SSC-JE

Staff Selection Commission Junior Engineer

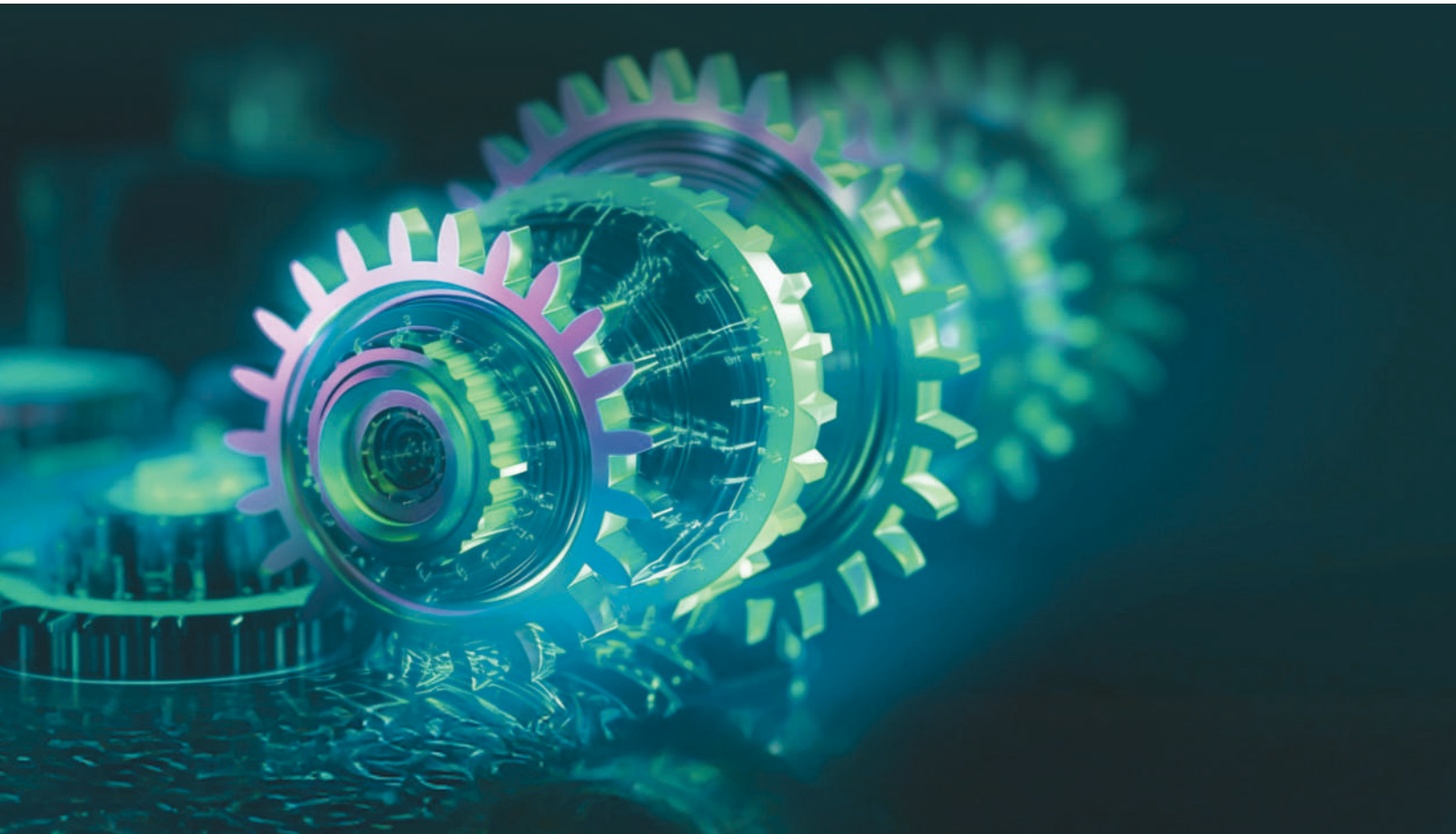
CHAPTER WISE

12 Previous Years' Solved Papers

2012-2024

WITH DETAILED SOLUTIONS

MECHANICAL ENGINEERING



Subjectwise Weightage Sheet

Weightage Sheet

Years	Subjects						
	EM	SOM	TOM	MD	RAC	HT	Automobile
2024	3	3	2	2	11	0	0
2024 (CBT2)	2	1	3	1	10	0	0
2023	3	2	2	2	14	0	0
2023 (CBT2)	2	3	1	0	8	0	0
2022	2	2	4	1	7	0	0
2020	1	3	4	0	12	0	0
2019	2	8	6	3	21	0	3
2018	3	3	2	1	10	0	0
2017	3	13	11	3	2	0	1
2016	6	9	5	1	5	6	1
2015	3	13	4	3	5	0	0
2014	6	7	10	2	1	0	4
2013	1	11	7	3	1	0	1
2012	0	13	12	5	0	0	0
Avarage Questions	2-3	4-8	4-6	1-3	7-10	0	0-1

Years	Subjects						
	FM	HM	ICE	MS	Production	Thermodynamics	Power Plant
2024	15	6	9	1	11	13	13
2024 (CBT2)	26	3	13	2	4	9	26
2023	24	8	8	2	5	14	16
2023 (CBT2)	25	5	7	1	4	13	22
2022	22	3	14	0	2	14	20
2020	21	5	10	5	3	9	22
2019	19	7	9	4	1	8	16
2018	19	10	11	5	0	10	20
2017	22	7	8	6	4	16	3
2016	21	7	4	5	8	12	3
2015	23	6	5	2	7	10	8
2014	21	6	11	2	9	10	8
2013	8	8	8	0	21	12	5
2012	11	8	7	4	14	12	7
Avarage Questions	15-20	6-8	8-11	2-4	4-8	10-14	15-20

Table of Contents

01
CHAPTER

Basic Concepts & Zeroth Law of Thermodynamics

1. The zeroth law of thermodynamics is based on the concept of _____. **[SSC-JE-2024]**

(a) Heat capacity (b) Entropy
(c) Enthalpy (d) Temperature

2. Identify the correct option based on the given assertion and reason.

Assertion (A): Hot tea kept in a thermos flask remains hot for a longer duration.

