

5000⁺

Objective Solved
Questions

Volume-3

Thermodynamics

RAC

IC Engine

Power Plant

Heat & Mass Transfer

MCOQ

MECHANICAL ENGINEERING

Topic Wise Objective Question & Answer with Solution

Topic Wise Presentation

Thoroughly Revised & Updated

Also Useful for

**State Engineering Service Examinations,
Public Sector Examination**

&

Other Competitive Examinations.

 **EAPublications**
ENGINEERS ACADEMY PUBLICATIONS

Log on to : www.eapublications.org | Ph. : 08094441777



Publisher and Distributor

Engineers Academy Publications

100-102, Ram Nagar, Bambala Puliya, Toll Tax,
Tonk Road, Pratap Nagar, Jaipur (Rajasthan)-302033
E-Mail : engineers.academy.india@gmail.com

All Rights Reserved :

This book or part there of cannot be translated or reproduced in any form (except for review or criticism) without the written permission from the Publishers.

ISBN : 978-93-93531-77-3

First Edition : 2025

Without prior written permission of publisher and author, no person/publisher/institute should use full part of the text/design/question/material of the book. If any body/publisher/institute is found in default legal action will be taken accordingly.

Price : ₹ 600.00

Although every effort has been made to avoid mistakes and omissions, there may be possibility some mistakes been left inadvertently. This book is released with the understanding that neither author nor publisher will be responsible in any manner for mistakes/premissions in the book. Dispute, if any, shall be subject to Jaipur (Rajasthan) Jurisdiction only.



DIRECTOR'S *Message*

To reach heights one must start climbing and if the journey is difficult then perseverance is the key to success. As a teacher we have realized over past years that success in any competitive exam requires hard work and proper guidance. **Engineers Academy** with its unique teaching methodologies has always proved that we meet the expectations of thousands of students and parents to make their dreams come true. With changing patterns, we have adapted ourselves to deliver the best and ensure better results.

This book has been organized and executed with a lot of care, dedication and passion for lucidity. A conscious attempt has been made to simplify the concepts to facilitate better understanding of the subject.

Engineers Academy has many successful stories of students who secured All India Rank in ESE, GATE, PSUs and JEn. Now we invite you to become a part of Engineers Academy to explore and achieve ultimate goal of your life. We promise to provide you quality guidance with competitive environment which is far advanced and ahead than the reach of other institution.

We would feel satisfied if the book meets the needs of the students for whom it is meant.

Lastly, we are thankful to all the engineers, authors whose work has been the source of enlightenment, inspiration and guidance in presenting this book.

It is hoped that the book in its new form will enjoy its ever increasing popularity.

Regards

Dr. Pankaj Goyal



Preface

This book has been written to meet the growing requirements of candidates appearing for BSNL, DRDO, ISRO, BARC, ECIL, TTA, RRB-JE, State and Public Sector Engineering Examinations. Though every candidate has ability to succeed but competitive environment, in-depth knowledge, quality guidance, time management and good source of study is required to achieve goals.

This book includes Multiple Choice Questions (MCQ) which works as a mock exam practice for the reader. Questions of all the subject have been organized in systematic, concepts oriented and error less manner so that it become easy and interesting for even a beginner to understand. It is a very convenient book and must be solved by candidate aiming for competitive exams.

After solving this booklet students can feel encouraged and develop confidence to attempt each and every type of numerical as well as theoretical problems. Each problems explains solving approach so that at the end, so the reader is well equipped to be able to apply any type of problem solving requirement and distinctly choose one strategy or type from the other.

We hope this book will be proved an important tool to succeed in BSNL, DRDO, ISRO, BARC, ECIL, TTA, RRB-JE, State and Public Sector Engineering Examinations.

It is earnestly hoped that with the extensive additions and revisions, the present edition will facilitate the students not only in preparing themselves for competitive examinations but also in preparing for their regular examinations and prove more useful to the students than the earlier editions.

