Thermodynamics Objective Type Questions And Answers

1. Which of the following variables controls the physical properties of a perfect gas

- (a) pressure
- (b) temperature
- (c) volume
- (d) all of the above
- (e) atomic mass.

Answer : d

2. The unit of temperature in S.I. units is

- (a) Centigrade
- (b) Celsius
- (c) Fahrenheit
- (d) Kelvin
- (e) Rankine.

Answer : d

3. Which of the following laws is applicable for the behavior of a perfect gas

- (a) Boyle's law
- (b) Charles'law
- (c) Gay-Lussac law
- (d) all of the above
- (e) Joule's law.

Answer : d

4. The unit of mass in S.I. units is

- (a) kilogram
- (b) gram
- (c) tonne
- (d) quintal
- (e) newton.

Answer : a

5. The unit of length in S.I. units is

- (a) meter
- (b) centimeter
- (c) kilometer
- (d) millimeter.

Answer : a

6. The unit of time in S.I. units is

- (a) second
- (b) minute
- (c) hour
- (d) day
- (e) year.

Answer : a

7. The unit of energy in S.I. units is

- (a) watt
- (b) joule
- (c) joule/s
- (d) joule/m
- (e) joule m.

Answer : b

8. According to Gay-Lussac law for a perfect gas, the absolute pressure of given mass varies directly as

- (a) temperature
- (b) absolute
- (c) absolute temperature, if volume is kept constant
- (d) volume, if temperature is kept constant
- (e) remains constant,if volume and temperature are kept constant.

Answer : c

9. General gas equation is

- (a) PV=nRT
- (b) PV=mRT
- (d) PV = C
- (c) PV=KiRT
- (e) Cp-Cv = Wj

Answer : b

10. An ideal gas as compared to a real gas at very high pressure occupies

- (a) more volume
- (b) less volume
- (c) same volume
- (d) unpredictable behaviour
- (e) no such correlation.

Answer : a

11. Which of the following can be regarded as gas so that gas laws could be applicable, within the commonly encountered temperature limits.

- (a) 02, N2, steam, C02
- (b) Oz, N2, water vapour

- (c) S02, NH3, C02, moisture
- (d) 02, N2, H2, air
- (e) steam vapours, H2, C02.
Answer : d

12. According to Dalton's law, the total pres sure of the mixture of gases is equal to

- (a) greater of the partial pressures of all
- (b) average of the partial pressures of all
- (c) sum of the partial pressures of all
- (d) sum of the partial pressures of all divided by average molecular weight
- (e) atmospheric pressure.
Answer : c

13. The unit of pressure in S.I. units is

- (a) kg/cm2
- (b) mm of water column
- (c) pascal
- (d) dynes per square cm
- (e) bars
Answer : c

14. Temperature of a gas is produced due to

- (a) its heating value
- (b) kinetic energy of molecules
- (c) repulsion of molecules
- (d) attraction of molecules
- (e) surface tension of molecules.
Answer : b

15. A closed system is one in which

- (a) mass does not cross boundaries of the system, though energy may do so
- (b) mass crosses the boundary but not the energy
- (c) neither mass nor energy crosses the boundaries of the system
- (d) both energy and mass cross the boundaries of the system
- (e) thermodynamic reactions take place.
Answer : a

16. According to kinetic theory of gases, the absolute zero temperature is attained when

- (a) volume of the gas is zero
- (b) pressure of the gas is zero
- (c) kinetic energy of the molecules is zero
- (d) specific heat of gas is zero
- (e) mass is zero.

Answer : c

17. The pressure'of a gas in terms of its mean kinetic energy per unit volume E is equal to

- (a) E/3
- (b) E/2
- (c) 3E/4
- (d)2E/3
- (e) 5E/4.

Answer : d

18. Kinetic theory of gases assumes that the collisions between the molecules are

- (a) perfectly elastic
- (b) perfectly inelastic
- (c) partly elastic
- (d) partly inelastic
- (e) partly elastic and partly inelastic.

Answer : a

19. Kinetic energy of the molecules in terms of absolute temperature (T) is proportional to

- (a) T
- (b) j
- (c) J2
- (d) Vr
- (e) 1/Vr.