Reason (R): A thermos flask is an example of a closed system. **[SSC-JE-2024 (CBT-2)]**

(a) Both A and R are true
(b) A is true but R is false
(c) A is false but R is true
(d) Both A and R are false

3. If the temperature of 'A' is equal to the temperature of 'B' and 'C', then the temperature of 'B' will be equal to the temperature of 'C'. This is known as: **[SSC-JE-2023]**

(a) Law of thermal equilibrium
(b) Law of equality of temperature
(c) Joule's law
(d) Zeroth law of thermodynamics

4. A thermometer works on the principle of _____. **[SSC-JE-2023]**

(a) 3rd law of thermodynamics
(b) Zeroth law of law of thermodynamics
(c) Joule's law
(d) 2nd law of thermodynamics

5. The SI unit of specific heat is **[SSC-JE-2023]**

(a) Jkg/K (b) J/kg.K
(c) JK/kg (d) J/kg

6. In the thermodynamic system, the primary driving force for mass transfer is _____. **[SSC-JE-2023]**

(a) pressure difference
(b) mass difference
(c) temperature difference
(d) concentration difference

7. Flow process is used for which of the following systems? **[SSC-JE-2023]**

(a) Open system
(b) Both open and closed systems
(c) Isolated system
(d) Closed system

8. Match the thermodynamic systems with their correct examples. **[SSC-JE-2023 (CBT-2)]**

Thermodynamic System	Example
A. Open	1. The gas sealed within the cylinder of a spark-ignition engine
B. Closed	2. Liquid nitrogen is stored in a sealed and insulated container
C. Isolated	3. A car radiator

(a) A-3, B-1, C-2
(b) A-1, B-2, C-3
(c) A-1, B-3, C-2
(d) A-2, B-3, C-1

9. Which of the following statements is incorrect regarding a thermodynamic system? **[SSC-JE-2023 (CBT-2)]**

(a) An isolated system is a closed system that does not interact in any way with its surroundings.
(b) The system boundary may be movable or fixed.
(c) The surface separating the system and its surroundings is known as the boundary.
(d) Everything, including the system, is known as the surroundings.

10. Which of the following is NOT a property of the thermodynamic system? **[SSC-JE-2022]**

(a) Pressure (b) Heat
(c) Internal energy (d) Temperature

11. Which of the following is the extensive property of thermodynamic system? **[SSC-JE-2020]**

(a) Pressure (b) Volume
(c) Temperature (d) Density

12. Heat and work are : **[SSC-JE-2020]**
(a) Intensive properties
(b) Extensive properties
(c) Point functions
(d) Path function

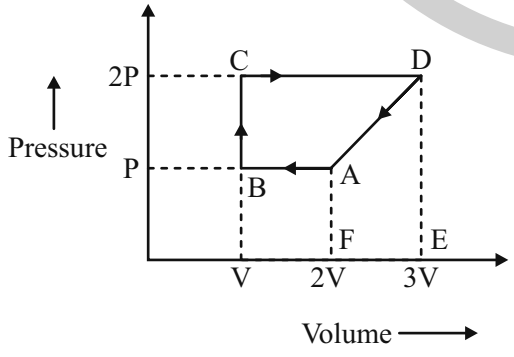
13. Constant volume process is also called as **[SSC-JE-2020, 2018]**
(a) Isobaric (b) Isochoric
(c) Isentropic (d) Adiabatic

14. Define thermodynamics. **[SSC-JE-2020]**
(a) It deals with dynamics under thermal conditions
(b) It is a science which deals with work done
(c) It is a science which deals with the relation between work and properties of systems
(d) It is a science which deals with the relation between heat, work and properties of systems

15. Control volume in a thermodynamic system refers to– **[SSC-JE-2020, 2017, 2016]**
(a) A specified mass in fluid flow
(b) Mass that moves across the boundary
(c) Fixed region in space for thermodynamic study
(d) Transfer of energy across the boundary

16. In a reversible adiabatic process, the heat added (in joule) is: **[SSC-JE-2019]**
(a) 0 (b) 1.5
(c) 1 (d) 2

17. Figure shows the P-V diagram of an ideal gas. The work done by the gas in the process ABCDA is: **[SSC-JE-2019]**



(a) 4 PV (b) 2 PV
(c) 0.5 PV (d) 1.5 PV

18. On T-S diagram, constant pressure line slope is expressed as: **[SSC-JE-2019]**
(a) S/T (b) T/C_P
(c) $C_P/\gamma T$ (d) T/S

19. In an isentropic process, the pressure of a monoatomic ideal gas increases by 0.5%. The Volume will decrease (in%) by (Take $(0.995)^{0.625}$-0.997): **[SSC-JE-2019]**
(a) 0.4 (b) 0.2
(c) 0.3 (d) 0.1

20. The ratio of specific heat at constant pressure to the specific heat at constant volume for a triatomic gas, is: **[SSC-JE-2019]**
(a) 1.8 (b) 1.3
(c) 1.6 (d) 1.4

