INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)
Dundigal, Hyderabad - 500 043

MECHANICAL ENGINEERING

DEFINITIONS AND TERMINOLOGY QUESTION BANK

Course Name	:	**Automobile Engineering**
Course Code	:	**AME020**
Program	:	B.Tech
Semester	:	VIII
Branch	:	Mechanical Engineering
Academic Year	:	2019– 2020
Course Faculty	:	Mr. VKVS KrishnamRaju, Assistant Professor Mr. M Prashanth Reddy, Assistant professor

OBJECTIVES:

The course should enable the students to:	
I	Understand the function of various parts of automobile, features of fuel supply systems for S.I and C.I engines.
II	Distinguish the features of various types of cooling, ignition and electrical systems.
III	Analyze the working principles and operations details of transmission and suspension systems.
IV	Recognize the working of various braking and steering systems.
V	Summarize the ways and means of reducing the emissions from automobiles.

DEFINITIONS AND TERMINOLOGYQUESTION BANK

S No	QUESTION	ANSWER	Blooms Level	CO	CLO Code
UNIT -I					
1	Explain Engine	Engine refers to a device which transforms one form of energy into the other form. Heat engine is a modified form of engine used for transforming chemical energy of fuel into thermal energy and subsequently for producing work	Understand	CO 1	AME020.01
2	Explain Piston And Piston Rings	Piston is a cylindrical part which reciprocates inside the cylinder and is used for doing work and getting work. Piston has piston rings tightly fitted in groove around piston and provide a tight seal so as to prevent leakage across piston and cylinder wall during piston's reciprocating motion	Remember	CO 1	AME020.01
3	Explain Crankcase	Crankcase actually acts like a sump housing crank, crankshaft, and connecting rod and is attached to cylinder. These are made of aluminium alloy, steel, cast iron etc. by casting process	Remember	CO 1	AME020.01

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4	Explain Gudgeon Pin	It is the pin joining small end of the connecting rod and piston. This is made of steel by forging process.	Remember	CO 1	AME020.01
5	What is Stroke	It is the nominal distance travelled by the piston between two extreme positions in the cylinder.	Remember	CO 1	AME020.01
6	Explain Dead Centre	The extreme end positions inside the cylinder at which piston reverses it's motion. Thus, there are two dead centres in cylinder, called as 'top dead centre' or 'inner dead centre' and 'bottom dead centre' or 'outer dead centre'. Top dead centre (TDC) is the farthest position of piston from crankshaft. It is also called inner dead centre (IDC). Bottom dead centre (BDC) refers to the closed position of piston from crankshaft. It is also called outer dead center (ODC).	Remember	CO 1	AME020.02
7	DefineSwept Volume	It is the volume swept by piston while travelling from one dead centre to the other. It may also be called stroke volume or displacement volume. Mathematically, Swept volume = Piston area × Stroke	Understand	CO 1	AME020.02
8	Explain Clearance Volume	It is the volume space above the piston inside cylinder, when piston is at top dead centre. It is provided for cushioning considerations and depends, largely upon compression ratio.	Understand	CO 1	AME020.02
9	Explain Compression Ratio	It is the ratio of the total cylinder volume when piston is at BDC to the clearance volume. Compression ratio = $\frac{\text{Swept volume} + \text{Clearance volume}}{\text{Clearance volume}}$	Understand	CO 1	AME020.02
10	DefineIndicated Power	It refers to the power available inside the cylinder i.e. the power provided to piston. Indicated power = (Energy in fuel) – (Energy loss in exhaust, coolant, radiation etc.)	Understand	CO 1	AME020.02
11	Explain Brake Power	It refers to the power available at crankshaft i.e. it is the useful shaft work. Brake power = (Indicated power) – (Energy loss in friction, pumping and unaccounted losses etc.) Brake power = $\frac{2\pi NT}{60}$ Watt	Understand	CO 1	AME020.02
12	Explain Friction Power	It refers to the power lost due to friction and other reasons. It is quantified by the	Remember	CO 1	AME020.02

