

**SNS COLLEGE OF TECHNOLOGY**  
**DEPARTMENT OF AGRICULTURE ENGINEERING**

**19AGT301 HEAT POWER ENGINEERING**

Two Mark Questions

**COMBUSTION**

**1) What is flame front?**

**Ans.:-**The flame front is a narrow zone separating the fresh mixture from the combustion products. The velocity with which the flame front moves, with respect to the unburned mixture in a direction normal to its surface is called the normal flame velocity.

**2) What is equivalence ratio?**

**Ans.:-**Equivalence ratio is the ratio of the actual fuel-air ratio to the stoichiometric fuel-air ratio

**3) What are the terms homogeneous gas mixture and heterogeneous gas mixture ?**

**Ans.:-**In a homogeneous gas mixture the fuel and oxygen molecules are more or less, uniformly distributed. In a heterogeneous gas mixture, the fuel and oxygen molecules are not distributed uniformly

**4) What are the Knock Limited Parameters?**

**Ans.:-Knock Limited Compression Ratio:** The knock limited compression ratio is obtained by increasing the compression ratio of a variable compression ratio engine until incipient knocking is observed.

**Knock Limited Inlet Pressure:** The inlet pressure can be increased by opening the throttle or increasing supercharger deliver pressure until the incipient knock is observed.

**Knock Limited Indicated Mean Effective Pressure:** The indicated mean effective pressure measured at incipient knock is usually abbreviated as Klimep. This parameter and the corresponding fuel consumption are obviously of great practical interest.

$$\text{Performance number (PN)} = \frac{\text{KLIMEP of test fuel}}{\text{KLIMEP of iso-octane}}$$

**Highest Useful Compression Ratio (HUCR)**

The highest useful compression ratio is the highest compression ratio employed at which a fuel can be used in a specified engine under specified set of operating conditions, at which detonation first becomes audible with both the ignition and mixture strength adjusted to give the highest efficiency.

Relative performance number, rpn, which is defined as:

$$rpn = \frac{\text{Actual Performance number}}{\text{Performance number corresponding to the imep of 100}}$$

**5) What is the self ignition temperature?**

**Ans.:-**The self ignition temperature (S.I.T.) is the temperature at which the fuel ignites and continues to burn without the need of a flame to initiate the burning.

**6) What is ignition lag in SI Engine?**

**Ans.:-**The time lag between first igniting of fuel and the commencement of the main phase of combustion is called the period of incubation or is also known as ignition lag.

**7) What are the terms Ignition delay period, Physical delay and Chemical delay in CI engine?**

**Ans.:-Ignition delay period** in CI engine is counted from the start of injection to the point where the pressure-crank angle curve separates from the motoring curve indicated as start of combustion.

**Physical delay:** The Physical delay is the time between the beginning of injection and the attainment of chemical reaction conditions

**Chemical delay :** During the Chemical delay, reactions start slowly and then accelerate until inflammation or ignition takes place.

**8)What is combustion process ?**

**Ans.:-**According to Ricardo, the **combustion process** can be imagined as if developing in two stages, one the growth and development of a self-propagating nucleus of flame (ignition lag), and the other the spread of that flame throughout the combustion chamber.

**9)What is detonation.**

**Ans.:-**A very sudden rise of pressure during combustion accompanied by metallic hammer like sound is called detonation.

**10)What is the significance of delay period in CI engine?**

**Ans.:-**The delay period exerts a great influence in the C.I. engine combustion phenomenon. It is clear that the pressure reached during the second stage will depend upon the duration of the delay period .

The longer the delay, the more rapid and higher the pressure rise. This causes rough running and may cause diesel knock. Therefore we must aim to keep the delay period as short as possible, both for the sake of smooth running and in order to maintain control over the pressure changes. But some delay period is necessary otherwise the droplets would not be dispersed in the air for complete combustion.

**11) What are the theories of detonation?**

**Ans.:-**There are two general theories of knocking/detonation

(i) The auto-ignition theory

(ii) The detonation theory.

(i) Auto-ignition theory. Auto-ignition refers to initiation of combustion without the necessity of a flame. The auto-ignition theory of knock assumes that the flame velocity is normal before the onset-of auto-ignition and that gas vibrations are created by a number of end-gas elements auto-igniting almost simultaneously.

(ii) Detonation theory. In the auto-ignition theory, it is assumed that the flame velocity is normal before the onset of auto-ignition whereas in detonation theory a true detonating wave formed by pre-flame reactions has been proposed as the Mechanism for explosive auto-ignition. Such a shock wave would travel through the chamber at about twice the sonic velocity and would compress the gases to pressures and temperatures where the reaction should be practically instantaneous.