Even though, enough readings were given for correcting the error and printing mistakes, due to human tendency there could be some minor types in the book. If any such types found, they will be highly appreciated and in incorporated in the next edition. Also, please provide your valuable suggestions at : engineers.academy.india@gmail.com

Wish you all the best. Have a nice reading.

Team of
Engineers Academy Publications

CONTENTS

S.No.	TOPIC	Page No.
1.	Thermodynamics	03 – 46
2.	Refrigeration & Air Conditioning.....	49 – 90
3..	Internal Combustion Engine.....	93 – 124
4.	Power Plant	127 – 164
5.	Heat & Mass Transfer	167 – 220



UNIT-I

THERMODYNAMICS

1. Basic Introduction of Thermodynamics	03 – 09
2. Energy Interactions and First Law of Thermodynamics	10 – 24
3. Second law of Thermodynamics	25 – 39
4. Properties of Pure Substance	40 – 43
5. Thermodynamics Relations	44 – 46



ENGINEERS ACADEMY[®]

Your GATEway to Professional Excellence

IES • GATE • PSUs • JTO • IAS • NET

BASIC INTRODUCTION OF THERMODYNAMICS

CHAPTER

1

OBJECTIVE QUESTIONS

- Triple point temperature of water is-
(a) 273 K (b) 273.14 K
(c) 273.15 K (d) 273.16 K
- General gas equation can be expressed as
(a) $PV = \text{constant}$ (b) $PV = RT$
(c) $PV = mRT$ (d) $PV^\gamma = K$
- An isolated system is that in which
(a) Mass transfer takes place
(b) There is no transfer of mass and energy
(c) Only transfer of energy takes place
(d) None of the above
- Which of the following is unit for universal gas constant?
(a) dynes/ $^\circ\text{C}$ (b) erg/mol $^\circ\text{C}$
(c) W/m ^2K (d) kcal/ $^\circ\text{C}$
- Absolute pressure is equal to
(a) Gauge pressure + vacuum pressure
(b) Gauge pressure - vacuum pressure
(c) Gauge pressure + atmospheric pressure
(d) None of the above
- A compound pressure gauge can measure
(a) Complex pressure
(b) Vacuum pressure
(c) Positive and negative pressure
(d) None of these
- Amongst the following which is not a property of the system?
(a) Pressure (b) Temperature
(c) Specific volume (d) Work
- All engineering processes are
(a) Irreversible
(b) Constant entropy
(c) Quasi-static
(d) In thermodynamic equilibrium
- A tank of volume ∇ contains a gas at pressure p (absolute) and temperature T , with a uniform state. At $t = 0$, the gas begins escaping from the tank through a valve with a flow area A . The air passing through the valve has an average speed of \bar{V} and density ρ . If the universal gas constant is R , then what is the instantaneous rate of change of density in the tank at $t = 0$?
(a) 0 (b) $\frac{\rho A \bar{V}}{\nabla}$
(c) $-\frac{\rho A \bar{V}}{\nabla}$ (d) $\frac{-\partial p}{\partial t} / RT$
- Which of the following is considered as thermodynamic potential?
(a) Temperature (b) Internal energy
(c) Enthalpy (d) Entropy