S No	QUESTION	ANSWER	Blooms Level	CO	CLO Code
		difference between indicated power and brake power. Friction power = Indicated power – Brake power			
13	ExplainIndicator Diagram	Indicator diagram is the graphical description of pressure and volume variations occurring inside cylinder. An indicator diagram for a four-stroke internal combustion engine	Remember	CO 1	AME020.02
14	Explain Fuel Filter	A fuel filter is a filter in the fuel line that screens out dirt and rust particles from the fuel, normally made into cartridges containing a filter paper.	Remember	CO 1	AME020.02
15	Explain Lubrication System	The job of the lubrication system is to distribute oil to the moving parts to reduce friction between surfaces which rub against each other.	Remember	CO 1	AME020.03
16	What is Viscosity Index	Viscosity Index is a measure of how much the viscosity of an oil changes with temperature. Single viscosity oil could be too thick at low temperature and very thin at high engine temperatures.	Remember	CO 1	AME020.03
17	What is Crank Case Ventilation	Air must circulate through the crankcase when engine is running. This removes water gasoline and blowby gases from the crankcase. This is also helps prevent the formation of sludge.	Understand	CO 1	AME020.03
18	What is Cetane Number	The cetane number refers to the ease with which diesel fuel ignites. A high cetane number means the fuel is fast burning and ignites easily at a relatively low temperature.	Understand	CO 1	AME020.03
19	Explain Common Rail Diesel	A single, highly pressurised fuel line supplies diesel to all cylinders allowing for finer control over fuel use. Vastly reduces diesel engine's noise and improves fuel economy.	Understand	CO 1	AME020.03
20	ExplainTurbo Diesel Injection	Most modern diesel engines are now fitted with turbochargers to maximise performance.	Understand	CO 1	AME020.03
21	ExplainVolumetric Efficiency	The amount of air entering the cylinder due to the vacuum created by the downward motion of the piston is always less than the actual displacement of the piston because of the constriction of the air intake system	Remember	CO 1	AME020.03
UNIT -II					
1	Explain Antifreeze	Antifreeze is an additive which lowers the freezing point of a water-based liquid and increases its boiling point. An antifreeze mixture is used to achieve freezing-point depression for cold environments and also achieves boiling-point elevation ("anti-boil") to allow higher coolant temperature.	Understand	CO 2	AME020.04

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2	Explain Radiator	Radiators are heat exchangers used to transfer thermal energy from one medium to another for the purpose of cooling and heating. The majority of radiators are constructed to function in automobiles, buildings, and electronics.	Understand	CO 2	AME020.04
3	Explain Thermostatic Radiator Valve	A thermostatic radiator valve (TRV) is a self-regulating valve fitted to hot water heating system radiator, to control the temperature of a room by changing the flow of hot water to the radiator.	Remember	CO 2	AME020.04
4	Explain Ignition	Ignition system generates a spark or heats an electrode to a high temperature to ignite a fuel-air mixture in spark ignition internal combustion engines, oil-fired and gas-fired boilers, rocket engines, etc.	Understand	CO 2	AME020.05
5	Explain Spark Plug	A spark plug is a device for delivering electric current from an ignition system to the combustion chamber of a spark-ignition engine to ignite the compressed fuel/air mixture by an electric spark, while containing combustion pressure within the engine	Remember	CO 2	AME020.05
6	Explain Bendix Drive	A Bendix drive is a type of engagement mechanism used in starter motors of internal combustion engines. The device allows the pinion gear of the starter motor to engage or disengage the flywheel of the engine automatically when the starter is powered or when the engine fires, respectively	Understand	CO 2	AME020.05
7	Explain Electronic Control Throttle System	Provides an all-electronic system able to detect throttle pedal position by means of a series of sensors. It then relays that information to a computer which instantaneously activates the throttle by means of a DC motor. Also known as fly by wire/drive by wire.	Understand	CO 2	AME020.05
8	Explain Electronic Control Module	An ECM is an electronic "brain" which controls a system in a car, such as the engine management system, transmission or body electrics.	Understand	CO 2	AME020.05
9	Explain Exhaust Gas Recirculation	A proportion of exhaust gasses are redirected back into the engine to help burn fuel more efficiently and significantly reduce harmful emissions.	Remember	CO 2	AME020.05
10	Explain Electronic Control Unit	An ECU is an electronic "brain" which controls a system in a car, such as the engine management system, transmission or body electrics.	Understand	CO 2	AME020.05
11	Explain Gasoline Direct Injection	Very high pressure fuel injection directly into the engine combustion chamber. Enabling increased efficiency of engine operation. Also known as DI, FSI.	Remember	CO 2	AME020.05
12	Explain Satellite Navigation System	GPS technology interfaces with mapping software either built to provide spoken, turn by turn instructions to	Understand	CO 2	AME020.05