21. What is the work done for a constant volume process? **[SSC-JE-2019]**
(a) 0.5 (b) 0
(c) –1 (d) 1

22. A closed thermodynamic system is one in which: **[SSC-JE-2019, 2017, 2016]**
(a) There is no energy or mass transfer across the boundary
(b) There is no mass transfer but energy transfer exists
(c) There is no energy transfer but there is mass transfer
(d) Both energy and mass transfer exit

23. Enthalpy is: **[SSC-JE-2019, 2018, 2017, 2015]**
(a) internal energy / pressure volume product
(b) internal energy – pressure volume product
(c) internal energy × pressure volume product
(d) internal energy + pressure volume product

24. Isolated system indicates- **[SSC-JE-2019]**
(a) Mass of substance cross the boundary
(b) Energy of substance cross the boundary
(c) Both mass and energy of substance cross the boundary
(d) Both mass and energy of substance does not cross the boundary

25. Zeroth law of thermodynamics forms the basis of measurement of- **[SSC-JE-2018, 2017]**
(a) Pressure
(b) Temperature
(c) Heat exchange
(d) Work

26. During throttling process **[SSC-JE-2018, 2016, 2013]**
(a) Internal energy does not change
(b) Pressure does not change
(c) Entropy does not change
(d) Enthalpy does not change

27. When there is no heat exchange between two bodies that are at the same temperature, they are said to be in **[SSC-JE-2018]**

(a) Thermal equilibrium
(b) Energy equilibrium
(c) Heat equilibrium
(d) Electrical equilibrium

28. The gas constant (R) is equal to the: **[SSC-JE-2018]**

(a) Sum of two specific heats
(b) Difference between to specific heats
(c) Ratio of two specific heats
(d) Product of two specific heats

29. An ideal gas undergoes an isothermal process between states 1 and 2. The applicable equation is: **[SSC-JE-2018]**

(a) $P_1V_1 = P_2V_2$ (b) PV^{γ} = constant
(c) $P_1/T_1 = P_2/T_2$ (d) ρ = constant

30. C_p and C_v for working fluid in a diesel cycle are 1 kJ/kgK and 0.718 kJ/kgK respectively. Temperatures at the beginning and the end of heat addition process are 1473 K and 1723 K respectively. The heat added is: **[SSC-JE-2018]**

(a) 250 kJ/kg (b) 179.5 kJ/kg
(c) 430.75 kJ/kg (d) 420 kJ/s

31. Liquids have **[SSC-JE-2017]**

(a) No specific heat
(b) different values of specific heat at same temperature
(c) only one value of specific heat
(d) two distinct value of specific heat

32. Total heat supplied at constant volume is **[SSC-JE-2017]**

(a) $Q = m\Delta C_p \times (T_2 - T_1)$
(b) $Q = m\Delta R\Delta(T_2 - T_1)$
(c) $Q = m\Delta C_v\Delta(T_2 + T_1)$
(d) $Q = mC_v \times (T_2 - T_1)$

33. In a polytropic process **[SSC-JE-2017]**

(a) $\frac{T_1}{T_2} = \left(\frac{V_2}{V_1}\right)^{n+\frac{1}{n}} = \left(\frac{P_1}{P_2}\right)^{n-1}$

(b) $\frac{T_1}{T_2} = \left(\frac{V_2}{V_1}\right)^{n-1} = \left(\frac{P_1}{P_2}\right)^{n}$

(c) $\frac{T_1}{T_2} = \left(\frac{V_2}{V_1}\right)^{n-1} = \left(\frac{P_1}{P_2}\right)^{n-1}$

(d) $\frac{T_1}{T_2} = \left(\frac{V_2}{V_1}\right)^{n-1} = \left(\frac{P_1}{P_2}\right)^{\frac{n-1}{n}}$

34. In metric system the unit of heat is given as **[SSC-JE-2017]**

(a) CHU (b) BTU
(c) kcal (d) Kelvin

35. A reversible adiabatic process in a T-S diagram is a _____. **[SSC-JE-2017]**

(a) point (b) vertical line
(c) horizontal line (d) parabolic curve

36. Which equation clearly defines the entropy change during the isothermal process for a system with m kg of gas at pressure P_1, Volume V_1, temperature T_1 and S_1 is heated to state points of pressure P_2, volume V_2, temperature T_2 and entropy S_2? **[SSC-JE-2017]**

(a) $mC_v \ln\frac{T_2}{T_1}$ (b) $mC_p \ln\frac{T_2}{T_1}$

(c) $mR \ln\frac{V_2}{V_1}$ (d) $mC_v\left(\frac{n-\gamma}{n-1}\right)\ln\frac{T_2}{T_1}$

37. Which equation represents the steady flow system? **[SSC-JE-2017]**

(a) $H_1 + \frac{V_1^2}{2gJ} + \frac{Z_1}{J} + Q = \frac{V_2^2}{2gJ} + \frac{Z_2}{J} + \text{Losses}$

(b) $H_1 + \frac{V_1^2}{2gJ} + \frac{Z_1}{J} + Q = \frac{V_2^2}{2gJ} + \frac{Z_2}{J}$ + Losses + workdone

(c) $H_1 + \frac{V_1^2}{2gJ} + \frac{Z_1}{J} + Q = H_2 + \frac{V_2^2}{2gJ} + \frac{Z_2}{J}$ + Losses + workdone

(d) $H_1 + \frac{V_1^2}{2gJ} + \frac{Z_1}{J} = H_2 + \frac{V_2^2}{2gJ} + \frac{Z_2}{J}$ + Losses + workdone