Answer : a

20. Superheated vapour behaves

- (a) exactly as gas
- (b) as steam
- (c) as ordinary vapour
- (d) approximately as a gas
- (e) as average of gas and vapour.

Answer : d

21. No liquid can exist as liquid at

- (a) – 273 °K
- (b) vacuum
- (c) zero pressure
- (d) centre of earth
- (e) in space.

Answer : c

22. Absolute zero pressure will occur

- (a) at sea level
- (b) at the center of the earth
- (c) when molecular momentum of the system becomes zero
- (d) under vacuum conditions
- (e) at a temperature of – 273 °K

Answer : c

23. The unit of power in S.I. units is

- (a) newton
- (b) pascal
- (c) erg
- (d) watt
- (e) joule.

Answer : d

24. The condition of perfect vacuum, i.e., absolute zero pressure can be attained at

- (a) a temperature of – 273.16°C
- (b) a temperature of 0°C
- (c) a temperature of 273 °K
- (d) a negative pressure and 0°C temperature
- (e) can't be attained.

Answer : a

25. Specific heat of air at constant pressure is equal to

- (a) 0.17
- (b) 0.21
- (c) 0.24
- (d) 1.0
- (e) 1.41

Answer : c

26. Intensive property of a system is one whose value

- (a) depends on the mass of the system, like volume
- (b) does not depend on the mass of the system, like temperature, pressure, etc.
- (c) is not dependent on the path followed but on the state
- (d) is dependent on the path followed and not on the state
- (e) remains constant.

Answer : b

27. Characteristic gas constant of a gas is equal to

- (a) C/C_v
- (b) C_v/C_p
- (c) $C_p - C_v$
- (d) $C_p + C_v$

- (e) Cp x Cv

Answer : c

28. The behaviour of gases can be fully determined by

- (a) 1 law
- (b) 2 laws
- (c) 3 laws
- (d) 4 laws

Answer : d

29. Boyle's law i.e. pV = constant is applicable to gases under

- (a) all ranges of pressures
- (b) only small range of pressures
- (c) high range of pressures
- (d) steady change of pressures
- (e) atmospheric conditions.

Answer : b

30. The ratio of two specific heats of air is equal to

- (a) 0.17
- (b) 0.24
- (c) 0.1
- (d) 1.41
- (e) 2.71.

Answer : d

31. Which law states that the internal energy of a gas is a function of temperature

- (a) Charles' law
- (b) Joule's law
- (c) Regnault's law
- (d) Boyle's law
- (e) there is no such law.

Answer : b

32. Which law states that the specific heat of a gas remains constant at all temperatures and pressures

- (a) Charles' Law
- (b) Joule's Law
- (c) Regnault's Law
- (d) Boyle's Law
- (e) there is no such law.

Answer : c

33. The same volume of all gases would represent their

- (a) densities
- (b) specific weights
- (c) molecular weights
- (d) gas characteristic constants
- (e) specific gravities.

Answer : c

34. An open system is one in which

- (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
- (e) thermodynamic reactions do not occur.

Answer : c

35. Gases have

- (a) only one value of specific heat
- (b) two values of specific heat
- (c) three values of specific heat
- (d) no value of specific heat
- (e) under some conditions one value and sometimes two values of specific heat.

Answer : b

36. According to which law, all perfect gases change in volume by l/273th of their original volume at 0°C for every 1°C change in temperature when pressure remains constant

- (a) Joule's law
- (b) Boyle's law
- (c) Regnault's law
- (d) Gay-Lussac law
- (e) Charles' law.

Answer : e

37. According to Avogadro's Hypothesis

- (a) the molecular weights of all the perfect gases occupy the same volume under same conditions of pressure and temperature
- (b) the sum of partial pressure of mixture of two gases is sum of the two
- (c) product of the gas constant and the molecular weight of an ideal gas is constant
- (d) gases have two values of specific heat
- (e) all systems can be regarded as closed systems.

Answer : a

38. Work done in a free expansion process is

- (a) + ve
- (b) -ve

- (c) zero
- (d) maximum
- (e) minimum.

Answer : c

39. Extensive property of a system is one whose value

- (a) depends on the mass of the system like volume
- (b) does not depend on the mass of the system, like temperature, pressure, etc.
- (c) is not dependent on the path followed but on the state
- (d) is dependent on the path followed and not on the state
- (e) is always constant.