S No	QUESTION	ANSWER	Blooms Level	CO	CLO Code
		drivers. Also known as GPS (Global Positioning System).			
13	Explain Ball Joints	Movable joints in the steering linkage and suspension system of a vehicle that permit rotating movement in any direction between the parts that are joined.	Understand	CO 2	AME020.05
14	Explain Compression Ratio	The ratio of maximum volume to minimum volume of cylinder is known as the compression ratio. It is 8 to 12 for spark ignition engine and 12 to 24 for compression ignition engine.	Remember	CO 2	AME020.05
15	What is Ignition Delay	It is the time interval between the ignition start (spark plug start in S.I. engine and inject fuel in C.I. engine) and the actual combustion starts.	Understand	CO 2	AME020.05
16	ExplainMean Effective Pressure	The average pressure acting upon the piston is known as mean effective pressure. It is given by the ratio of the work done by the engine to the total volume of engine. Mean effective pressure = Work done by engine / Total volume of cylinder	Remember	CO 2	AME020.06
17	What is Ignition Coil	ignition coil (also called a spark coil) is an induction coil in an automobile's ignition system that transforms the battery's low voltage to the thousands of volts needed to create an electric spark in the spark plugs to ignite the fuel.	Understand	CO 2	AME020.06
18	ExplainCycle Time	The time required to complete a specified activity or process; for example – final assembly test requires twenty minutes to complete.	Understand	CO 2	AME020.06
19	ExplainDeburr	Deburr is a machining process that removes the rough edges or 'burrs' from a machined part.	Understand	CO 2	AME020.06
20	What is Dual Clutch Transmission	A semi-automatic transmission that uses two separate clutches for odd and even gears that will operate as an automatic transmission during normal driving but gives the driver the option to manually shift gears.	Remember	CO 2	AME020.06
21	ExplainSix Sigma	Six Sigma is a quality process that was developed by Motorola in the 80s to improve manufacturing quality and provide a method for quality monitoring and control. The six sigma goal for manufacturing is to drive quality to less than 4 defects per million parts built.	Understand	CO 2	AME020.06
UNIT -III					
1	Explain Clutch	A clutch is a mechanical device which engages and disengages power transmission especially from driving shaft to driven shaft.	Understand	CO 3	AME020.07
2	Explain Centrifugal Clutch	A centrifugal clutch is a clutch that uses centrifugal force to connect two concentric shafts, with the driving shaft	Understand	CO 3	AME020.07

S No	QUESTION	ANSWER	Blooms Level	CO	CLO Code
		nested inside the driven shaft. It engages more at higher speeds.			
3	Explain Synchro Mesh Gear Boxes	Synchro mesh gear box is similar to the constant mesh type in that all the gears on the main shaft are in constant mesh with the corresponding gears on the lay shaft. The gears on the lay shaft are fixed to it while those on the main shaft are free to rotate on the same.	Remember	CO 3	AME020.07
4	Explain All Wheel Drive	Popular terminology for permanent four-wheel drive systems. Vehicle can distribute power to all four wheels rather than just to the front or rear wheels only.	Understand	CO 3	AME020.08
5	Explain Constant Velocity Joint	A mechanical coupling that allows drive shafts not in the same plane, to spin at the same speeds.	Remember	CO 3	AME020.08
6	Explain Continuously Variable Transmission	A continuously variable transmission is an automatic transmission that can vary drive ratios seamlessly using an internal belt and cone arrangement.	Understand	CO 3	AME020.09
7	Explain Smart Brake Support	Using a millimeter-wave radar (SBS) is capable of detecting vehicles and obstacles as far as 200 m ahead. When a risk of collision is detected, the system slows the car via a two-stage brake operation.SBS aims to help the driver avoid or reduce the severity of collisions, particularly when driving at mid- to high speeds (between 15 km/h and 145 km/h), by automatically applying the brake if there is a danger of collision.(Mazda)	Understand	CO 3	AME020.08
8	Explain Twin Clutch Transmission	A semi-automatic transmission system with double dry clutch, consisting of two gearboxes in parallel that allow the next gear to engage while the previous one is still engaged.	Understand	CO 3	AME020.08
9	Explain Pressure Angle	The arc from the line of Action to the horizontal 90^{o} line dividing the two gears.	Remember	CO 3	AME020.09
10	Explain Addendum Circle	The addendum circle coincides with the tops of the teeth of a gear and is concentric with the standard (reference) pitch circle and radially distant from it by the amount of the addendum. For external gears, the addendum circle lies on the outside cylinder while on internal gears the addendum circle lies on the internal cylinder.	Understand	CO 3	AME020.08
11	Explain Hobbing	Hobbing is a machining process for making gears, splines, and sprockets using a cylindrical tool with helical cutting teeth known as a hob.	Remember	CO 3	AME020.08
12	Explain Anti-Roll Bar	Also called "anti-sway bar", is a torsion-bar which connects the front- or the rear-wheels with each other. The anti-roll bar is used to adjust the balance of the vehicle and limit the amount of	Remember	CO 3	AME020.09