38. A process in which no heat crosses the boundary of the system is called : **[SSC-JE-2017, 2014]**

(a) Ideal process
(b) Adiabatic process
(c) Isothermal process
(d) Isobaric process

39. Change in internal energy in a closed system is equal to heat transferred if the reversible process takes place at constant : **[SSC-JE-2017]**

(a) Pressure (b) Temperature
(c) Volume (d) Internal energy

40. Which of the following is NOT an extensive property? **[SSC-JE-2017, 2013]**

(a) Enthalpy (b) Entropy
(c) Specific enthalpy (d) None of these

41. Which of the following is an intensive property? **[SSC-JE-2017]**

(a) Temperature
(b) Pressure
(c) Volume
(d) Both temperature and pressure

42. Which of the following are intensive properties? **[SSC-JE-2017]**

(1) Kinetic Energy (2) Specific Enthalpy
(3) Pressure (4) Entropy

Select the correct answer using the code given below

(a) 1 and 3 (b) 2 and 3
(c) 1, 3 and 4 (d) 2 and 4

43. Throttling is _____ process : **[SSC-JE-2017]**

(a) reversible (b) irreversible
(c) adiabatic (d) isothermal

44. What is the temperature at which a system goes under a reversible isothermal process without heat transfer? **[SSC-JE-2017]**

(a) Absolute zero temperature
(b) Critical temperature
(c) Reversible temperature
(d) Boiling temperature

45. Molar specific heat of an ideal gas depend on **[SSC-JE-2017]**

(a) Its pressure
(b) Its temperature
(c) Both its pressure and temperature
(d) The number of atoms in a molecule

46. In a thermodynamic system, a process in which volume remains constant is called _____ process **[SSC-JE-2017]**

(a) isobaric (b) isometric
(c) adiabatic (d) isentropic

47. The heat absorbed or rejected during a polytropic process is equal to: **[SSC-JE-2017]**

(A) $\left(\frac{\gamma-n}{\gamma-1}\right)^{1/2}$ × work done

(B) $\left(\frac{\gamma-n}{n-1}\right)^{1/2}$ × work done

(C) $\left(\frac{\gamma-n}{\gamma-1}\right)$ × work done

(D) $\left(\frac{\gamma-n}{\gamma-1}\right)^{2}$ × work done

(a) (A) only (b) (B) only
(c) (C) only (d) (D) only

48. If C_p = specific heat of gas at constant pressure and C_v = Specific heat of gas at constant volume, then **[SSC-JE-2017]**

(a) $C_v = C_p$ (b) $C_v > C_p$
(c) $C_v < C_p$ (d) None of these

49. What is the fundamental unit of enthalpy? **[SSC-JE-2017]**

(a) ML^2T^{-2} (b) $ML^{-2}T^{-1}$
(c) $ML^{-2}T^{-2}$ (d) $ML^{-2}T^2$

50. The Heat transfer, Q The work done W and the change in internal energy U and all zero in the case of **[SSC-JE-2017]**

(a) A rigid vessel containing steam at 150°C left in the atmosphere which is at 25°C
(b) 1 kg of gas contained in an insulated cylinder expanding as the piston moves slowly outward
(c) A rigid vessel containing ammonia gas connected through a valve to an evacuated rigid vessel, the vessel, the valve and the connecting pipes being well insulated and the valve being opened and after a time, condition through the two vessel becoming uniform
(d) 1 kg of air flowing adiabatically from the atmosphere into a previously evacuated bottle

51. For an isolated system which has no interaction with the surrounding. Which of the following statement is/ are CORRECT? **[SSC-JE-2017]**

(a) Heat transferred is zero
(b) Work done is zero
(c) Internal energy remains constant
(d) All options are correct

52. In isopiestic process, the **[SSC-JE-2017]**

(a) Temperature remains constant
(b) Volume remains constant
(c) PV constant
(d) Pressure remains constant

53. Consider the following properties: **[SSC-JE-2017]**

(1) Entropy
(2) Viscosity
(3) Temperature
(4) Specific heat and constant volume

Which of the above properties of a system is/are extensive?

(a) Only 1 (b) Only 1 and 2
(c) Only 2, 3 and 4 (d) Only 1, 2 and 4

54. Which of the following is INCORRECT for reversible adiabatic process? **[SSC-JE-2017]**

(a) $dS = 0$ (b) S is constant

(c) $dQ = 0$ (d) Q is not constant

55. Which of the following statement is INCORRECCT? **[SSC-JE-2017]**

(a) Work is high grade energy

(b) Heat is low grade energy

(c) Low grade energy can be converted into high grade energy in a cycle

(d) None of these

56. Which of the statement is TRUE? **[SSC-JE-2017]**

(a) Two reversible adiabatic paths intersect at a point

(b) Two reversible adiabatic paths can never intersect to each other

(c) Two property line can never intersect to each other

(d) Both two reversible adiabatic paths can never intersect to each other, and two property line can never intersect to each other.

