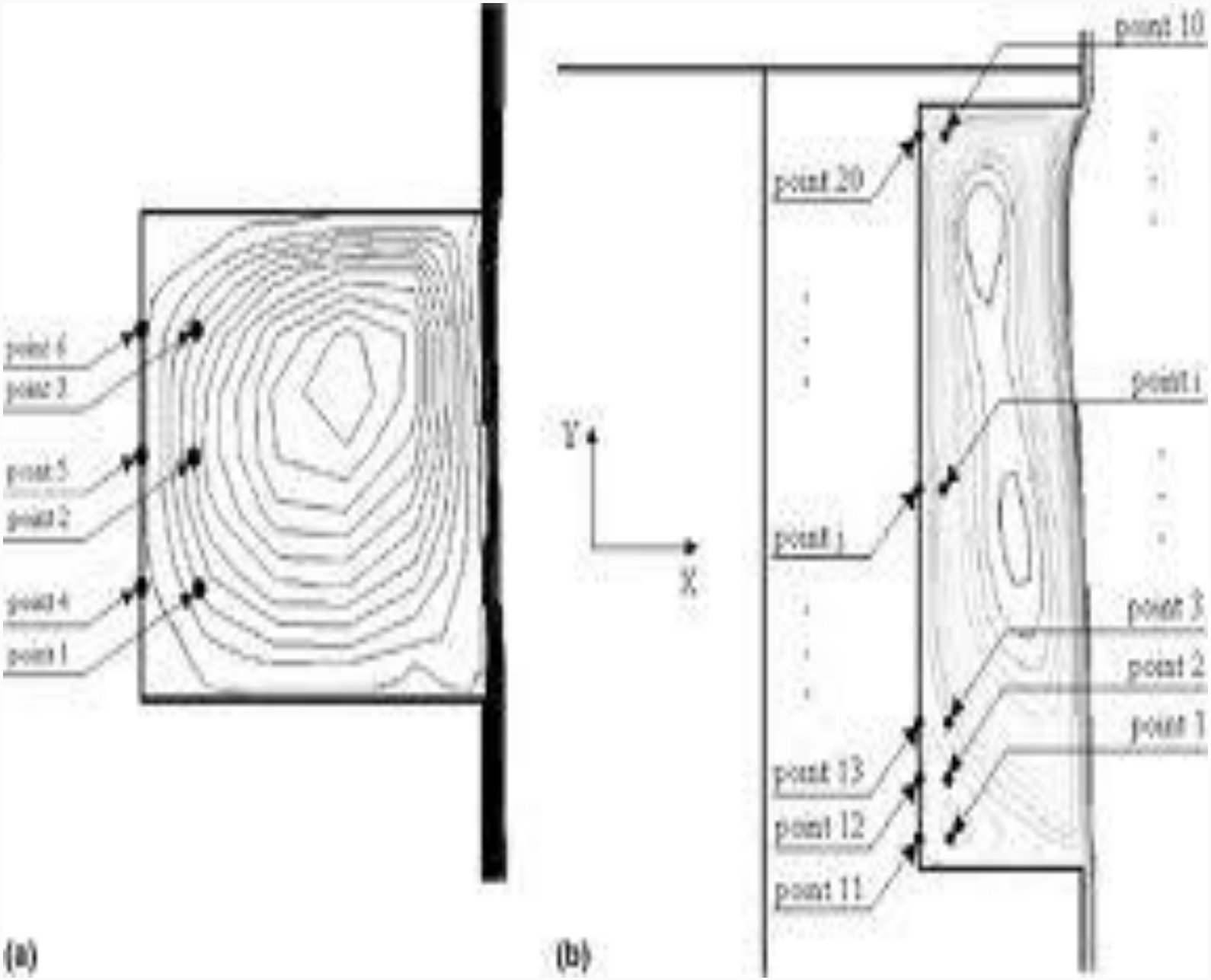
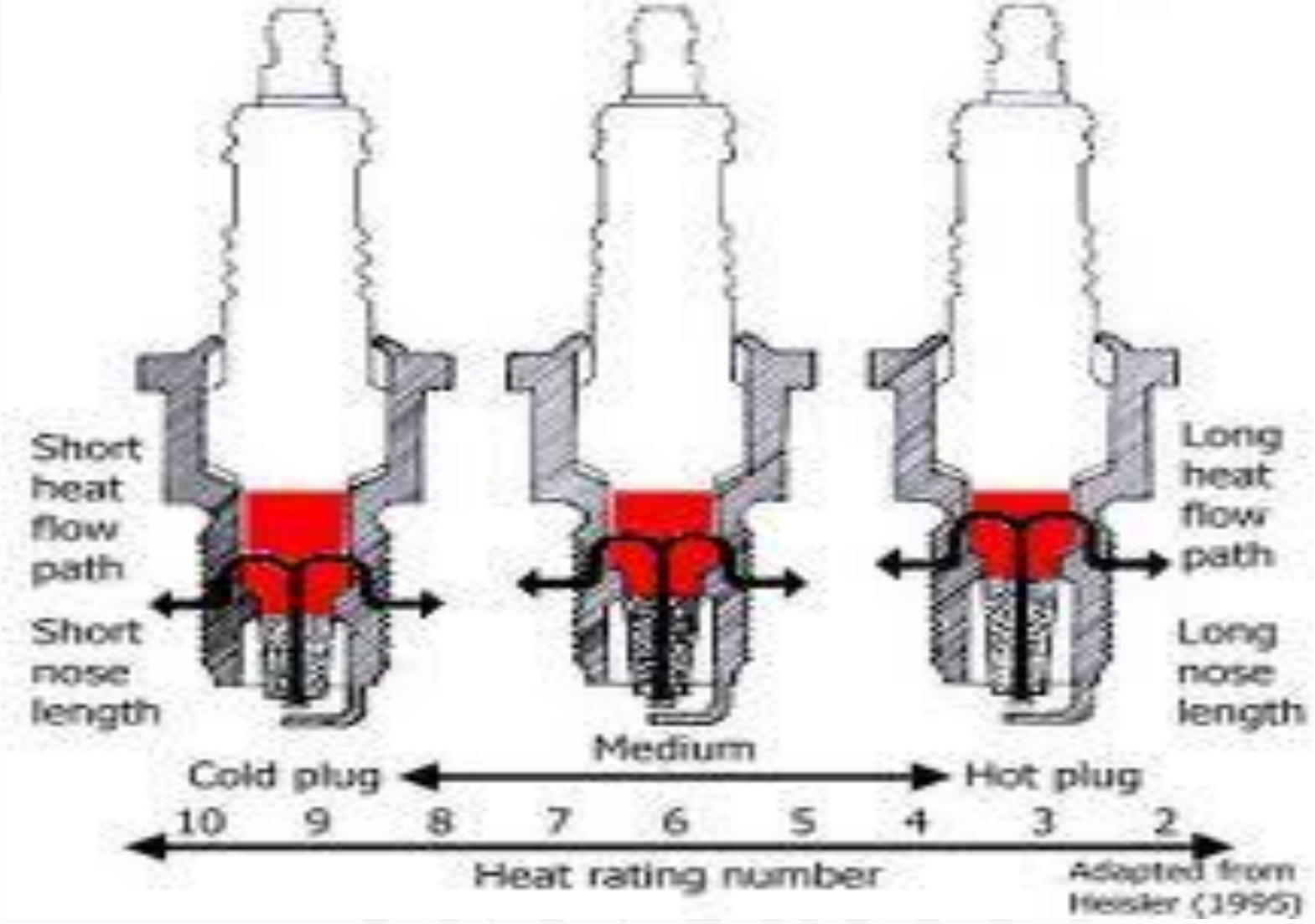
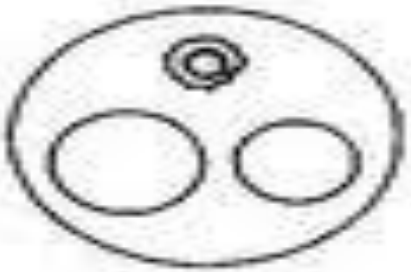
Detonation in IC Engine