Answer : a

40. The statement that molecular weights of all gases occupy the same volume is known as

- (a) Avogadro's hypothesis
- (b) Dalton's law
- (c) Gas law
- (d) Law of thermodynamics
- (e) Joule's law.

Answer : a

41. If a gas is heated against a pressure, keeping the volume constant, then work done will be equal to

- (a) + v
- (b) – ve
- (c) zero
- (d) pressure x volume
- (e) any where between zero and infinity.

Answer : c

42. To convert volumetric analysis to gravimetric analysis, the relative volume of each constituent of the flue gases is

- (a) divided by its molecular weight
- (b) multiplied by its molecular weight
- (c) multiplied by its density
- (d) multiplied by its specific weight
- (e) divided by its specific weight.

Answer : b

43. Properties of substances like pressure, temperature and density, in thermodynamic coordinates are

- (a) path functions
- (b) point functions
- (c) cyclic functions

- (d) real functions
- (e) thermodynamic functions.

Answer : b

44. An isolated system is one in which

- (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
- (e) thermodynamic reactions do not occur.

Answer : b

45. Which of the following quantities is not the property of the system

- (a) pressure
- (b) temperature
- (c) specific volume
- (d) heat
- (e) density.

Answer : d

46. Mixture of ice and water form a

- (a) closed system
- (b) open system
- (c) isolated system
- (d) heterogeneous system
- (e) thermodynamic system.

Answer : d

47. According to Avogadro's law, for a given pressure and temperature, each molecule of a gas

- (a) occupies volume proportional to its molecular weight
- (b) occupies volume proportional to its specific weight
- (c) occupies volume inversely proportional to its molecular weight
- (d) occupies volume inversely proportional to its specific weight
- (e) occupies same volume.

Answer : e

48. On weight basis, air contains following parts of oxygen

- (a) 21
- (b) 23
- (c) 25
- (d) 73
- (e) 79.

Answer : b

49. Which of the following is the property of a system

- (a) pressure and temperature
- (b) internal energy
- (c) volume and density
- (d) enthalpy and entropy
- (e) all of the above.

Answer : e

50. Which of the following is not the intensive property

- (a) pressure
- (b) temperature
- (c) density
- (d) heat
- (e) specific volume.

Answer : d

51. Which of the following items is not a path function

- (a) heat
- (b) work
- (c) kinetic energy
- (d) vdp
- (e) thermal conductivity.

Answer : e

52. Heat and work are

- (a) point functions
- (b) system properties
- (c) path functions
- (d) intensive properties
- (e) extensive properties.

Answer : c

53. Work done in an adiabatic process between a given pair of end states depends on

- (a) the end states only
- (b) particular adiabatic process
- (c) the value of index n
- (d) the value of heattransferred
- (e) mass of the system.

Answer : a

54. Which of the following parameters is constant for a mole for most of the gases at a given temperature and pressure

- (a) enthalpy

- (b) volume
- (c) mass
- (d) entropy
- (e) specific volume.

Answer : b

55. A perfect gas at 27°C is heated at constant pressure till its volume is double. The final temperature is

- (a) 54°C
- (b) 327°C
- (c) 108°C
- (d) 654°C
- (e) 600°C

Answer : b

56. The value of n = 1 in the polytropic process indicates it to be

- (a) reversible process
- (b) isothermal process
- (c) adiabatic process
- (d) irreversible process
- (e) free expansion process.

Answer : b

57. Solids and liquids have

- (a) one value of specific heat (ft) two values of specific heat
- (c) three values of specific heat
- (d) no value of specific heat
- (e) one value under some conditions and two values under other conditions.

Answer : a

58. If value of n is infinitely large in a polytropic process pV" = C, then the process is known as constant

- (a) volume
- (b) pressure
- (c) temperature
- (d) enthalpy
- (e) entropy.

Answer : a

59. The index of compression n tends to reach ratio of specific heats y when

- (a) flow is uniform and steady
- (b) process is isentropic
- (c) process is isothermal
- (d) process is isentropic and specific heat does not change with temperature

- (e) process is isentropic and specific heat changes with temperature.

