



# INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

Dundigal, Hyderabad - 500 043

## MECHANICAL ENGINEERING

### DEFINITIONS AND TERMINOLOGY QUESTION BANK

Course Name	:	<b>AEROSPACE PROPULSION AND COMBUSTION</b>
Course Code	:	<b>AAE551</b>
Program	:	<b>B. Tech</b>
Semester	:	<b>VI</b>
Branch	:	<b>Mechanical Engineering</b>
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Course Faculty	:	<b>Mr. Vijay Kumar M, Asst. Professor, Aero</b>

#### OBJECTIVES:

I	To help students to consider in depth the terminology and nomenclature used in the syllabus.
II	To focus on the meaning of new words / terminology/nomenclature

### DEFINITIONS AND TERMINOLOGY QUESTION BANK

S. NO	QUESTION	ANSWER	Blooms Level	CLO	CO	CLO Code
<b>UNIT-I</b>						
1	What is power?	The ability or capacity to do something or act in a particular way.	Understand	CLO 1	CO 1	AAE551.01
2	What is an engine?	A machine with moving parts that converts power into motion	Remember	CLO 1	CO 1	AAE551.01
3	Explain the term “propulsion”.	propulsion means to push forward or drive an object forward. The term is derived from two Latin words: pro, meaning before or forward; and propel, meaning to drive. A propulsion system consists of a source of mechanical power, and a propeller (means of converting this power into propulsive force).	Remember	CLO 1	CO 1	AAE551.01
4	What is thrust?	Thrust is a reaction force described quantitatively by Newton's third law. When a system expels or accelerates mass in one direction, the accelerated mass will cause a force of equal magnitude but opposite direction on that system.	Remember	CLO 1	CO 1	AAE551.01
5	Define fuel.	A fuel is any material that can be made to react with other substances so that it releases energy as heat energy or to be used for work. The concept was originally applied solely to those materials capable of releasing chemical energy but has since also been applied to other sources of heat energy	Remember	CLO 1	CO 1	AAE551.01
6	Define the term “turbine” and	A turbine is a rotary mechanical device that extracts energy from a fluid flow and converts it into useful work. The work produced by a turbine	Understand	CLO 1	CO 1	AAE551.01

S. NO	QUESTION	ANSWER	Blooms Level	CLO	CO	CLO Code
	its importance in propulsion systems.	can be used for generating electrical power when combined with a generator. A turbine is a turbo machine with at least one moving part called a rotor assembly, which is a shaft or drum with blades attached. Moving fluid acts on the blades so that they move and impart rotational energy to the rotor.				
7	What is performance of a component?	It is the action or process of performing a task or function Examples: Gas turbine: A turbine driven by expanding hot gases produced by burning fuel, as in a jet engine.	Understand	CLO 1	CO 1	AAE551.01
8	Define power plant.	A power station also referred to as a power plant or powerhouse and sometimes generating station or generating plant, is an industrial facility for the generation of power.	Remember	CLO 1	CO 1	AAE551.01
9	Explain the term "SFC".	Specific fuel consumption is the amount of fuel consumed by a vehicle for each unit of power output and is the rate of fuel burnt to produce a unit of thrust	Remember	CLO 2	CO 1	AAE551.02
10	What is cycle?	A series of events that are regularly repeated in the same order. Examples: Otto cycle, Diesel cycle and Bratyton cycle	Understand	CLO 2	CO 1	AAE551.02
11	Explain the term "heat" and its importance.	Heat is the transfer of kinetic energy from one medium or object to another or from an energy source to a medium or object. Such energy transfer can occur in three ways: radiation, conduction, and convection.	Understand	CLO 2	CO 1	AAE551.02
12	What is the meaning of energy.	In physics, energy is the quantitative property that must be transferred to an object in order to perform work on, or to heat, the object. Energy is a conserved quantity; the law of conservation of energy states that energy can be converted in form, but not created or destroyed. The SI unit of energy is the joule	Remember	CLO 3	CO 1	AAE551.03
13	What is system and explain its significance.	A set of things working together as parts of a mechanism or an interconnecting network; a complex whole.	Remember	CLO 3	CO 1	AAE551.03
14	Define the term "enthalpy".	a thermodynamic quantity equivalent to the total heat content of a system. It is equal to the internal energy of the system plus the product of pressure and volume.	Understand	CLO 3	CO 1	AAE551.03
15	Define internal energy of the system.	Internal energy is defined as the energy associated with the random, disordered motion of molecules. It is separated in scale from the macroscopic ordered energy associated with moving objects; it refers to the invisible microscopic energy on the atomic and molecular scale.	Understand	CLO 4	CO 1	AAE551.04
16	Explain the terms of pressure, temperature in a system.	It is a continuous physical force exerted on or against an object by something in contact with it and the temperature is degree or intensity of heat present in a substance or object, especially as expressed according to a comparative scale and shown by a thermometer or perceived by touch.	Understand	CLO 4	CO 1	AAE551.04