57. Gases have **[SSC-JE-2017]**

(a) Two specific heats

(b) Three specific heats

(c) One specific heat

(d) None of these

58. In an isothermal atmosphere, the pressure **[SSC-JE-2017]**

(a) Decreases linearly with elevation

(b) Remains constant

(c) Varies in the same way as the density

(d) Increases exponentially with elevation

59. Specific volume of a gas is the volume of **[SSC-JE-2017]**

(a) Gas at NTP

(b) Unit mass of that gas

(c) Total amount of gas at some stated temperature and pressure

(d) Gas at –273°C

60. A gas is compressed frictionless from an initial state of y m^3 and 1 MPa to a final state of 0.2 m^3 and 1 MPa. There is a transfer of 40 kJ of heat from the gas and a drop of 20 kJ in internal energy. What is the initial state volume of the gas? **[SSC-JE-2016]**

(a) 0.2 (b) 0.22

(c) 19.8 (d) 20.2

61. Which equation is the CORRECT representation for the steady flow energy equation for a nozzle? **[SSC-JE-2016]**

(a) $h_1 + \frac{c_1^2}{2} = h_2 + \frac{c_2^2}{2} d$

(b) $h_1 + \frac{c_1}{2} = h_2 + \frac{c_2}{2} d$

(c) $h_1 + \frac{c_1^2}{2} = h_2 + \frac{c_2^2}{2} d$

(d) $h_1 + \frac{c_1}{2} = h_2 + \frac{c_2}{2} d$

62. The enthalpy of steam is defined as _____. **[SSC-JE-2016]**

(a) difference of internal energy and product of pressure and volume

(b) product of internal energy and pressure

(c) sum of internal energy and product of pressure and volume

(d) amount of heat change divided by the absolute temperature

63. Calorie is measure of _____. **[SSC-JE-2016]**

(a) specific heat

(b) quantity of heat

(c) thermal capacity

(d) entropy

64. The sequence of process that eventually returns the working _____. **[SSC-JE-2016]**

(a) event

(b) thermodynamic cycle

(c) thermodynamic property

(d) none of these

65. Thermal equilibrium between two or more bodies exists, when they are brought together, there is no change in _____. **[SSC-JE-2016]**

(a) density (b) pressure

(c) temperature (d) all options are correct

66. In isothermal expansion, work done by gas depends upon _____. **[SSC-JE-2016]**

(a) atomicity of gas only

(b) expansion ratio only

(c) adiabatic index

(d) both Atomicity of gas and expansion ratio

67. Non quasi-static process is _____. **[SSC-JE-2016]**

(a) free expansion of gas

(b) expansion of a gas in a cylinder under constant pressure

(c) rapid compression of a gas in a cylinder

(d) gradual compression of a gas in a cylinder

68. If a gas vapour is allowed to expand through a very minute aperture, then such a process is known as _____. **[SSC-JE-2016]**
(a) free expansion
(b) throttling
(c) hyperbolic expansion
(d) parabolic expansion

69. Three states of matter are distinguished with respect to molecules by the _____. **[SSC-JE-2016]**
(a) atoms in molecules
(b) number
(c) orientation
(d) character of motion

70. Under ideal conditions, isothermal, isobaric, isochoric and adiabatic processes are _____. **[SSC-JE-2016]**
(a) static processes
(b) dynamic processes
(c) quasi-static processes
(d) stable processes

71. Calculate the enthalpy of 3 kg of fluid that occupies a volume of $1.5m^3$, if the internal energy is 3.5 M Joules/kg and the pressure is 0.3 MN/m^2: **[SSC-JE-2016]**
(a) 3.95 MJ
(b) 3.65 MJ
(c) 10.95 MJ
(d) None of these

72. In order that a cycle be reversible, following must be satisfied : **[SSC-JE-2016]**
(a) Free expansion or friction resisted expansion/compression process should not be encountered
(b) When heat is being absorbed, temperature of hot source and working substance should be same
(c) When heat is being rejected, temperature of cold source and working substance should be same
(d) All options are correct

73. If a fluid expands suddenly into vacuum through an orifice of large dimension, then such a process is called _____. **[SSC-JE-2016]**
(a) free expansion
(b) hyperbolic expansion
(c) adiabatic expansion
(d) parabolic expansion

74. When a gas flows through a very long pipe of uniform cross section, the approximately: flow is **[SSC-JE-2016]**
(a) Isentropic (b) Isobaric
(c) Isothermal (d) Adiabatic

75. A reversible process _____; **[SSC-JE-2016]**
(a) must pass through a continuous series of equilibrium states
(b) leaves no history of the events in surroundings
(c) must pass through the same states on the reversed path as on the forward path
(d) all options are correct

76. The work required for compression in a closed system increases when the value of 'n' (the index of compression) _____. **[SSC-JE-2016]**
(a) increases
(b) decreases
(c) remains the same
(d) first increases and then decreases

77. On a pressure volume diagram, the process line $PV^n = C$ (as the value of 'n' increases) will _____. **[SSC-JE-2016]**
(a) come closer to y-axis
(b) come closer to x-axis
(c) come closer to 45° inclined line
(d) remain in the same position

78. A system will be thermodynamic equilibrium only if it is in _____. **[SSC-JE-2016]**
A. Thermal equilibrium
B. Mechanical equilibrium
C. Chemical equilibrium
(a) Only A (b) Only B
(c) Only C (d) A, B and C

79. A football was inflated to a gauge pressure of 1 bar when the ambient temperature was 15°C When the game started next day, the air temperature at the stadium was 5° C Assume that the volume of the football remains constant at $2500cm^3$. The amount of heat lost by the air in the football and the gauge pressure of air in the football at the stadium respectively equal to _____. **[SSC-JE-2016]**
(a) 30.6 J and 1.94
(b) 21.8 J and 0.93
(c) 61.1 J and 1.94
(d) 43.7 J and 0.93

80. The difference between two specific heats, C_p and C_v, for a gas represents _____. **[SSC-JE-2016]**
(a) increase in kinetic energy of gas molecules
(b) increase in potential energy of gas molecules
(c) external work done
(d) increase in volume