**12)What are the Effects of detonation**

**Ans.:-**1. Noise and roughness 2. Mechanical damage 3. Carbon deposits.

4. Increase in heat transfer 5. Decrease in power output and efficiency 6. Pre-ignition.

**13) What are the methods to Control of detonation in SI engine? -**

**Ans.:-**The detonation can be controlled or even stopped by the following methods

1. Increasing engine r.p.m. 2. Retarding spark. 3, Reducing pressure in the inlet manifold by throttling.

4. Making the ratio too lean or too rich, preferably latter.

5. Water injection. Water injection increases the delay period as well as reduces the flame temperature.

6. Use of high octane fuel can eliminate detonation. High octane fuels are obtained by adding additives known as dopes (such as tetra-ethyl of lead, benzol, xylene etc.), to petrol.

**14)What is pre-ignition.**

**Ans.:-**The premature combustion which starts before application of spark in Si engine is called pre-ignition.

**15)What are the terms octane number and Cetane number of fuel?**

**Ans.:-**The fuel under test is compared with a mixture of iso-octane (high rating) and normal heptane (low rating), by volume. The octane number of the fuel is the percentage of octane in the reference mixture which knocks under the same conditions as the fuel.

**CETANE NUMBER**

The procedure for obtaining Cetane number is similar to that for obtaining the octane number of petrol. Reference mixtures of Cetane (C<sub>16</sub>H<sub>34</sub>) (high ignitability), and a-methylnaphthalene (C<sub>11</sub>H<sub>10</sub>) (low ignitability), are used. The mixture is made by volume and the ignitability of the test fuel is quoted as the percentage of Cetane in the reference mixture which has the same ignitability.

**16)What is the significance of Turbulence?**

**Ans.:-**Significance of Turbulence

Turbulence plays a very important role in combustion phenomenon in S.I. (as well CI.) engines. The flame speed is very low in non-turbulent mixtures. A turbulent motion of the mixture intensifies the processes of heat transfer and mixing of the burned and unburned portions in the flame front (diffusion). These two factors cause the velocity of turbulent flame to increase practically in proportion to the turbulent velocity. The turbulence of the mixture is due to admission of fuel-air mixture through comparatively narrow sections of the intake pipe, valves etc., in the suction stroke.

**17)What are the terms Swirl, Squish and Tumble?**

**Ans.:-** The main macro mass motion within the cylinder is rotational motion and is called **swirl**. It is generated by constructing the intake system to give a tangential component to the intake flow as it enters the cylinder. This is done by shaping and contouring the intake manifold, valve ports and even the piston face. This radial inward motion of the gas mixture is called "**squish**" It adds to other mass motions within the cylinder to mix the air and fuel and to quickly spread the flame front

As the piston nears T.D.C. squish motion generates a secondary rotational flow called **“tumble”**. This rotation occurs about a circumferential axis near the outer edge of the piston bowl.

**18) What are the different phases of combustion in SI and CI engines?**

**Ans.:-**

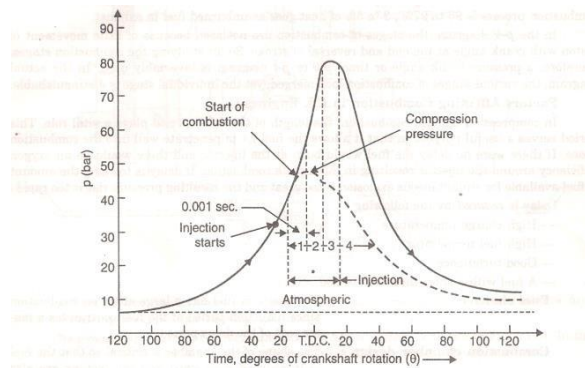
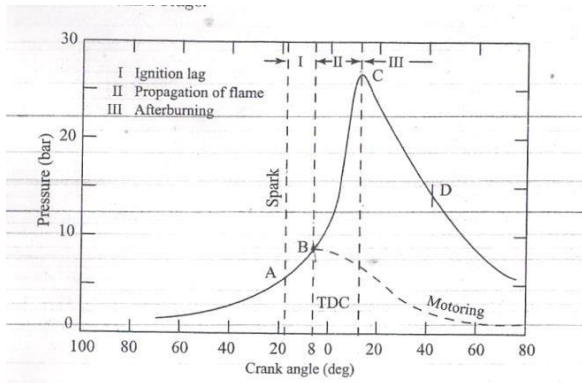


Fig. 23.63. Combustion phenomenon of C.I. engine.

Three phases of combustion in **SI engine**

1. Ignition lag
2. Propagation of flame
3. After burning

Four phases of combustion in **CI engine**

1. Ignition delay period.
2. Period of rapid or uncontrolled combustion.
3. Period of controlled combustion.
4. After burning

**1) What is the function of a compressor?**