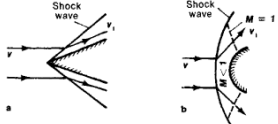
S. NO	QUESTION	ANSWER	Blooms Level	CLO	CO	CLO Code
17	What is gain or loss of work?	Both are regarded as energy transfer within the system and used for obtaining work by utilizing pressure and temperature of a gas.	Understand	CLO 5	CO 2	AAE551.05
18	Define thrust augmentation .	It is a process by which the thrust produced by a jet-propulsion engine may be increased temporarily over its normal value by some secondary means (as the burning of additional fuel in the tail pipe, or the injection of water into the engine inlet and the combustion chambers) which increases the mass flow, the velocity, or both	Remember	CLO 5	CO 2	AAE551.05
19	Define universal gas constant.	The gas constant, also known as the universal molar gas constant, is a physical constant that appears in an equation defining the behavior of a gas under theoretically ideal conditions $PV = nRT$	Remember	CLO 5	CO 2	AAE551.05
20	What is meant by control volume .	In continuum mechanics and thermodynamics, a control volume is a mathematical abstraction employed in the process of creating mathematical models of physical processes	Remember	CLO 5	CO 2	AAE551.05

### UNIT - II

1	What is air intake?	Air intake is like amazing medicine that allows your engine to finally breath. Cold air intakes move the air filter outside of the engine compartment so that cooler air can be sucked into the engine for combustion. Cooler air brings more oxygen (denser air) into the combustion chamber and that means more power	Remember	CLO 5	CO 2	AAE551.05
2	What is compressor?	A compressor is a mechanical device that increases the pressure of a gas by reducing its volume. An air compressor is a specific type of gas compressor. As gases are compressible, the compressor also reduces the volume of a gas	Understand	CLO 5	CO 2	AAE551.05
3	What is diffusion process?	Diffusion is a physical process that refers to the net movement of molecules from a region of high concentration to one of lower concentration. The material that diffuses could be a solid, liquid or gas. Similarly, the medium in which diffusion occurs could also be in one of the three physical states	Understand	CLO 5	CO 2	AAE551.05
4	Differentiate centrifugal and axial flow.	The main difference is in how they operate vs how they are maintained. Flow through a centrifugal compressor is turned perpendicular to the axis of rotation, while air in an axial compressor flows parallel to the axis of rotation	Remember	CLO 6	CO 2	AAE551.06
5	Define spool	A cylindrical device on which film, magnetic tape, thread, or other flexible materials can be wound.	Remember	CLO 6	CO 2	AAE551.06
6	Define stall.	A compressor stall is a local disruption of the airflow in the compressor of a gas turbine or turbocharger. A stall that results in the complete disruption of the airflow through the compressor is referred to as a compressor surge.	Remember	CLO 6	CO 2	AAE551.06
7	Explain the term surge.	Surge is defined as the operating point at which centrifugal compressor peak head capability and minimum flow limits are reached. Actually, the working principle of a centrifugal compressor is increasing the kinetic energy of the fluid with a rotating impeller	Understand	CLO 6	CO 2	AAE551.06

