



**POSTAL
BOOK PACKAGE**

2025

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**MECHANICAL
ENGINEERING**

Objective Practice Sets

Internal Combustion Engines

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Basic and Air Standard Cycles

MCQ and NAT Questions

- Q.1** The function of piston rings in internal combustion engines is to
- dissipate heat to cylinder walls
 - seal the cylinder
 - prevent piston from wear
 - all of the above
- Q.2** Advantage of two stroke engine over a four stroke engine is
- more uniform turning moment on crankshaft
 - reduced friction loss
 - more power for same cylinder dimensions
 - all of the above
- Q.3** The power to weight ratio of diesel engine compared to petrol engine is
- high
 - low
 - same
 - high in some cases and low in other cases
- Q.4** An engine has four cylinders of 68 mm bore and 75 mm stroke. The cubic capacity of the engine is
- 1089.5cm³
 - 1289.5cm³
 - 1489.5m³
 - 1689.5cm³
- Q.5** A certain engine produces 10 kW indicated power & mechanical efficiency is 80%. The friction power is
- 12 kW
 - 8 kW
 - 4 kW
 - 2 kW
- Q.6** Fuel consumption of a engine is 0.35 kg/kW-hr and heating value of fuel is 43000 kJ/kg. The brake thermal efficiency is
- 20.1%
 - 23.9%
 - 28.29%
 - 32.21%
- Q.7** The relative efficiency of a engine will be equal to if air standard efficiency & brake thermal efficiency of engine are 53.4% & 24.4% respectively.
- 40.7%
 - 45.7%
 - 13.1%
 - 53.4%
- Q.8** In a SI engine very high compression ratio cannot be used because
- the engine efficiency would be unmanageable high
 - the power required for compression would be high
 - cylinders will required very thick walls
 - self-ignition may takes place before the spark occurs
- Q.9** In a four stroke IC engine cam shaft rotates at
- same speed as crankshaft
 - twice the speed of crankshaft
 - half the speed of crankshaft
 - none of the above
- Q.10** Thermal efficiency of CI engine is higher than that of SI engine due to
- fuel used
 - higher compression ratio
 - constant pressure heat addition
 - none of the above
- Q.11** If clearance volume is 10% of swept volume, the compression ratio will be equal to
- 9
 - 10
 - 11
 - 12
- Q.12** In an engine working on Otto cycle, the compression ratio is 5.5. The work output per cycle is $23.625 \times 10^5 V_c$ joule where V_c is the clearance volume in m³, the mean effective pressure (in bar) is
- 3.25 bar
 - 5.25 bar
 - 7.25 bar
 - 9.25 bar
- Q.13** The order of values of thermal efficiency of Otto, diesel and Dual cycle, when they have equal compression ratio and heat rejection, is given by
- $\eta_{\text{Otto}} > \eta_{\text{diesel}} > \eta_{\text{dual}}$

- (a) The pressure at the beginning of the compression stroke is 0.1 MPa.
 (b) The compression ratio of the cycle is 15.15.
 (c) The specific volume at the end of compression stroke is $0.23 \text{ m}^3/\text{kg}$.
 (d) The specific network output of the cycle is 663.7 kJ/kg .

- Q.93** In a compression ignition engine, the inlet air pressure is 1 bar and the pressure at the end of isentropic compression is 32.42 bar. The expansion ratio is 8. The temperature at the end of compression stroke is 810 K. Which of the following statements is(are) correct?
 (For air $\gamma = 1.4$, $R = 0.287 \text{ kJ/kgK}$)
 (a) The compression ratio of the cycle is 12.
 (b) Maximum temperature in the cycle is $942.^\circ\text{C}$.
 (c) Cut-off ratio of the cycle is 1.5.
 (d) Air standard efficiency of the above diesel cycle is 43.44%.

- Q.94** A diesel engine has a compression ratio of 17 and cut-off takes place at 10% of the stroke. The pressure and temperature at the beginning of the compression stroke are 1 bar and 300 K respectively. (Take $\gamma = 1.4$ for air)
 (a) Maximum pressure in the cycle is 52.8 bar.
 (b) Maximum temperature in the cycle is 1490.8 K.

- (c) Cut-off ratio for the cycle is 2.6.
 (d) Air standard efficiency of diesel cycle is 43.44%.