11. The smallest quantity of a substance, which can exist by itself in a chemically recognizable form, is known as
- (a) Element (b) Compound
(c) Atom (d) Molecule
- [JPSC - AE]**
12. Which one of the following is the extensive property of thermodynamic System?
- (a) volume (b) Density
(c) Pressure (d) Temperature
13. Which of the following quantities, is NOT the property of a system ?
- (a) Temperature (b) Specific volume
(c) Heat (d) Pressure
14. In an irreversible process there is
- (a) loss of heat (b) no loss of work
(c) gain of heat (d) none of the above
15. Temperature of a gas is due to
- (a) Its heating value
(b) Kinetic energy of molecules
(c) Repulsion of molecules
(d) Attraction of molecules
- [NTPC - DIP]**
16. The sequence of processes that eventually returns the working substance to its original state is known as
- (a) Event
(b) Process
(c) Thermodynamic property
(d) Thermodynamic cycle
17. Thermodynamic equilibrium is completely defined by the specifications of
- (a) Internal energy
(b) Enthalpy
(c) Generalized displacements
(d) All of the above
18. Which conversion is incorrect?
- (a) $1 \text{ kWh} = 3.6 \times 10^6 \text{ Nm}$
(b) $1 \text{ Nm} = 0.238 \times 10^{-3} \text{ kcal}$
(c) $1 \text{ Hp hr} = 0.746 \text{ kWh}$
(d) $1 \text{ kcal} = 4.1868 \text{ Nm}$
19. In thermal engineering, the combination of ice & water is a(an)
- (a) Open system
(b) Isolated system
(c) Heterogeneous system
(d) Closed system
- [AEM]**
20. The absolute zero temperature is taken as :
- (a) -237°F (b) 273°C
(c) 237°F (d) -273°C
- [NMRC JE - 2017]**
21. An open system
- (a) Is a specified region where transfers of energy and/or mass take place
(b) Is a region of constant mass and only energy is allowed to cross the boundaries
(c) Cannot transfer either energy or mass to or from the surroundings
(d) Has an enthalpy transfer across its boundaries and the mass within the system is not necessarily constant
- [BPSC ME - 2016]**
22. The principle of working of the constant volume thermometer is based on
- (a) Boyle's law
(b) Charle's law
(c) Gay - Lussac's law
(d) Equation of state
- [MPE - 2014]**
23. The instrument which measures the temperature of the source without direct contact is
- (a) Bi - metallic cut-out
(b) Vapour pressure thermometer
(c) Pyrometer
(d) Thin film thermometer
- [MPE - 2014]**

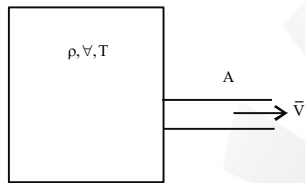
24. In reference to Thermodynamic equilibrium, it is required to have,
(a) Mechanical Equilibrium
(b) Chemical Equilibrium
(c) Thermal Equilibrium
(d) Mechanical, Chemical and Thermal Equilibrium
[AEM - 2017]
25. The value of 'n' index for constant volume process is equal to
(a) $n = 0$ (b) $n = 1$
(c) $n = \gamma$ (d) $n = \infty$
[CEMPM - 2018]
26. What are the properties of a thermodynamic system whose value for the entire system is equal to the sum of their values for individual parts of the system?
(a) Thermodynamic properties
(b) Extensive properties
(c) Intensive properties
(d) Specific properties
[CEMPM - 2018]
27. Centigrade and Fahrenheit scale have same value at
(a) -120°C (b) -85°C
(c) -40°C (d) 273°C
28. In a one tonne capacity water cooler, water enters at 30°C at the rate of 200 litres per hour. The outlet temperature of water will be (sp. heat of water = 4.18 kJ/kg K)
(a) 3.5°C (b) 6.3°C
(c) 23.7°C (d) 15°C
29. Which one of the following represents open thermodynamic system?
(a) Manual ice cream freezer
(b) Centrifugal pump
(c) Pressure cooker
(d) Bomb calorimeter
[RRB JE (Shift-2) - 2015]
[RRB JE Chandigarh - 2014]
30. Intensive Property of a system is the one that
(a) Does not depend on mass
(b) Depends on mass
(c) Depends on path followed
(d) Depends on mass and on path followed
[ISRO Technical Assistant - 2016]
31. Which one of the following is law perfect gases?
(a) Boyle's law (b) Gay-ussac's law
(c) Charles's law (d) All of the above
[MP Sub Engineer 4th April - 2016 Evening]
32. The unit of energy in S.I. Units is
(a) Joule (J) (b) Joule meter (Jm)
(c) Watt (W) (d) Joule/meter (J/m)
[Vizag steel (J.T.) - 2017]
33. A definite area or a space where some thermodynamic process takes place is known as
(a) Thermodynamic system
(b) Thermodynamic cycle
(c) Thermodynamic process
(d) Thermodynamic law
[Vizag steel (J.T.) - 2017]
34. Which of the following is not a point function?
(a) volume (b) Pressure
(c) internal energy (d) heat transfer
[UPRVNL JE - 2016]
35. The reading of temperature on Celsius scale is 40°C . What is equivalent reading of temperature on Fahrenheit scale?
(a) 114°F (b) 104°F
(c) 110°F (d) 134°F
[UPRVNL JE - 2016]
36. Consider the Following :
1. Temperature 2. Enthalpy
3. internal energy 4. specific entropy
Which of these are extensive properties?
(a) 1, 2, 3, 4 (b) 2, 4
(c) 2, 3 (d) 3, 4