81. Compressed air coming out from a punctured football _____. **[SSC-JE-2016]**

(a) becomes hotter
(b) becomes cooler
(c) remains at the same temperature
(d) may become hotter or cooler depending upon the humidity of the surrounding air

82. The boiling and freezing points for water marked on a temperature scale P as 130° P and –20°P respectively. What will be the reading on this scale corresponding to 60°C on Celsius scale? **[SSC-JE-2016]**

(a) 60°P (b) 70°P
(c) 90°P (d) 110°P

83. In an isothermal process, the internal energy **[SSC-JE-2016, 2014]**

(a) Increases (b) Decreases
(c) Remains constant (d) None of the above

84. Temperature of a gas is produced due to **[SSC-JE-2016]**

(a) Its heating value
(b) Kinetic energy of molecules
(c) Repulsion of molecules
(d) Attraction of molecules

85. A perfect gas at 27°C is heated at constant pressure till its volume is doubled. The final temperature is **[SSC-JE-2016]**

(a) 54°C (b) 108°C
(c) 327°C (d) 600°C

86. Which of the following is not an extensive property: **[SSC-JE-2016]**

(a) Entropy (b) Enthalpy
(c) Internal energy (d) Density

87. An Ideal gas at 27°C is heated at constant pressure till its volume becomes there times. What would be the temperature of gas? **[SSC-JE-2016]**

(a) 81°C (b) 627°C
(c) 543°C (d) 327°C

88. Total heat of a substance is also known as: **[SSC-JE-2016]**

(a) Internal energy (b) Entropy
(c) Latent heat (d) Enthalpy

89. The universal gas constant in S.I. unit is equal to **[SSC-JE-2016]**

(a) 8314 (b) 831.4
(c) 8480 (d) 848

90. The value of an extensive property is essentially dependent on **[SSC-JE-2016]**

(a) Mass of the system
(b) Interaction of the system with its surroundings
(c) Path followed by the system in going from one state to another
(d) Nature of boundaries, rigid or flexible

91. Properties of substances like pressure, temperature and density in thermodynamic coordinates are **[SSC-JE-2016]**

(a) Path function
(b) Point functions
(c) Cyclic functions
(d) Real functions

92. During a process on the closed system its internal energy increases by twice the units than the heat added to it. It is possible due to : **[SSC-JE-2016]**

(a) Radiation of heat from surroundings
(b) Lowering of the temperature
(c) Increasing of the temperature
(d) Performing of shaft work on the system

93. An open system is one in which : **[SSC-JE-2016]**

(a) Mass does not cross boundaries of the system, though energy may do so
(b) Neither mass nor energy crosses the boundaries of the system
(c) Both energy and mass cross the boundaries of the system
(d) Mass crosses the boundary but not the energy

94. For a thermodynamic process to be reversible, the temperature difference between hot body and working substance should be: **[SSC-JE-2016]**

(a) Negative (b) Infinity
(c) Maximum (d) Zero

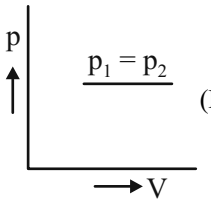
95. Maximum work by an expansion of a gas in a closed system is possible when process takes place at constant: **[SSC-JE-2016]**

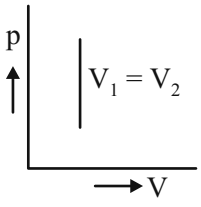
(a) Pressure (b) Temperature
(c) Volume (d) Enthalpy

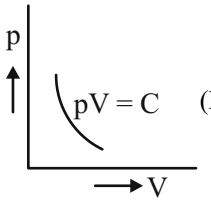
96. In a throttling process with negligible change in the potential and kinetic energies: **[SSC-JE-2016]**

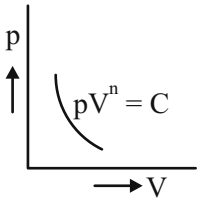
(a) The enthalpy does not remains constant
(b) The enthalpy remains constant
(c) The entropy remains constant
(d) The pressure remains constant

97. The polytropic process on p–V diagram is represented by the figure. **[SSC-JE-2016]**

(A) 

(B) 

(C) 

(D) 

(a) A only (b) B only
(c) C only (d) D only

98. The area below the P-V diagram of a non-flow process represents- **[SSC-JE-2015]**
(a) Heat transfer
(c) Entropy transfer
(b) Mass transfer
(d) Work transfer

99. Heat supplied to system equals the work done in case of non-flow process carried out **[SSC-JE-2015]**
(a) Isochorically (b) Isobarically
(c) Isothermally (d) Adiabatically

100. The process in which no heat enters or leaves the system is called- **[SSC-JE-2014]**
(a) Isobaric (b) Isothermal
(c) Isentropic (d) Isochoric

101. An isothermal process is one which : **[SSC-JE-2014]**
(a) The heat transfer of the system under consideration is zero
(b) The temperature of the system under consideration remains constant during the change
(c) The pressure of the gas in the system is proportional to the volume of the gas
(d) The internal energy of the system under consideration decreases during the change

102. Density of water is maximum at : **[SSC-JE-2014]**
(a) 0°C (b) 0°K
(c) 4°C (d) 100°C

103. Which of the following is an extensive property? **[SSC-JE-2014]**
(a) Density (b) Enthalpy
(c) Temperature (d) Pressure

104. Which gas among the following has the highest value of adiabatic index? **[SSC-JE-2014]**
(a) Oxygen (b) Methane
(c) Helium (d) Nitrogen