S No	QUESTION	ANSWER	Blooms Level	CO	CLO Code
		sway or body roll especially when cornering.			
13	Explain Coil Spring:	Carry the weigth of the car and provides a cushion to absorb road imperfections and return the vehicle to a predetermined ride height. Have a major influence on the handling of the car, and looks as well. Progressive or higher spring rates and shorter overall lengths are often used to lower the vehicle's ride height for enhancing the appearance and improving the handling.	Understand	CO 3	AME020.09
14	Explain A-Arm, (Control Arm), (Wishbone)	A suspension linkage formed in the shape of an A or V found commonly on the front suspension. The sides of the two legs of the A-arm are connected to the chassis by rubber bushings and the peak of the A-arm is attached to the wheel assembly.	Understand	CO 3	AME020.09
15	What is Ackermann Steering Geometry	With perfect Ackermann, at any angle of steering, the center point of all of the circles traced by all wheels will lie at a common point.	Remember	CO 3	AME020.09
16	ExplainAlloy Wheel	A generic term used to describe any non-steel road wheel usually cast as one piece. The usual alloys are either aluminum or magnesium.	Understand	CO 3	AME020.09
17	What is Centripetal Force	In the case of an object moving in a circular path, the net force is a special force called the centripetal force Centripetal is Latin for "center seeking". So a centripetal force is a center seeking force which means that the force is always directed toward the center of the circle. Without this force, an object will simply continue moving in straight line motion	Remember	CO 3	AME020.09
18	ExplainDouble Wishbone Suspension Systems	It is an independent suspension design using two (occasionally parallel) wishbone-shaped arms to locate the wheel. Each wishbone or arm has two mounting points to the chassis and one joint at the knuckle. The shock absorber and coil spring mount to the wishbones to control vertical movement. The shown three examples are all variations on the same theme.	Remember	CO 3	AME020.08
19	Define Roll Center	The roll center of a vehicle is the notional point in the transverse vertical plane through any pair of wheel centers at which the cornering forces in the suspension are reacted to the sprung mass of vehicle body.	Remember	CO 3	AME020.08
20	ExplainUndersteer	The handling characteristic in which the front tires break loose because they are running a larger slip angle than the rear tires. Also known as plowing.	Remember	CO 3	AME020.09

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21	What is Upright	Uprightmounted vertically (upright) between the upper and lower control arm's outer rod ends. The upright is the foundation of all outboard systems: the spindle and calipers are mounted directly to it.	Understand	CO 3	AME020.09
UNIT -IV					
1	ExplainAntilock Braking System	Prevents the wheels of a car locking up and skidding under heavy braking so control and steering is maintained.	Remember	CO 4	AME020.10
2	Define Electronic Brake Distribution	Electronically controls and distributes appropriate brake pressure to all brakes dependant on load and braking force. Replaces traditional mechanical brake proportioning valve.	Understand	CO 4	AME020.10
3	What is Electric Power Steering	Uses an electric motor to provide directional control to the driver, without any hydraulic systems.	Understand	CO 4	AME020.10
4	ExplainLimited Slip Differential	A Limited Slip Differential allows two driving wheels to operate in unison when one breaks traction. It provides improved control and traction in slippery conditions.	Remember	CO 4	AME020.10
5	ExplainVehicle Dynamic Control	VDC (Vehicle Dynamic Control) is a system that intervenes in conditions approaching the limit, when vehicle stability is at risk, and assists the driver in controlling the car.	Understand	CO 4	AME020.10
6	What is Vehicle Identification Number	A unique 17 digit number, for each individual car, that can indentifiy date of manufacture, manufacturing plant and standards etc.	Remember	CO 4	AME020.11
7	Define Brake Torque	The output of a foundation brake. When divided by the tyre radius determines the braking force. Torque is a multiple of the clamp force, friction level and disc effective radius for a disc brake system.	Remember	CO 4	AME020.10
8	What is Clamp Force	The clamp force of a caliper is the brake line pressure multiplied by the total piston area on one side of the disc. when multiplied by the number of friction interfaces (usually 2), the pad friction level and the disc effective radius gives the brake torque.	Remember	CO 4	AME020.10
9	What is Disc Brake Pad	The component in a disc brake system that is fitted with friction material and clamped against the brake disc (rotor) to cause friction.	Remember	CO 4	AME020.11
10	ExplainDot	US Department of Transport. Defined some salient point for brake fluid. DOT3,4 and 5 fluid are widely used.	Understand	CO 4	AME020.11
11	ExplainDrum Brake	A type of brake in which a circular drum rotates around a set of brake shoes which are fixed to the hub and act on the drum by expanding radially.	Understand	CO 4	AME020.11