37. An aircraft engine is an example of:
 (a) closed system (b) open system
 (c) isolated system (d) quasi equilibrium
[UPRVNL JE - 2016]
38. What is degree of freedom at triple point of water?
 (a) zero (b) one
 (c) Two (d) Three
[UPRVNL JE - 2016]
39. A thermodynamic property:
 (a) Can have different values when the system in a particular state
 (b) Depends on the past history of the system
 (c) Does not depend on the past history of the system
 (d) Depends on path
[UPRVNL JE - 2016]
40. Gibbs phase rule for general system is:
 (a) $P + F = C - 1$ (b) $P + F = C + 1$
 (c) $P + F = C - 1$ (d) $P + F = C + 2$
[UPRVNL JE - 2016]
41. When the chemical potentials of two systems are same, then they are said to be in what type of equilibrium?
 (a) Thermal (b) Mechanical
 (c) Diffusive (d) None of these
[MP Sub Engineer 5 April - 2016]
42. A closed thermodynamic system manifesto when:
 (a) Materials not allowed to cross the boundary, but energy transfer does occur across the boundary
 (b) There is transfer of both mass and energy across the system boundaries
 (c) There is only transfer of mass, but no heat and work energy are transferred
 (d) There is absolutely no interaction of the system with surroundings across its boundaries
[UPRVUNL AE - 2014]
43. Spot the odd one out.
 (a) Specific enthalpy
 (b) Kinetic Energy
 (c) Work
 (d) Pressure
[UPRVUNL JE 2015]
44. A system and its environment put together constitute—
 (a) An adiabatic system
 (b) An isolated system
 (c) A segregated system
 (d) A homogeneous system
[RRB JE Bhopal Paper II (Shift-II) - 2015]
45. Control volume refers to
 (a) A fixed region in space
 (b) A specified mass
 (c) An isolated system
 (d) A reversible process only
[RRB JE (Shift-I) - 2015]
46. All of the following are intensive properties EXCEPT?
 (a) Mass (b) Density
 (c) Pressure (d) Temperature
[RRB JE (Shift-I) - 2015]
47. Cyclic integral of any property is:
 (a) Zero (b) One
 (c) Infinite (d) Two
[RRB SSE (Shift-II) - 2015]
48. Which of the following are intensive properties?
 1. Kinetic Energy
 2. Specific Enthalpy
 3. Pressure
 4. Entropy
 (a) 1 and 3 (b) 2 and 3
 (c) 1, 3 and 4 (d) 2 and 4