The loud pulsating noise heard within the engine cylinder.
Due to auto-ignition of unburnt fuel high pressure waves are created.
These high pressure waves may break the piston.


point 6
point 3
point 5
point 2
point 4
point 1
(a)
point 10
point 20
point i
point 1
point 3
point 2
point 1
point 13
point 12
point 11
Y
X
(b)

Firing-end Temperature Heat Range



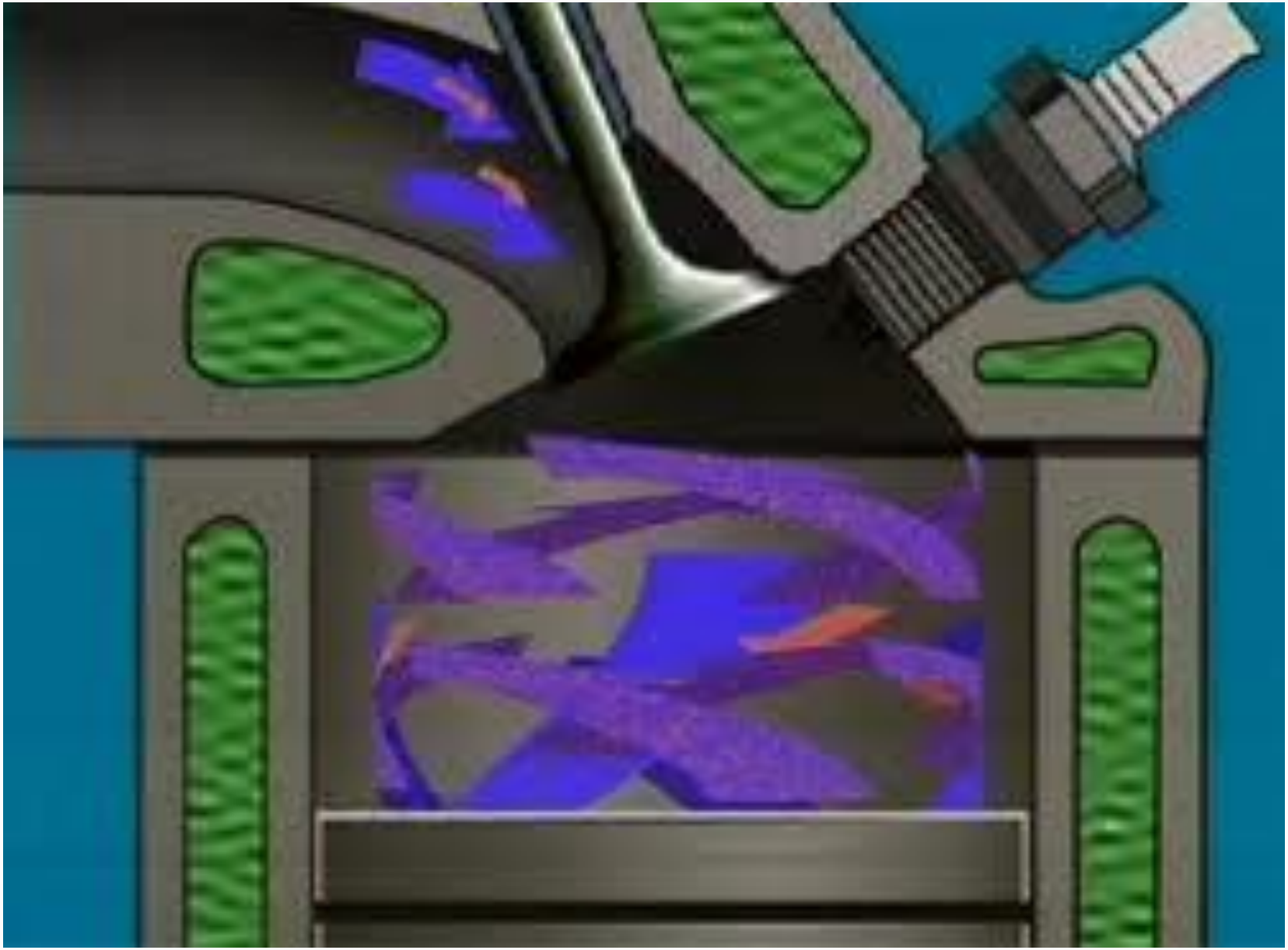


SPARK OCCURS,
COMBUSTION BEGINS

FLAME FRONT
MOVES OUT

COMBUSTION
NEARLY COMPLETE

END GASES
DETONATE



Factors for Detonation

The shape of combustion chamber.
Relative position of spark plug.
Chemical nature of fuel.
Initial temperature and pressure of fuel.

Effects of Detonation

1. Noise : Due to detonation sound intensity increases.
2. Pre-ignition : Due to overheating of spark plug.
3. Increase heat transfer : Due to high temperature increases heat trasfer.
4. Mechanical damage : High pressure shock waves may damage piston
5. Decrease in power o/p : Due to abnormal combustion decreases power o/p.

Effects of Detonation

1. Noise : Due to detonation sound intensity increases.
2. Pre-ignition : Due to overheating of spark plug.
3. Increase heat transfer : Due to high temperature increases heat trasfer.
4. Mechanical damage : High pressure shock waves may damage piston
5. Decrease in power o/p : Due to abnormal combustion decreases power o/p.

Remedies or Detonation is controlled by

By increasing engine r.p.m.
Retarding (decelerating) spark.
Reducing pressure in inlet manifold.

References

1. V. Ganesan, (2008), Internal Combustion Engines, Tata McGraw-Hill Publishing Company Ltd.
2. William. H. Crouse (2006), Automotive Mechanics, 10th Edition, McGraw-Hill, ISBN: 978-0-07-063435-0.
3. Kirpal Singh (2011), Automobile Engineering, 12th edition, Standard Publications, ISBN: 978-8-180-14177-5.
4. Joseph Heitner (1999), Automotive Mechanics: Principles and Practices, 2nd edition, Affiliated East West Pvt. Ltd, ISBN: 978-8-176-71015-2.
5. Bosch Automotive Hand Book (2007), 8th Edition, SAE Publications, ISBN: 978-0-7680-4851-3
6. K. Newton and W. Steeds (2001), the motor vehicle, 13th Edition, Butterworth-Heinemann Publishing Ltd, ISBN: 978-0-080-53701-6.
7. Onkar Singh, (2009), Applied Thermodynamics, New Age International.
8. Internal Combustion Engine Fundamentals, John B. Heywood McGraw-Hill Education; 2 edition (31 May 2018), ISBN-13: 978-1260116106

Thank you