- Q.95** The minimum and maximum temperature in air standard Otto cycle are 300 K and 1875 K respectively. Which of the following statements is(are) correct when network output is maximum?
 (For air take, $c_p = 1.005 \text{ kJ/kgK}$, $c_v = 0.718 \text{ kJ/kgK}$, $\gamma = 1.4$)
 (a) Temperature after the compression process in 750 K.
 (b) Compression ratio of the cycle is 6.72.
 (c) Heat added in the cycle is 807.75 kJ/kg
 (d) Network output from the cycle is 430.76 kJ/kg

- Q.96** Which of the following statements is(are) true for Dual cycle?
 (a) The heat addition at constant pressure is 2-3 times more than the heat addition at constant volume.
 (b) The dual cycle engine is more compact in size with respect to diesel cycle.
 (c) The sound pollution for dual cycle engine is higher than that of the diesel cycle engine.
 (d) The maintenance is easier and maintenance cost is less for dual cycle engine than that of the diesel cycle engine.



Answers Basic and Air Standard Cycles

1. (d)	2. (d)	3. (b)	4. (a)	5. (d)	6. (b)	7. (b)
8. (d)	9. (c)	10. (b)	11. (c)	11. (b)	13. (d)	14. (c)
15. (c)	16. (b)	17. (c)	18. (c)	19. (a)	20. (b)	21. (b)
22. (d)	23. (c)	24. (a)	25. (c)	26. (b)	27. (c)	28. (b)
29. (b)	30. (c)	31. (d)	32. (b)	33. (d)	34. (a)	35. (b)
36. (b)	37. (c)	38. (c)	39. (c)	40. (a)	41. (b)	42. (d)
43. (a)	44. (a)	45. (d)	46. (c)	47. (c)	48. (a)	49. (d)
50. (d)	51. (d)	52. (c)	53. (d)	54. (a)	55. (d)	56. (d)
57. (d)	58. (b)	59. (a)	60. (c)	61. (c)	62. (a)	63. (b)
64. (b)	65. (6.075)	66. (75)	67. (168)	68. (0.34)	69. (25)	70. (264)
71. (5.328)	72. (2)	73. (1.78)	74. (53.9)	75. (45.45)	76. (5.34)	77. (535.96)
78. (1554.97)		79. (8.92)	80. (154.6)	81. (83.9)	82. (6.94)	83. (c)
84. (c)	85. (b)	86. (a)	87. (a, c)	88. (a, d)	89. (b, d)	90. (a, d)
91. (a, b, c)		92. (a, d)	93. (a, b, c)	94. (a, c)	95. (a, c)	96. (a, b, d)

MCQ and NAT Questions

- Q.1** Octane No. of which fuel is zero?
 (a) Normal heptane
 (b) Iso Octane
 (c) 2-2-4 trimethyl pentane
 (d) Methyl alcohol
- Q.2** Reference fuels for knock rating of S.I. engine fuels would include
 (a) iso-octane & alpha-methyl naphthalene
 (b) normal octane & aniline
 (c) isooctane & n-hexane
 (d) n-heptane & isooctane
- Q.3** The two reference fuels used for Cetane rating are
 (a) Cetane and iso-octane
 (b) Cetane and tetra ethyl lead
 (c) Cetane and n-heptane
 (d) Cetane and α -methyl naphthalene
- Q.4** By higher octane number of S.I. fuel, it is meant that fuel has
 (a) higher heating value (b) higher flash point
 (c) lower volatility (d) longer ignition delay
- Q.5** Diesel engine fuels are rated by
 (a) Octane number (b) HUCR
 (c) Cetane number (d) CFR number
- Q.6** If petrol is used in a diesel engine, then
 (a) higher knocking will occur
 (b) efficiency will be low
 (c) low power will be produced
 (d) black smoke will be produced
- Q.7** If diesel is fed by mistake in the oil tank of a petrol engine, then engine will
 (a) give lot of smoke
 (b) knock
 (c) not run
 (d) run for some time and stop
- Q.8** Hydrocarbons are decomposed into smaller hydrocarbons by
 (a) reforming (b) refining
 (c) cracking (d) Polymerization
- Q.9** The molecular structure of the straight run gasoline is changed by
 (a) cracking (b) reforming
 (c) refining (d) boiling
- Q.10** The petrol generally used in cars has the octane number of the order of
 (a) 100-200 (b) 80-90
 (c) 20-60 (d) 35-50
- Q.11** Alcohol are unsuitable as diesel engine fuels because
 (a) the Cetane number of alcohol fuels is very low which prevents their ignition by compression
 (b) the Cetane no of alcohol fuels is very high which prevents their ignition by compression
 (c) the octane number of alcohol fuels is very low which prevents their ignition by compression
 (d) none of the above
- Q.12** Anti-knock characteristics of alcohol when compared to gasoline is:
 (a) higher (b) lower
 (c) equal (d) none of the above
- Q.13** Amount of oxygen needed to completely burn 1 kg of methane (CH_4) is
 (a) 2 kg (b) 4 kg
 (c) 16 kg (d) 22 kg
- Q.14** When crude oil is heated, then which one of the following hydrocarbon is given off first?
 (a) Gasoline (b) Paraffin
 (c) Diesel (d) Natural gas
- Q.15** Excess quantities of sulphur in diesel fuel are objectionable because it may cause the following except