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12	Define DTV	Disc Thickness Variation, the variation in thickness between two points on the friction surface of a rotor. It is usually caused by poor alignment of the rotor/calliper or the rubbing of the friction material against the rotor when the brakes are off.	Remember	CO 4	AME020.11
13	What is Metal Matrix (MMC)	Term applied to a family of composite materials consisting of metallic cores infused with "whiskers" or "grains" of very stiff non-metallic elements resulting in a light and strong material. The most popular of the metal matrix composites is Aluminium ceramic metal matrix, the ceramic typically but not exclusively being composed of Silicon Carbide, Aluminium Oxides and Boron Carbides. Used for lightweight brake discs where the operation temperatures are well below 400deg C.	Understand	CO 4	AME020.11
14	ExplainCaster	Caster angle is the tilt of king pin centre line towards front of back from the vertical line. It is the angle between the vertical line and king pin centre line in the wheel plane when looked from side.	Understand	CO 4	AME020.12
15	ExplainCamber	Camber angle is the angle between the vertical line and centre line of the tyre when viewed from the front of the vehicle. Camber angle is positive when this is outward. This happens when wheels are further apart at top than at bottom.	Understand	CO 4	AME020.12
16	ExplainThrust Angle	The thrust angle is an imaginary line drawn perpendicular to the axle's centre line. It compares the direction that the rear axle is aimed with the center line of the vehicle. It also confirms if the rear axle is parallel to its front axle then the wheelbase on both sides of the vehicle is the same.	Understand	CO 4	AME020.12
17	What is Toe	A rear-wheel drive vehicle "pushes" the front axle's tyres as they roll along the road. Tyre rolling resistance causes a little drag resulting in rearward movement of the suspension arms against their bushings. Because of this, most rear-wheel drive vehicles use positive toe-in to compensate for the movement, enabling the tyres to run parallel to each other at speed.	Remember	CO 4	AME020.12
18	ExplainKing Pin Inclination	It is the angle between king pin centre line and vertical line when seen from the front of the vehicle. It is also called steering axle inclination. King pin inclination and caster are used to improve directional stability in cars.	Understand	CO 4	AME020.11
19	ExplainToe In & Toe Out	In automotive engineering, toe also known as tracking. This can be contrasted with steer, which is the anti-	Understand	CO 4	AME020.12