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8	Define ramjet.	A ramjet, sometimes referred to as a flying stovepipe or an athodyd (aero thermodynamic duct), is a form of air breathing jet engine that uses the engine's forward motion to compress incoming air without an axial compressor or a centrifugal compressor.	Understand	CLO 6	CO 2	AAE551.06
9	What is the term called "scramjet".	A scramjet (supersonic combustion ramjet) is a variant of a ramjet air breathing jet engine in which combustion takes place in supersonic airflow that allows the scramjet to operate efficiently at extremely high speeds	Remember	CLO 6	CO 2	AAE551.06
10	What is combustion process?	Combustion is a chemical process or a reaction between Fuel (Hydrocarbon) and Oxygen	Remember	CLO 7	CO 2	AAE551.07
11	Define turbine.	a machine for producing continuous power in which a wheel or rotor, typically fitted with vanes, is made to revolve by a fast-moving flow of water, steam, gas, air, or other fluid	Remember	CLO 7	CO 2	AAE551.07
12	What is impulse turbine?	An impulse turbine is a turbine that is driven by high velocity jets of water or steam from a nozzle directed on to vanes or buckets attached to a wheel	Understand	CLO 7	CO 2	AAE551.07
13	Define reaction turbine?	A reaction turbine is a type of turbine that develops torque by reacting to the pressure or weight of a fluid. The operation of reaction turbines is described by Newton's third law of motion	Understand	CLO 7	CO 2	AAE551.07
14	Define galling in a turbine.	Galling is a form of wear caused by adhesion between sliding surfaces.	Remember	CLO 7	CO 2	AAE551.07
15	What is the term called "pitting".	Pitting corrosion, or pitting, is a form of extremely localized corrosion that leads to the creation of small holes in the metal.	Remember	CLO 7	CO 2	AAE551.07
16	Explain the term after burner.	An afterburner (or a reheat) is a component present on some jet engines, mostly those used on military supersonic aircraft. Its purpose is to provide an increase in thrust, usually for supersonic flight, takeoff, and combat situations. $F=(M_e*V_e-M_a*V_a) +(P_e-P_a)*A_e$	Remember	CLO 7	CO 2	AAE551.07
17	Define air bleed off of an engine.	Bleed air produced by gas turbine engines is compressed air that is taken from the compressor stage of those engines, which is upstream of the fuel-burning sections	Understand	CLO 8	CO 2	AAE551.08
18	What is meant by thrust augmentation .	a process by which the thrust produced by a jet-propulsion engine may be increased temporarily over its normal value by some secondary means	Understand	CLO 8	CO 2	AAE551.08
19	Define turbine fuel.	Jet fuel, aviation turbine fuel (ATF) is a type of aviation fuel designed for use in aircraft powered by gas-turbine engines	Understand	CLO 8	CO 2	AAE551.08
20	Define mach number.	In fluid dynamics, the Mach number is a dimensionless quantity representing the ratio of flow velocity past a boundary to the local speed of sound $M = V/a$ . If $M < 0.8$ , then the flow is Subsonic. If $0.8 < M < 1$ , then the flow is Transonic. If $M = 1$ , then the flow is Sonic. If $M > 1$ , then the flow is Supersonic. If $M > 5$ , then the flow is Hypersonic	Understand	CLO 8	CO 2	AAE551.08