Answer : d

60. The term N.T.P. stands for

- (a) nominal temperature and pressure
- (b) natural temperature and pressure
- (c) normal temperature and pressure
- (d) normal thermodynamic practice
- (e) normal thermodynamic pressure.

Answer : c

61. A heat exchange process in which the product of pressure and volume remains constant is known as

- (a) heat exchange process
- (b) throttling process
- (c) isentropic process
- (d) adiabatic process
- (e) hyperbolic process.

Answer : e

62. Change in enthalpy of a system is the heat supplied at

- (a) constant pressure
- (b) constant temperature
- (c) constant volume
- (d) constant entropy
- (e) N.T.P. condition.

Answer : a

63. Zeroth law of thermodynamics

- (a) deals with conversion of mass and energy
- (b) deals with reversibility and irreversibility of process
- (c) states that if two systems are both in equilibrium with a third system, they are in thermal equilibrium with each other
- (d) deals with heat engines
- (e) does not exist.

Answer : c

64. In an isothermal process, the internal energy of gas molecules

- (a) increases
- (b) decreases
- (c) remains constant
- (d) may increase/decrease depending on the properties of gas
- (e) shows unpredictable behaviour.

Answer : c

65. If a certain amount of dry ice is mixed with same amount of water at 80°C, the final temperature of mixture will be

- (a) 80°C
- (b) 0°C
- (c) 40°C
- (d) 20°C
- (e) 60°C.

Answer : b

66. One watt is equal to

- (a) 1 Nm/s
- (b) 1 N/mt
- (c) 1 Nm/hr
- (d) 1 kNm/hr
- (e) 1 kNm/mt.

Answer : a

67. Work done is zero for the following process

- (a) constant volume
- (b) free expansion
- (c) throttling
- (d) all Of the above
- (e) none of the above.

Answer : d

68. The basis for measuring thermodynamic property of temperature is given by

- (a) zeroth law of thermodynamics
- (b) first law of thermodynamics
- (c) second law of thermodynamics
- (d) third law of thermodynamics
- (e) Avogadro's hypothesis.

Answer : a

69. In a non-flow reversible process for which p = (- 3V+ 15) x 105N/m2,V changes from 1 m to 2 m3. The work done will be about

- (a) 100 xlOO5 joules
- (b) lxlO5 joules
- (c) 10 xlO5 joules
- (d) 10 xlO5 kilo joules
- (e) 10xl04ki\ojoules.

Answer : c

70. For which of the following substances, the gas laws can be used with minimum error

- (a) dry steam
- (b) wet steam
- (c) saturated steam
- (d) superheated steam
- (e) steam at atmospheric pressure.

Answer : d

71. On volume basis, air contains following parts of oxygen

- (a) 21
- (b) 23
- (c) 25
- (d) 77
- (e) 79.

Answer : a

72. The value of the product of molecular weight and the gas characteristic constant for all the gases in M.K.S. unit is

- (a) 29.27 kgfm/mol°K
- (b) 8314kgfm/mol°K
- (c) 848kgfm/mol°K
- (d) 427kgfm/mol°K
- (e) 735 kgfm/mol°K.

Answer : c

73. Universal gas constant is defined as equal to product of the molecular weight of the gas and

- (a) specific heat at constant pressure
- (b) specific heat at constant volume
- (c) ratio of two specific heats
- (d) gas constant
- (e) unity.

Answer : d

74. For which of the following substances, the internal energy and enthalpy are the functions of temperature only

- (a) any gas
- (b) saturated steam
- (c) water
- (d) perfect gas
- (e) superheated steam.

Answer : d

75. In a free expansion process

- (a) work done is zero
- (b) heat transfer is zero

- (c) both (a) and (b) above
- (d) work done is zero but heat increases
- (e) work done is zero but heat decreases.

Answer : c

77. If a gas vapour is allowed to expand through a very minute aperture, then such a process is known as

- (a) free expansion
- (b) hyperbolic expansion
- (c) adiabatic expansion
- (d) parabolic expansion
- (e) throttling.

Answer : e

78. If a fluid expands suddenly into vacuum through an orifice of large dimension, then such a process is called

- (a) free expansion
- (b) hyperbolic expansion
- (c) adiabatic expansion
- (d) parabolic expansion
- (e) throttling.