S No	QUESTION	ANSWER	Blooms Level	CO	CLO Code
		symmetric angle, i.e. both wheels point to the left or right, in parallel (roughly). Positive toe, or toe in, is the front of the wheel pointing in towards the centreline of the vehicle Negative toe, or toe out, is the front of the wheel pointing away from the centreline of the vehicle.			
20	What is Bump Steer	The amount of toe angle gain or loss that occurs during compression and extension. While driving over obstacles and during body roll the tires will "steer" without direct driver actuation.	Understand	CO 4	AME020.12
21	What is Body Roll	The tilt of the body relative to the suspension. This is encountered during turning where centripetal force will cause the chassis to lean to the outside of the turn, causing the outside suspension to compress and the inside to extend.	Remember	CO 4	AME020.12
UNIT -V					
1	Define Automobile Emission	Emissions produced by motor vehicles, especially internal combustion engines. Emissions of many air pollutants have been shown to have variety of negative effects on public health and the natural environment.	Understand	CO 5	AME020.13
2	What is Liquid Petroleum Gas	LPG is a popular alternative fuel to petrol or diesel. The cost per litre is less than petrol but it is less fuel efficient.	Remember	CO 5	AME020.13
3	Explain Zero Emission Vehicle	Vehicle that emmits zero exhaust emissions. Full electric vehicle.	Understand	CO 5	AME020.13
4	What is Catalytic Converter	An air pollution abatement device that removes pollutants from motor vehicle exhaust, either by oxidizing them into carbon dioxide and water or reducing them to nitrogen and oxygen.	Understand	CO 5	AME020.13
5	ExplainCarboxyhemoglobin	Haemoglobin in which the iron is associated with carbon monoxide (CO). The affinity of haemoglobin for CO is about 300 times greater than for oxygen	Understand	CO 5	AME020.13
6	What is Carbon Adsorber	An add-on control device which uses activated carbon to absorb volatile organic compounds from a gas stream. The VOCs are later recovered from the carbon.	Remember	CO 5	AME020.14
7	ExplainCubic Feet Per Minute (Cfm)	A measure of the volume of a substance flowing through air within a fixed period of time. With regard to indoor air, refers to the amount of air, in cubic feet, that is exchanged with indoor air in a minute's time, or an air exchange rate	Understand	CO 5	AME020.14
8	What is Dissolved Oxygen (Do)	The oxygen freely available in water. Dissolved oxygen is vital to fish and other aquatic life and for the prevention of odors. Traditionally, the level of dissolved oxygen has been accepted as the single most important indicator of a	Remember	CO 5	AME020.13

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		water body's ability to support desirable aquatic life. Secondary and advanced waste treatment are generally designed to protect DO in waste-receiving waters			
9	ExplainEcology	The relationship of living things to one another and their environment, or the study of such relationships.	Understand	CO 5	AME020.13
10	What is Gasification	Conversion of solid material such as coal into a gas for use as a fuel.	Understand	CO 5	AME020.14
11	ExplainMist	Liquid particles measuring 40 to 500 microns that are formed by condensation of vapour. By comparison, "fog" particles are smaller than 40 micro-ns	Understand	CO 5	AME020.14
12	What is Nuclear Power Plant	A facility that converts atomic energy into usable power; heat produced by a reactor makes steam to drive turbines which produce electricity	Understand	CO 5	AME020.14
13	ExplainNatural Gas	A natural fuel containing primarily methane and ethane thatoccurs in certain geologic formations	Remember	CO 5	AME020.14
14	ExplainOzone Depletion	Destruction of the stratospheric ozone layer which shields the earth from ultraviolet radiation harmful to biological life. This destruction of ozone is caused by the breakdown of certain chlorine- and/or bromine-containing compounds (chlorofluorocarbons or halons) which break down when they reach the stratosphere and catalytically destroy ozone molecules.	Understand	CO 5	AME020.14
15	ExplainPh	A measure of the acidity or alkalinity of a liquid or solid material	Understand	CO 5	AME020.14
16	What is Toxic Substance	A chemical or mixture that may present an unreasonable risk of injury to health or the environment.	Understand	CO 5	AME020.14
17	ExplainBlender Pump	A fuel dispenser that draws fuel from two separate storage tanks and can dispense reprogrammed blends of those two fuels.	Understand	CO 5	AME020.15
18	Define Cetane Number	Cetane number relates to the fuels susceptibility to self-ignite. The higher the cetane number, the greater the fuel's tendency to self-ignite.	Remember	CO 5	AME020.15
19	ExplainAmendments To The Clean Air Act Of 1970	creating two gasoline standards to reduce vehicle emissions in highly polluted cities by requiring gasoline to contain cleaner-burning additives, such as ethanol	Understand	CO 5	AME020.15
20	What is Electrolysis	Electrolysis is a method by which an electric current splits water into hydrogen and oxygen. If the electricity used is from renewable sources, such as solar or wind, the resulting hydrogen will be considered renewable as well.	Understand	CO 5	AME020.15

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21	ExplainOxygenated Fuels	Fuels blended with an additive—usually ether or ethanol—to increase oxygen content, allowing more-thorough combustion for reduced carbon monoxide emissions.	Understand	CO 5	AME020.15

Signature of the Faculty **Signature of HOD**