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<b>UNIT - III</b>						
1	Define a propeller and explain its significance.	A propeller is a type of fan that transmits power by converting rotational motion into thrust. A pressure difference is produced between the forward and rear surfaces of the airfoil-shaped blade, and a fluid (such as air or water) is accelerated behind the blade. Propeller dynamics, like those of aircraft wings, can be modelled by Bernoulli's principle and Newton's third law.	Understand	CLO 8	CO 3	AAE551.08
2	What is inlet?	An air inlet or air intake is a system commonly used on the original air cleaner assemblies of carbureted engines to increase the temperature of the air going into the engine for the purpose of increasing the consistency of mixing of the air and fuel in order to reduce engine emissions and fuel usage	Remember	CLO 8	CO 3	AAE551.08
3	Define nozzle and its importance .	A nozzle is a device designed to control the direction or characteristics of a fluid flow (especially to increase velocity) as it exits (or enters) an enclosed chamber or pipe. A nozzle is often a pipe or tube of varying cross sectional area and it can be used to direct or modify the flow of a fluid (liquid or gas).	Remember	CLO 9	CO 3	AAE551.09
4	What is acceleration.	In physics, acceleration is the rate of change of velocity of an object with respect to time. An object's acceleration is the net result of all forces acting on the object, as described by Newton's Second Law	Understand	CLO 9	CO 3	AAE551.09
5	Define noise of a propeller.	a sound, especially one that is loud or unpleasant or that causes disturbance when propeller is rotating	Remember	CLO 9	CO 3	AAE551.09
6	Define throat of the nozzle.	It is middle part of the nozzle which connects inlet and outlet	Remember	CLO 9	CO 3	AAE551.09
7	Define convergent nozzle.	The convergent nozzle is a spout that begins large and gets smaller, abatement in cross-sectional region. As a liquid enters the smaller cross-area, it needs to accelerate because of the production of mass.	Understand	CLO 9	CO 3	AAE551.09
8	What is a divergent nozzle?	The divergent nozzle is a spout that begins small and gets larger, abatement in cross-sectional region. As a liquid enters the larger cross-area, it needs to decelerate because of the production of mass.	Remember	CLO 9	CO 3	AAE551.09
9	What is subsonic flow?	Subsonic Flow: When the fluid velocity is lower than the acoustic speed ( $M < 1$ ) then the fluid flow is called as subsonic. However Mach number of the flow changes while passing over an object or through a duct. Hence for simplicity, flow is considered as subsonic if Mach number is in the range of 0-0.8	Remember	CLO 10	CO 3	AAE551.10
10	Define shock.	The thin region between the shock and the body is called the Shock Layer 	Understand	CLO 10	CO 3	AAE551.10

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11	What is aerodynamics and its significance.	It is a branch of dynamics that deals with the motion of air and other gaseous fluids and with the forces acting on bodies in motion relative to such fluids	Remember	CLO 10	CO 3	AAE551.10
12	What is meant by under expanded nozzle?	An under expansion in a nozzle is where the gas is expelled at a greater pressure than the atmosphere around it, this causes the plume to expand outwards reducing the efficiency of the thrust	Remember	CLO 10	CO 3	AAE551.10
13	Define isentropic flow.	In fluid dynamics, an isentropic flow is a fluid flow that is both adiabatic and reversible. That is, no heat is added to the flow, and no energy transformations occur due to friction or dissipative effects	Understand	CLO 10	CO 3	AAE551.10
14	What is entropy layer.	Shock curvature implies that shock strength is different for different streamlines – stagnation pressure and velocity gradients - rotational flow	Remember	CLO 10	CO 3	AAE551.10
15	What is supersonic flow?	Supersonic flow. Fluid motion in which the Mach number M, defined as the speed of the fluid relative to the sonic speed in the same medium, is more than unity. It is, however, common to call the flow transonic when $0.8 < M < 1.4$ , and hypersonic when $M > 5$ .	Remember	CLO 10	CO 3	AAE551.10
16	What is area-velocity relation of a nozzle?	Relation between pressure, velocity and area. In a nozzle, the exit velocity increases as per continuity equation $\rho_1 A_1 V_1 = \rho_2 A_2 V_2$ , $A v = \text{const.}$ Pressure is inversely proportional to velocity, so we have lower pressure at the exit of the nozzle.	Understand	CLO 10	CO 3	AAE551.10
17	Explain the concept of thrust reversal of a nozzle.	Thrust reversal, also called reverse thrust, is the temporary diversion of an aircraft engine's thrust so that it is directed forward, rather than backward. Reverse thrust acts against the forward travel of the aircraft, providing deceleration	Remember	CLO 10	CO 3	AAE551.10
18	Define viscous layer.	Thick boundary merges with shock wave to produce a merged shock-viscous layer.	Remember	CLO 11	CO 3	AAE551.11
19	What is meant by over expanded nozzle.	An over expanded nozzle is where the gas is expelled at a lesser pressure than the atmosphere around it, thus as it leaves the nozzle the gas gets pushed in by the atmosphere reducing the efficiency of the thrust.	Understand	CLO 11	CO 3	AAE551.11
20	What is hypersonic flow?	If the mach number achieves $M > 5$ , then the flow is called to be a hypersonic flow	Understand	CLO 11	CO 3	AAE551.11
<b>UNIT - IV</b>						
1	Define combustion	It is a rapid chemical combination of a substance with oxygen, involving the production of heat.	Remember	CLO 11	CO 3	AAE551.11
2	What is flame?	It is a hot glowing body of ignited gas that is generated by something on fire.	Understand	CLO 11	CO 3	AAE551.11
3	What is meant by emission of gases.	An emission of something such as gas or radiation is the release of it into the atmosphere	Remember	CLO 11	CO 3	AAE551.11
4	What is choked flow?	Choked flow is a fluid dynamic condition associated with the venturi effect. When a flowing fluid at a given pressure and temperature passes	Understand	CLO 12	CO 3	AAE551.12