49. The thermoelectric effect was first observed by
- (a) Seebeck (b) Pirani
(c) Thermas (d) Thomas young
- [M.P. Vyapam - 2017]
50. Thermocouples are used for measuring which of the following parameter?
- (a) Humidity (b) Pressure
(c) Temperature (d) Density
- [UPRVUNL AE - 2014]
51. The instrument used to measure high temperatures in a furnace is known as
- (a) thermometer (b) pyrometer
(c) calorimeter (d) barometer
- [Vizag Steel (J.T.) - 2016]
52. Ice kept in a well-insulated thermoflask is an example of which system?
- (a) Closed system
(b) Isolated system
(c) Open system
(d) Non-flow adiabatic system
- [RRB JE (Shift-II) - 2015]
53. Platinum resistance thermometer can be used upto°C.
- (a) 1000 (b) 1500
(c) 200 (d) 850
- [M.P Vyapam - 2017]
54. The measurement of a thermodynamic property known as temperature is based on
- (a) Zeroth law of thermodynamics
(b) First law of thermodynamics
(c) Second law of thermodynamics
(d) None of these
- [Vizag Steel (J.T.) - 2017]
55. Identify the correct statement for the Zeroth Law of thermodynamics.
- (a) Two thermodynamic systems are always in thermal equilibrium with each other.
(b) If two systems are in thermal equilibrium, then the third system will also not in thermal equilibrium with each other.
(c) Two systems not in thermal equilibrium with a third system will also not in thermal equilibrium with each other.
(d) When two systems are in thermal equilibrium with a third system, they are in thermal equilibrium with each other.
- [UPRVUNL JE - 2014]
56. The fixed point/points for celcius temperature scale is/are
- (a) Ice point as 0°C
(b) Steam point as 100°C
(c) Both ice and steam opoints as 0° & 100°C respectively
(d) Triple point of water as 0.01°C
- [DMRC JE 2013]
57. For the calculation of real temperature in thermodynamics the value of absolute zero temperature is considered as
- (a) -273°C (b) 283°C
(c) 300°C (d) 293°C
- [MP Sub Engineer 5th April - 2016]
58. Which among the following gives the correct relationship between Centigrade and Fahrenheit scales?
- (a) $C = 5/9 (F-32)$
(b) $F = (9/5) C-32$
(c) $C = (9/5) (F - 32)$
(d) $C = 9/5 (F - 32)$
- [UPRVUNL AE - 2014]
59. $75^{\circ}\text{C} = \dots^{\circ}\text{F}$, the correct option for the blank space is-
- (a) 73.6 (b) 192.6
(c) 77.4 (d) 167.0
- [Rajasthan JE-2016]

ANSWERS AND EXPLANATIONS

1. *Ans. (d)*
2. *Ans. (c)*
3. *Ans. (b)*
4. *Ans. (b)*
5. *Ans. (c)*
6. *Ans. (c)*
7. *Ans. (d)*
8. *Ans. (a)*
9. *Ans. (c)*



From conservation of mass.

$$-\frac{\partial m}{\partial t} = \rho AV$$

$$\frac{\partial}{\partial t}(\rho V) = -\rho AV$$

$$\frac{\partial \rho}{\partial t} = \frac{-\rho AV}{V}$$

10. *Ans. (a)*
11. *Ans. (c)*
12. *Ans. (a)*
13. *Ans. (c)*
14. *Ans. (a)*
15. *Ans. (b)*
16. *Ans. (d)*
17. *Ans. (d)*
18. *Ans. (d)*

$$1 \text{ cal} = 4.18 \text{ joule/N.m}$$

$$1 \text{ k cal} = 4.18 \times 1000 \text{ Joule/N.m}$$

19. *Ans. (c)*

20. *Ans. (d)*

By international agreement, absolute zero is defined as precisely ; "0" K on the Kelvin scale, which is a thermodynamic (absolute) temperature scale and -273.15 degrees Celsius on the Celsius scale.

21. *Ans. (a)*

A system in which energy and mass transfer take place

22. *Ans. (c)*

23. *Ans. (c)*

24. *Ans. (d)*

25. *Ans. (d)*

26. *Ans. (b)*

27. *Ans. (c)*

$$\frac{C-0}{100} = \frac{F-32}{180} \Rightarrow -40^\circ$$

28. *Ans. (d)*

$$3.5 \times 3600 = 4.18 \times 200 (30 - t)$$

$$\therefore t = 15^\circ\text{C}$$

29. *Ans. (b)*

30. *Ans. (a)*

31. *Ans. (d)*

32. *Ans. (a)*

33. *Ans. (a)*

34. *Ans. (d)*

35. *Ans. (b)*

36. *Ans. (c)*

37. *Ans. (b)*

38. *Ans. (a)*

39. *Ans. (c)*

40. *Ans. (d)*

41. *Ans. (c)*

42. *Ans. (a)*

43. *Ans. (c)*

44. *Ans. (b)*