OCTANE NUMBER: Higher the ON, more compression the fuel can withstand before igniting. Why fuel comprsn is imp?

Diesel Engines — (CI) — Compress air and inject fuel. [12 to 24 is CR]

Gasoline Engines — (SI) — Compress air-fuel mixture, and then ignite. [8 to 12 is CR]

Knocking ≡ Pre-ignition of air-fuel mixture (much higher P than engine system components are designed for — "knocking" or "Pinging" Sound).

Iso-octane — Ref. Std. to benchmark tendency of gasoline/LPG to resist ignition

Defn: Octane Rating is measured in a test engine and is defined by comparison with a mixture of 2,2,4-TMP (iso-octane) and n-heptane that would have the same anti-knocking capacity as fuel under test — % by vol. of iso-octane in that mixture is the Oct. No. of the fuel.

Can Oct. No. be > 100? Yes. (Typically, RON). Racing fuels, LPG, alcohols like MeOH, etc. have RON > 110 or higher.

Oct. No additives: MTBE, ETBE, TELead.

RON: Oct. No. from tests in a standard engine (variable comprsn ratio)

MON: measured @ 900 rpm (instead of 600 rpm for RON) in same test engine, but with preheated air fuel mixture and variable ignition timing to further stress the fuel's knock resistance. MON < RON (by 8 to 12).

Anti-Knock Index ≡ AKI = (R+M)/2

n-heptane: 0 → Alkanes / Branched Alkanes / Olefins / Aromatics / Oxygenates → Iso-octane (100) by Defn.

CETANE NUMBER: Indicator of combustion speed of diesel. Higher the cetane no, more easily the fuel will combust in a CI engine ≡ will have shorter ignition delay periods. Diesel engines operate well with CN of 40 to 55.

* Premium diesel often use additives to improve CN and lubricity, detergents to clean fuel injectors and minimize carbon deposits, water dispersants and other additives — they may not have a higher CN.
* Eg. of additives to ↑ CN ≡ Alkyl nitrates (2-ethyl hexyl nitrate) and di-tertbutyl peroxide.

Cetane (n-hexadecane: $C_{16}H_{34}$) — CN of 100
Alpha-methyl naphthalene — CN of 0
} by Defn.

For Tests, Cetane and iso-cetane mixture is used (2,2,4,4,6,8,8-heptamethyl nonane).

CLOUD POINT: Temperature below which wax in diesel or biowax in biodiesels for a cloudy appearance. Presence of solidified waxes thickens the oil and clogs the fuel filters and injectors in engines. The wax also accumulates on cold surfaces (e.g., pipeline) and forms an emulsion with water. Thus, cloud point indicates the tendency of oil to plug filters or small orifices at cold operating temperatures.

COLD FILTER PLUGGING POINT: Lowest T(°C) at which given vol. of diesel type fuel passes thru std. filtration device in a specified time when cooled under certain conditions. [Cloud Point of +1°C ≡ CFPP of -10°C
Clo— — of -7°C ≡ CFPP of -20°C with additives].

Winter Diesel / Summer Diesel ; Winter Gasoline / Summer Gasoline.

POUR POINT: Temperature at which it becomes semi-solid and loses its flow characteristics. Typically measured for crude oils.
Cool and check flow after regular ΔT(1°C or 3°C); Final stage - hold horizontal for 5 secs.

FLASH POINT: Lowest temperature at which a liquid can form an ignitable mixture in air near the surface of the liquid. Lower the flash point, easier is ignition (Eg. gasoline = -40°C ; Ethylene Glycol = 111°C). (Diesel > 52°C)

FIRE POINT: Temperature @ which flame becomes self-sustained so as to contin burning the liquid (at flash point, flame doesn't need to be sustained). Fire point is usually few °C > flash point.

Flammable liquids ≡ Have a flash point < 37.8°C or 60.5°C based on Std. used
Combustible liquids ≡ Flash point > 37.8°C.
Open cup and Closed cup methods to measure Flash point ⇒ Give diff. results.

Gasoline — Low flash point and High Autoignition Temperature (250 to 280°C)
Diesel — High flash point and Low Autoignition Temperature. (210°C)

SMOKE POINT: Indicates the relative smoke producing properties of kerosene and ATF in a diffusion flame. Is related to HC type of the fuel. More aromatic the fuel, higher is the flame height or smokier the flame.
High smoke pt ⇒ Fuel of low smoke producing tendency. In the test, it is max. ht of flame that can be achieved without smoking.
(E.g. 43 mm for iso-octane)

ANILINE POINT: Lowest temperature at which equal volumes of aniline ($C_6H_5NH_2$) and the oil are miscible, i.e., form a single phase upon mixing. Gives an approximation of aromatic contents in the oil (like dissolves like). Chemical functionalization of oil (chlorination, sulfonation, etc.) can interfere with measurement due to changes to solvency.

VISCOSITY INDEX: Measure of change of η with T. Lower the VI, higher the change of η with T and vice-versa. η of lubricant ≡ Ability to lower friction. Automotive lubricants to perform over a wide range of T (cold @ start of engine to 200°C or higher when running). Best oils with highest VI will remain stable over large T-range. [VI = 0 (naphthenic) to VI = 100 (paraffinic)]