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		through a constriction into a lower pressure environment the fluid velocity increases.				
5	Define caloric value of the fuel.	The energy contained in a fuel or food, determined by measuring the heat produced by the complete combustion of a specified quantity of it. This is now usually expressed in joules per kilogram	Remember	CLO 12	CO 3	AAE551.12
6	Define Fuel injectors.	Fuel injectors are nozzles that inject a spray of fuel into the intake air. They are normally controlled electronically, but mechanically controlled injectors which are cam actuated also exist. A metered amount of fuel is trapped in the nozzle end of the injector, and a high pressure is applied to it, usually by a mechanical compression process of some kind.	Understand	CLO 12	CO 3	AAE551.12
7	Define turbulent flow.	Due to the high velocities involved, all flows into, out of, and within engine cylinders are turbulent flows. The exception to this is those flows in the corners and small crevices of the combustion chamber where the close proximity of the walls dampens out turbulence.	Remember	CLO 12	CO 3	AAE551.12
8	Define fuel sensitivity.	Operating conditions used to measure MON are more severe than those used to measure RON. Some fuels, therefore, will have a RON greater than MON. The difference between these is called fuel sensitivity: FS = RON – MON	Understand	CLO 12	CO 3	AAE551.12
9	Define knocking.	Knock is the auto ignition of the portion of fuel, air and residual gas mixture ahead of the advancing flame that produces a noise.	Remember	CLO 12	CO 3	AAE551.12
10	Define Fuel pump.	Electrically or mechanically driven pump to supply fuel from the fuel tank (reservoir) to the engine. Many modern automobiles have an electric fuel pump mounted submerged in the fuel tank. Some small engines and early automobiles had no fuel pump, relying on gravity feed.	Understand	CLO 13	CO 4	AAE551.13
11	Define delay period.	There is a delay of approx. constant duration until a noticeable increase in the cylinder pressure as a result of chemical reactions is recorded in pressure ~ alpha diagram called the delay period	Remember	CLO 13	CO 4	AAE551.13
12	Define combustion efficiency.	A combustion efficiency is defined to account for the fraction of fuel which burns. It is typically has values in the range 0.95 to 0.98 when an engine is operating properly. For one engine cycle in one cylinder, the heat added is $Q_{in} = m_f Q_{HV} \eta_c$	Understand	CLO 13	CO 4	AAE551.13
13	Define whirl velocity.	The whirl velocity is the tangential component of absolute velocity at the blade inlet and outlet. This component of velocity is responsible for the whirling or rotating of the turbine rotor	Remember	CLO 13	CO 4	AAE551.13
14	What is Reynolds number and its significance.	A dimensionless number used in fluid mechanics to indicate whether fluid flow past a body or in a duct is steady or turbulent. $Re_D = \frac{\rho V D}{\mu} = \frac{V D}{\nu}$	Understand	CLO 13	CO 4	AAE551.13
15	Define flame stabilization.	Flame stability is achieved by attaching the flame to a simple device known as a burner. Flame stabilization is usually accomplished by causing	Remember	CLO 13	CO 4	AAE551.13