105. For a particular ideal gas, the value of R is 0.280 kJ/ kgK and the value of γ is 1.375. The value of C_p and C_v, are, respectively, in kJ/ kg K: **[SSC-JE-2014]**
(a) 1.111, 0.66 (b) 1.2, 0.70
(c) 1.25, 0.8 (d) 1.0267, 0.7467

106. The expression $\int_1^2 p.dV$ gives the measure of work done during **[SSC-JE-2013]**
(a) Steady flow reversible process
(b) Non-flow reversible process
(c) Open system and any process
(d) Any system and any process

107. Of the following, 'path function' quantity is **[SSC-JE-2012]**
(a) Work done (b) Pressure
(c) Enthalpy (d) Temperature

108. Which of the following is not a property of system? **[SSC-JE-2012]**
(a) Temperature (b) Pressure
(c) Specific volume (d) Heat

109. Which aspect does not pertain to a free expansion process? **[SSC-JE-2012]**
(a) Pressure remains constant
(b) No change in the temperature of the system
(c) No gain or loss of heat
(d) Work done is Zero

ANSWER KEY

1.	(d)	**2.**	(b)	**3.**	(d)	**4.**	(b)	**5.**	(b)	**6.**	(d)	**7.**	(a)
8.	(a)	**9.**	(d)	**10.**	(b)	**11.**	(b)	**12.**	(d)	**13.**	(b)	**14.**	(d)
15.	(c)	**16.**	(a)	**17.**	(d)	**18.**	(b)	**19.**	(c)	**20.**	(b)	**21.**	(b)
22.	(b)	**23.**	(d)	**24.**	(d)	**25.**	(b)	**26.**	(d)	**27.**	(a)	**28.**	(b)
29.	(a)	**30.**	(a)	**31.**	(c)	**32.**	(d)	**33.**	(d)	**34.**	(c)	**35.**	(b)
36.	(c)	**37.**	(c)	**38.**	(b)	**39.**	(c)	**40.**	(c)	**41.**	(d)	**42.**	(b)
43.	(b)	**44.**	(a)	**45.**	(d)	**46.**	(b)	**47.**	(c)	**48.**	(c)	**49.**	(a)
50.	(c)	**51.**	(d)	**52.**	(d)	**53.**	(a)	**54.**	(d)	**55.**	(c)	**56.**	(d)
57.	(b)	**58.**	(c)	**59.**	(b)	**60.**	(b)	**61.**	(a)	**62.**	(c)	**63.**	(b)
64.	(b)	**65.**	(c)	**66.**	(d)	**67.**	(a)	**68.**	(b)	**69.**	(d)	**70.**	(c)
71.	(c)	**72.**	(d)	**73.**	(a)	**74.**	(c)	**75.**	(d)	**76.**	(a)	**77.**	(a)
78.	(d)	**79.**	(d)	**80.**	(c)	**81.**	(b)	**82.**	(b)	**83.**	(c)	**84.**	(b)
85.	(c)	**86.**	(d)	**87.**	(b)	**88.**	(d)	**89.**	(a)	**90.**	(a)	**91.**	(b)
92.	(d)	**93.**	(c)	**94.**	(d)	**95.**	(a)	**96.**	(b)	**97.**	(d)	**98.**	(d)
99.	(c)	**100.**	(c)	**101.**	(b)	**102.**	(c)	**103.**	(b)	**104.**	(c)	**105.**	(d)
106.	(b)	**107.**	(a)	**108.**	(d)	**109.**	(a)						

SOLUTIONS

1. (d)

- The zeroth law of thermodynamics states that if two systems are each in thermal equilibrium with a third system, then they are in thermal equilibrium with each other.
- This law establishes the concept of temperature as a fundamental and measurable property, allowing for the definition and measurement of temperature.

2. (b)

Assertion (A): Hot tea kept in a thermos flask remains hot for a longer duration.

Reason (R): A thermos flask is an example of a closed system.

The assertion is true because a thermos flask is designed to retain heat and minimize heat loss, so hot tea remains hot for a longer period. However, the reason given is incorrect. A thermos flask is better described as an isolated system rather than a closed system, as it minimizes the exchange of both heat and matter with the surroundings. In a closed system, energy can still transfer, but matter cannot; in an isolated system, neither heat nor matter can exchange significantly with the surroundings.

3. (d)

The zeroth law of thermodynamics states that if two systems are each in thermal equilibrium with a third system, they are in thermal equilibrium with each other. It establishes the concept of temperature and thermal equilibrium, allowing us to compare temperatures between different systems.

4. (b)

The Zeroth Law of Thermodynamics states that if two systems are each in thermal equilibrium with a third system, they are in thermal equilibrium with each other. This principle is fundamental for the operation of thermometers, allowing them to measure temperature by comparing the thermal equilibrium of the thermometer with the system being measured.

5. (b)

We know that

Heat transfer (Q) = $mc\Delta T$

$$C = \frac{Q}{m\Delta T} = \frac{J}{kg \cdot K}$$

$\therefore$ Unit of specific heat (C) = J/kgK

6. (d)

The concentration difference, also known as a concentration gradient, is the primary driving force for mass transfer in a thermodynamic system. It causes the movement of substances from regions of higher concentration to regions of lower concentration, facilitating mass transfer processes such as diffusion or convection. While pressure, temperature, and mass differences can influence mass transfer, the concentration difference is the dominant factor determining the direction and rate of mass transfer.