Answer : a

79. The specific heat of air increases with increase in

- (a) temperature
- (b) pressure
- (c) both pressure and temperature
- (d) variation of its constituents
- (e) air flow

Answer : a

80. Which of the following processes are thermodynamically reversible

- (a) throttling
- (b) free expansion
- (c) constant volume and constant pressure
- (d) hyperbolic and pV = C
- (e) isothermal and adiabatic.

Answer : e

81. In order that a cycle be reversible, following must be satisfied

- (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 sub¬stance should be same

- (c) when beat is being rejected, temperature of cold source and working sub-stance should be same
- (d) all of the above
- (e) none of the above.

Answer : d

82. Which of the following processes is irreversible process

- (a) isothermal
- (b) adiabatic
- (c) throttling
- (d) all of the above
- (e) none of the above.

Answer : c

83. For a thermodynamic process to be reversible, the temperature difference between hot body and working substance should be

- (a) zero
- (b) minimum
- (d) maximum
- (d) infinity
- (e) there is no such criterion.

Answer : a

84. Minimum work in compressor is possible when the value of adiabatic index n is equal to

- (a) 0.75
- (b) 1
- (c) 1.27
- (d) 1.35
- (e) 2.

Answer : b

88. For reversible adiabatic process, change in entropy is

- (a) maximum
- (b) minimum
- (c) zero
- (d) unpredictable
- (e) negative

Answer : c

89. Entropy change depends on

- (a) heat transfer
- (b) mass transfer
- (c) change of temperature
- (d) thermodynamic state

- (e) change of pressure and volume.

Answer : a

90. Isochoric process is one in which

- (a) free expansion takes place
- (b) very little mechanical work is done by the system
- (c) no mechanical work is done by the system
- (d) all parameters remain constant
- (e) mass and energy transfer do not take place.

Answer : c

91. Energy can neither be created nor destroyed but can be converted from one form to other is inferred from

- (a) zeroth low of thermodynamic
- (b) first law of thermodynamics
- (c) second law to thermodynamics
- (d) basic law of thermodynamics
- (e) claussius statement.

Answer : b

92. First law of thermodynamics furnishes the relationship between

- (a) heat and work
- (b) heat, work and properties of the system
- (c) various properties of the system
- (d) various thermodynamic processes
- (e) heat and internal energy.

Answer : b

93. According to first law of thermodynamics

- (a) work done by a system is equal to heat transferred by the system
- (b) total internal energy of a system during a process remains constant
- (c) internal energy, enthalpy and entropy during a process remain constant
- (d) total energy of a system remains constant
- (e) entropy of a system remains constant.

Answer : d

94. In an isothermal process, the internal energy

- (a) increases
- (b) decreases
- (c) remains constant
- (d) first increases and then decreases
- (e) first decreases and then increases.

Answer : c

95. Change in enthalpy in a closed system is equal to heat transferred if the reversible process takes place at constant

- (a) pressure
- (b) temperature
- (c) volume
- (d) internal energy
- (e) entropy.

Answer : a

96. Change in internal energy in a closed system is equal to heat transferred if the reversible process takes place at constant

- (a) pressure
- (b) temperature
- (c) volume
- (d) internal energy
- (e) entropy.

Answer : c

97. Total heat of a substance is also known as

- (a) internal energy
- (b) entropy
- (c) thermal capacity
- (d) enthalpy
- (e) thermal conductance.

Answer : d

98. First law of thermodynamics

- (a) enables to determine change in internal energy of the system
- (b) does not help to predict whether the system will or not undergo a change
- (c) does not enable to determine change in entropy
- (d) provides relationship between heat, work and internal energy
- (e) all of the above.

Answer : e

99. According to first law of thermodynamics

- (a) mass and energy are mutually convertible
- (b) Carnot engine is most efficient
- (c) heat and work are mutually convertible
- (d) mass and light are mutually convertible
- (e) heat flows from hot substance to cold substance.

Answer : c

100. Addition of heat at constant pressure to a gas results in

- (a) raising its temperature

- (b) raising its pressure
- (c) raising its volume
- (d) raising its temperature and doing external work
- (e) doing external work.

Answer : d

101. Measurement of temperature is based on

- (a) thermodynamic properties
- (b) zeroth law of thermodynamics
- (c) first law of thermodynamics
- (d) second law of thermodynamics
- (e) joule's law.