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		some of the combustion products to re circulate and hence to continually ignite the fuel mixture.				
16	Define air fuel ratio.	Air–fuel ratio (AFR) is the mass ratio of air to fuel present in a combustion process such as in an engine or industrial furnace. The AFR is an important measure for anti-pollution and performance-tuning reasons.	Understand	CLO 14	CO 4	AAE551.14
17	Explain the term Stichiometric	Stichiometric or Theoretical Combustion is the ideal combustion process where fuel is burned completely in equal ratios.	Remember	CLO 14	CO 4	AAE551.14
18	What is flame tube cooling.	A system is provided for cooling especially the back plate of a flame tube of a combustion chamber for gas turbine engines, of the type having at least one burner arranged on the back plate and having a fuel nozzle and at least one swirler arranged coaxially with the fuel nozzle for the supply of combustion air	Remember	CLO 14	CO 4	AAE551.14
19	What is vaporizing method.	In the vaporizing method the fuel is sprayed from feed tubes into vaporizing tubes which are positioned inside the flame tube. These tubes turn the fuel through 180 degrees and, as they are heated by combustion, the fuel vaporizes before passing into the flame tube.	Remember	CLO 14	CO 4	AAE551.14
20	Define annular combustion chamber.	Annular means pertaining to an annulus or ring or Ring shaped. An annular combustion chamber is in the shape of a ring or a cylinder and the whole of the annulus between the compressor and the turbine is used for combustion	Remember	CLO 15	CO 4	AAE551.15
<b>UNIT - V</b>						
1	What is laminar flow?	Laminar flow is a smooth, orderly movement of a fluid, in which there is no turbulence, and any given sub current moves more or less in parallel with any other nearby sub current. Laminar flow is common in viscous fluids, especially those moving at low velocities.	Remember	CLO 15	CO 4	AAE551.15
2	Define flame propagation.	Flame propagation refers to the propagation of the reaction zone or combustion wave through a combustible mixture	Understand	CLO 15	CO 4	AAE551.15
3	What is lower flammability limit?	The lower flammability limit (also called the weak or lean limit) is the minimum percentage of fuel in the fuel/air mixture that can be flammable, or the minimum $\Phi$	Understand	CLO 15	CO 4	AAE551.15
4	Define Quenching.	Quenching in terms of combustion refers to extinguishing a flame. Flame quenching or extinction occurs at the walls of engine combustion chambers	Understand	CLO 15	CO 4	AAE551.15
5	What is Flammability ?	Flammability is the ability of a substance to burn or ignite, causing fire or combustion. The degree of difficulty required to cause the combustion of a substance is quantified through fire testing.	Understand	CLO 15	CO 4	AAE551.16
6	What is fire point?	The fire point of a fuel is the lowest temperature for ignition and sustained burning.	Understand	CLO 16	CO 4	AAE551.16
7	Define detonation of a flame.	a condition or appearance suggesting a flame such as (1): burning zeal or passion (2): a strong reddish-orange color	Understand	CLO 16	CO 4	AAE551.16



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8	What is the term called DNS.	A direct numerical simulation (DNS) is a simulation in computational fluid dynamics in which the Navier–Stokes equations are numerically solved without any turbulence model. This means that the whole range of spatial and temporal scales of the turbulence must be resolved.	Remember	CLO 16	CO 4	AAE551.16
9	Define diffusion flame.	In combustion, a diffusion flame is a flame in which the oxidizer combines with the fuel by diffusion. As a result, the flame speed is limited by the rate of diffusion. Diffusion flames tend to burn slower and to produce more soot than premixed flames because there may not be sufficient oxidizer for the reaction to go to completion,	Remember	CLO 17	CO 5	AAE551.17
10	What is pre mixed flame?	A premixed flame is a flame formed under certain conditions during the combustion of a premixed charge (also called pre-mixture) of fuel and oxidizer	Remember	CLO 17	CO 5	AAE551.17
11	Define ignition.	The mechanism for bringing about ignition in an internal combustion engine, typically activated by a key or switch.	Understand	CLO 18	CO 5	AAE551.18
12	Define upper flammability limit.	The upper flammability limit (also called the rich limit) is the maximum percentage of fuel in a fuel/air mixture that can be flammable, or the maximum $\Phi$ .	Remember	CLO 18	CO 5	AAE551.18
13	What is flash point?	The flash point of a fuel is the lowest temperature for ignition but not sustained burning.	Understand	CLO 19	CO 5	AAE551.19
14	What is LES and explain its application.	Large eddy simulation (LES) is a mathematical model for turbulence used in computational fluid dynamics. LES is currently applied in a wide variety of engineering applications, including combustion, acoustics, and simulations of the atmospheric boundary layer.	Remember	CLO 20	CO 5	AAE551.20
15	Define quenching thickness.	The quenching thickness or quenching distance is another measurable property of a fuel. The quenching distance is the smallest diameter or minimal channel width in which a flame can propagate.	Remember	CLO 20	CO 5	AAE551.20

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