7. (a)

System	Mass flow	Energy flow
Open	✓	✓
Closed	×	✓
Isolated	×	×

8. (a)

Thermodynamic System	Example
A. Open	3. A car radiator
B. Closed	1. The gas sealed within the cylinder of a spark-ignition engine
C. Isolated	2. Liquid nitrogen is stored in a sealed and insulated container

9. (d)

In thermodynamics, the surroundings refer to everything external to the system under consideration. The correct understanding is that the system is the specific part of the universe we are interested in studying or analyzing, while the surroundings include everything else. So, the surroundings encompass everything external to the system, not everything, including the system itself.

10. (b)

Pressure, internal energy, and temperature are properties of a thermodynamic system, while heat is a form of energy transfer between systems or between a system and its surroundings.

11. (b)

An extensive property depends on the amount of substance or the size of the system. Volume is a measure of the space occupied by the system, and it changes if the amount of substance in the system changes.

Extensive properties	Intensive properties
Mass	Temperature
Volume	Pressure
Total energy	Density
Enthalpy	Concentration
Entropy	Refractive index
Heat capacity	Viscosity
Internal energy	Chemical potential
Gibbs free energy	Electrical resistivity

12. (d)

Heat and work are forms of energy transfer that depend on the specific path taken during a process. They are not properties of the system because their values depend on how the system transitions from one state to another, unlike state functions such as temperature and pressure.

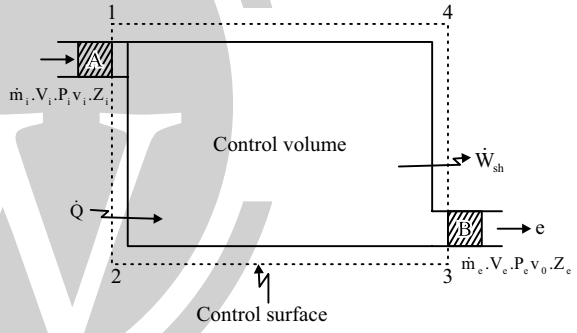
13. (b)

An isochoric process is one in which the volume remains constant. Because the volume does not change, the system does not perform work on the surroundings.

14. (d)

Thermodynamics is a branch of physical science that deals with the relations between heat and other forms of energy (such as work), and the properties of systems. It studies how energy is converted from one form to another and how it affects matter. Specifically, it focuses on the principles governing these processes and the behavior of physical systems in response to energy changes.

15. (c)



A control volume is a specified region in space through which mass may flow, and it is used for analyzing fluid flow systems like turbines, compressors, and pumps. The control volume approach helps in understanding the energy and mass transfer within a defined boundary.

16. (a)

A reversible adiabatic process (also known as an isentropic process) is a process in which there is no heat exchange between the system and its surroundings. Hence, the heat added Q is zero.

According to the first law of thermodynamics for an adiabatic process:

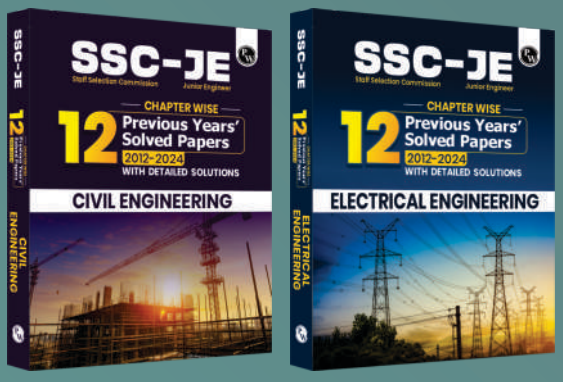
$\Delta U = Q - W$

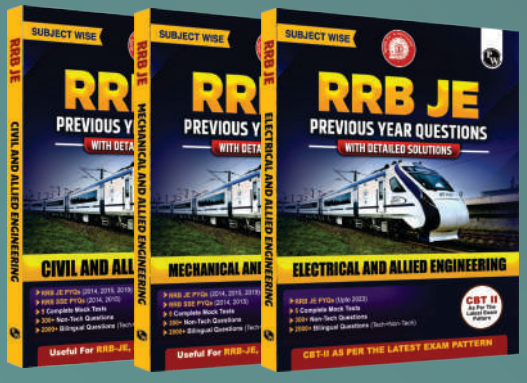
Since $Q = 0$,

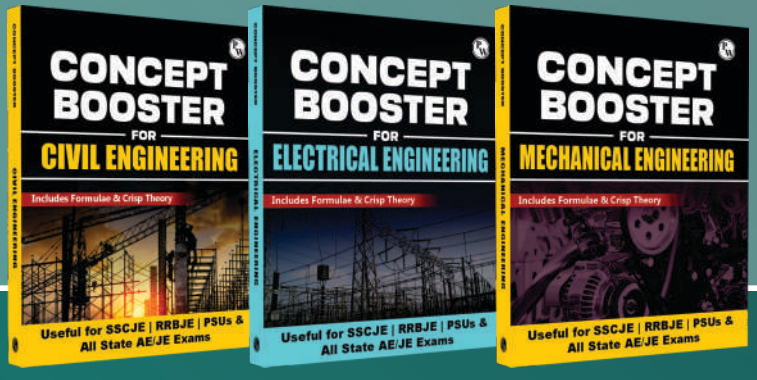
$\Delta U = -W$

Thus, in a reversible adiabatic process, no heat is added or removed from the system.

Other Useful Books for AE / JE Exams







₹ 999/-

PHYSICS WALLAH PUBLICATION

ISBN 978-93-7153-312-6

0cb24a8b-88d3-45b6-8f8b-5fc894853f93

To Buy PW Books
SCAN ME!

To share Feedback
SCAN ME!