Q.40 Statement (I): Automotive Petrol engines require Petrol of Octane number between 85-95.

Statement (II): Automotive Diesel engines require Diesel oil of Cetane number between 85-95.

Q.41 Statement (I): The volatility of a liquid in general is its tendency to evaporate under normal temperature and pressure.

Statement (II): A distillation curve is not a true boiling point curve but is commonly used to define and describe the volatility of fuels.

Multiple Select Questions (MSQ)

Q.42 The mass analysis of the petrol used in an engine was 84% C and 16% H₂. The dry exhaust gas analysis showed that the % by volume of CO₂ was six times that of O₂, and that no CO was present. If O₂ by volume is 21% in air and N₂ by volume is 79% in air. Which of the following statements is(are) correct?

(a) The air-fuel ratio by mass is 16.7:1 for given condition.

(b) The number of moles of O₂ required for complete combustion of 1 mole of fuel without any CO or O₂ in exhaust is 11.

(c) The % excess air required with respect to stoichiometric air is 10.6%.

(d) The % excess air required with respect to stoichiometric air is 8.3%.

Q.43 Petrol used in SI engine is assumed to have chemical formula C₇H₁₆. Air contains 23% oxygen by mass and 21% oxygen by volume. Which of the following statements is(are) correct?

(a) Stoichiometric air-fuel ratio by mass is 15.1 : 1.

(b) Stoichiometric air-fuel ratio by mass is 16.3 : 1

(c) If 25% excess air is supplied then the % of O₂ in the exhaust as per Orsat analysis is 3.97%.

(d) If 25% excess air is supplied then the % of CO₂ in the exhaust as per Orsat analysis is 11.38%



Answers	Fuels							
1. (a)	2. (d)	3. (d)	4. (d)	5. (c)	6. (a)	7. (c)	8. (c)	9. (b)
10. (b)	11. (a)	12. (a)	13. (b)	14. (d)	15. (c)	16. (b)	17. (d)	18. (c)
19. (c)	20. (a)	21. (c)	22. (b)	23. (b)	24. (c)	25. (b)	26. (d)	27. (b)
28. (b)	29. (b)	30. (c)	31. (a)	32. (c)	33. (b)	34. (d)	35. (d)	36. (c)
37. (b)	38. (c)	39. (c)	40. (c)	41. (b)	42. (a, b, c)	43. (a, d)		

Explanations Fuels

1. (a)

Normal-heptane detonates rapidly & hence, has been assigned an octane number of zero. Iso-octane is assigned as octane number of 100.

3. (d)

Cetane (C₁₆H₃₄) is arbitrarily given a number 100 & originally α-methyl naphthalene was given a number zero but now the reference is heptamethylnonane which is given a value 15.

4. (d)

By higher octane rating of SI engine, means that fuel have higher ignition delay.

6. (a)

Knocking tendency will increase if petrol engine is used in diesel engine.

7. (c)

If diesel oil is fed in petrol engine, the engine will not run because of lower compression ratio of petrol engine.

8. (c)

Cracking is the process of decomposition of hydrocarbon into smaller hydrocarbons.