>	<p>The electric vehicle drivetrain system is responsible for delivering power from the battery to the wheels. It is made up of several different moving parts. However, they all fall into the three main components: the electric motor, drive shafts, and transmission.</p>	 <p>The photograph shows a complete electric vehicle drivetrain assembly on a display stand. It includes the electric motor, drive shafts, and transmission, all connected to the wheels. The assembly is shown in a museum or exhibition setting.</p>

<p><b>Differential</b></p>	<p>The differential distributes equal amounts of torque to both wheels. This permits the wheels to react to resistance, or provide traction, to give the wheel more resistance to rotate less.</p>	
<p><b>Transmission</b></p>	<p>The transmission, also known as a gearbox, uses gears to transfer power from the engine to the drive wheels. In an electric vehicle, the transmission comprises a single gear in most cases.</p>	
<p><b>Power electronics</b></p>	<p>Power electronics convert and distribute electrical power to other vehicle systems such as heating and ventilation, lighting, and infotainment. Power electronics components include inverters, DC/DC converters, and chargers (for plug-in electric vehicles)</p>	<p style="text-align: center;">x</p>
<p><b>Interior Permanent Magnet (IPM) synchronous motors</b></p>	<p>An Interior Permanent Magnet (IPM) motor is a type of AC (Alternating Current) motor where the magnets are placed inside the spinning part of the motor, called the rotor.</p>	

<p><b>Torque</b></p>	<p>The driving torque of an electric vehicle is the thrust that the electric motor imparts to the mechanical transmission and thus to the wheels.</p>	
<p><b>Lithium-ion batteries</b></p>	<p>A lithium-ion battery is a rechargeable battery cell, containing the following parts:</p>	
<p><b>Lead-acid batteries</b></p>	<p>Lead-acid batteries are older, rechargeable batteries that were used in early EVs. They are heavy and less efficient compared to newer batteries, like lithium-ion, and are now mainly used for smaller tasks, like starting the engine or powering accessories.</p>	 <p style="text-align: center;"><b>Lead-acid batteries</b></p>
<p><b>Nickel-Metal-Hydrate (NiMH) batteries</b></p>	<p>A nickel-metal hydride battery (NiMH or Ni-MH) is a type of rechargeable battery. NiMH batteries tend to provide lower energy density and power density compared to lithium-ion batteries. In addition, lithium-ion batteries tend to self-discharge at a slower rate and have a longer cycle life.</p>	 <p style="text-align: center;"><b>NiMH Battery</b></p>

<p><b>lithium-air batteries</b></p>	<p>Lithium-air batteries are a type of advanced battery technology being researched for use in electric vehicles (EVs). They have the potential to store much more energy than current lithium-ion batteries, which could significantly increase the driving range of EVs. However, lithium-air batteries are still in the experimental stage and do not yet exist in commercial EVs.</p>	
<p><b>Cooling System</b></p>	<p>The cooling system in an electric vehicle regulates the temperature of the battery and other components to prevent overheating and ensure optimal performance. It typically uses a combination of liquid coolant and fans to maintain proper operating temperatures.</p>	<p style="text-align: center;"><b>Air Cooling of Battery</b></p> 
<p><b>Regenerative braking system</b></p>	<p>This feature causes the vehicle to decelerate as soon as the foot is lifted off the accelerator pedal and continues to actively brake if neither pedal is depressed. This essentially turns the motor into a generator and charges the vehicle's battery.</p>	<p style="text-align: center;"><b>REGENERATIVE BRAKING</b></p> 
<p><b>Electrification trends</b></p>	<p>Electrification trends in EVs refer to the increasing shift towards using electric power for vehicles instead of traditional gasoline or diesel engines. This includes advancements in battery technology, electric drive systems, and charging infrastructure, all aimed at improving the efficiency, range, and affordability of electric vehicles.</p>	<p style="text-align: center;">x</p>
<p><b>Electric Vehicle Range Anxiety</b></p>	<p>Range anxiety is the worry that electric vehicle (EV) owners feel about whether their car's battery will last for a trip or if they'll find a charging station when they need one. This concern is about the chance of running out of battery before reaching their destination or not finding a place to charge the car.</p>	<p style="text-align: center;">x</p>