Answer : b

106. If heat be exchanged in a reversible manner, which of the following property of the working substance will change accordingly

- (a) temperature
- (b) enthalpy
- (c) internal energy
- (d) entropy
- (e) all of the above.

Answer : d

107. Which of the following represents the perpetual motion of the first kind

- (a) engine with 100% thermal efficiency
- (b) a fully reversible engine
- (c) transfer of heat energy from low temperature source to high temperature source
- (d) a machine that continuously creates its own energy
- (e) production of energy by temperature differential in sea water at different levels.

Answer : d

108. If a system after undergoing a series of processes, returns to the initial state then

- (a) process is thermodynamically in equilibrium
- (b) process is executed in closed system cycle
- (c) its entropy will change due to irreversibility
- (d) sum of heat and work transfer will be zero
- (e) no work will be done by the system.

Answer : d

112. A diathermic wall is one which

- (a) prevents thermal interaction
- (b) permits thermal interaction

- (c) encourages thermal interaction
- (d) discourages thermal interaction
- (e) does not exist.

Answer : b

113. The door of a running refrigerator inside a room was left open. Which of the following statements is correct?

- (a) The room will be cooled to the temperature inside the refrigerator.
- (b) The room will be cooled very slightly.
- (c) The room will be gradually warmed up.
- (d) The temperature of the air in room will remain unaffected.
- (e) any one of above is possible depending on the capacity.

Answer : c

114. An adiabatic wall is one which

- (a) prevents thermal interaction
- (b) permits thermal interaction
- (c) encourages thermal interaction
- (d) discourages thermal interaction
- (e) dos not exist.

Answer : a

115. Compressed air coming out from a punctured football

- (a) becomes hotter
- (b) becomes cooler1
- (c) remains at the same temperature
- (d) may become hotter or cooler depend-ing upon the humidity of the surround¬ing air
- (e) attains atmospheric temperature.

Answer : b

116. During throttling process

- (a) heat exchange does not take place
- (b) no work is done by expanding steam
- (c) there is no change of internal energy of steam
- (d) all of the above
- (e) entropy decreases.

Answer : d

118. The energy of molecular motion appears as

- (a) heat
- (b) potential energy
- (c) surface tension
- (d) friction
- (e) increase in pressure.

Answer : a

120. A sudden fall in the barometer reading is a sign of approaching

- (a) fine weather
- (b) rains
- (c) storm
- (d) cold wave
- (e) hot wave.

Answer : c

121. Calorie is a measure of

- (a) specific heat
- (b) quantity of heat
- (c) thermal capacity
- (d)entropy
- (e) work.

Answer : b

123. One barometric pressure or 1 atmospheric pressure is equal to

- (a) 1 kgf/cnr2
- (b) 1.033 kgf/cm2
- (c) 0 kgf/cm2
- (d) 1.0197 kgf/cm2
- (e) 100 kgf/cm2.

Answer : b

124. Barometric pressure is equal to

- (a) 760 mm Hg
- (b) zero mm Hg
- (c) 735.6 mm Hg
- (d) 1 mm Hg
- (e) 100mm Hg.

Answer : a

125. The first law of thermodynamics is the law of

- (a) conservation of mass
- (b) conservation of energy
- (c) conservation of momentum
- (d) conservation of heat
- (e) conservation of temperature.

Answer : b

126. Kelvin Planck's law deals with

- (a) conservation of heat

- (b) conservation of work
- (c) conversion of heat into work
- (d) conversion fo work into heat
- (e) conservation of mass.

Answer : c

127. A perpetual motion machine is

- (a) a thermodynamic machine
- (b) a non-thermodynamic machine
- (c) a hypothetical machine
- (d) a hypothetical machine whose opera-tion would violate the laws of thermodynamics
- (e) an inefficient machine.

Answer : d

128. According to Clausis statement of second law of thermodynamics

- (a) heat can't be transferred from low temperature source to high temperature source
- (b) heat can be transferred for low temperature to high temperature source by using refrigeration cycle.
- (c) heat can be transferred from low temperature to high temperature source if COP of process is more than unity
- (d) heat can't be transferred from low temperature to high temperature source without the aid of external energy
- (e) all of the above.

Answer : d