

BASIC THERMODYNAMICS**FULL TEST - I (JULY- 18)**

- When a gas is throttled adiabatically from a high to a low pressure
 - the enthalpy remains same
 - there is degradation of energy
 - both of the mentioned
 - none of the mentioned
- In case of Boyle's law, if pressure increases by 1% the percentage decrease in volume is:
 - $\frac{1}{101}$ %
 - $\frac{100}{101}$ %
 - $\frac{1}{100}$ %
 - 0%
- The boiling and freezing points for water are marked on a temperature scale P as $130^{\circ}P$ and $-20^{\circ}P$ respectively. What will be the reading on this scale corresponding to $60^{\circ}C$ on Celsius scale?
 - $60^{\circ}P$
 - $70^{\circ}P$
 - $90^{\circ}P$
 - $110^{\circ}P$
- Three states of matter are distinguished with respect to molecules by the _____.
 - Atoms in molecules
 - Number
 - Orientation
 - Character of motion
- A football was inflated to a gauge pressure of 1 bar when the ambient temperature was $15^{\circ}C$. When the game started next day, the air temperature at the stadium was $5^{\circ}C$. Assume that the volume of the football remains constant at 2500 cm^3 . Gauge pressure of air to which the ball must have been originally inflated so that it would equal 1 bar gauge at the stadium is _____.
 - 2.23 bar
 - 0.93 bar
 - 1.07 bar
 - 1 bar
- Which of the following is expected to have highest thermal conductivity?
 - steam
 - solid ice
 - Melting ice
 - water
- If a gas vapor is allowed to expand through a very minute aperture, then such a process is known as _____.
 - Free expansion
 - Throttling
 - Hyperbolic expansion
 - Parabolic expansion
- Which of the following can be regarded as gas so that gas laws could be applicable, within the commonly encountered temperature limits?
 - $O_2, N_2, \text{ steam}, CO_2$
 - $O_2, N_2, \text{ water vapour}$
 - $SO_2, NH_2, CO_2, \text{ moisture}$
 - $O_2, N_2, H_2, \text{ air}$
- The condition of perfect vacuum, i.e., absolute zero pressure can be attained at
 - A temperature of $-273.16^{\circ}C$
 - A temperature of $0^{\circ}C$
 - A temperature of $273^{\circ}C$
 - A negative pressure and $0^{\circ}C$ temperature
- On a pressure volume diagram, the process line $PV^n = C$ (as the value of 'n' increase) will _____.
 - Come closer to y- axis
 - Come closer to x-axis
 - Come closer to 45° inclined line
 - Remain in the same position
- In isothermal expansion, work done by gas depends upon _____.
 - Atomicity of gas only
 - Expansion ratio only
 - Adiabatic index
 - Both Atomicity of gas and expansion ratio
- During an adiabatic process, the pressure P of a fixed mass of an ideal gas changes by ΔP and its volume V changes by ΔV . The value of $\frac{\Delta V}{V}$ is given by:
 - $-\gamma \frac{\Delta P}{P}$
 - $-\frac{1}{\gamma} \frac{\Delta P}{P}$
 - $\frac{1}{\gamma^3} \frac{\Delta P}{P}$
 - $\frac{\Delta P}{P}$

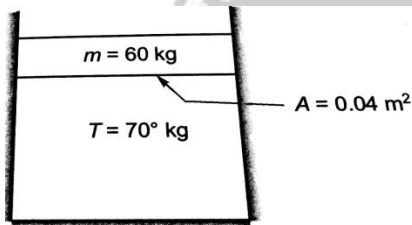
13. If two liquids at different temperatures are mixed, then the final temperature of the mixture of liquids can be obtained by using.

- (a) Zeroth law of thermodynamics
- (b) First law of thermodynamics
- (c) Second law of thermodynamics
- (d) Third law of thermodynamics

14. A closed balloon containing 10 kg of helium receives 5 kJ/kg of heat. During this process, the volume of the balloon slowly increases by 0.2m^3 at constant pressure of 100 kPa. The change in internal energy, in kJ, is:

- (a) 10
- (b) 20
- (c) 30
- (d) 70

15. The piston of a vertical piston-cylinder device containing a gas has a mass of 60 kg and a cross-sectional area 0.04 m^2 . The entire system is placed in a vacuum chamber. If temperature of the gas is 70°C . What is the pressure of gas inside the cylinder? $g = 9.8\text{ m/s}^2$.



- (a) 0.7 bar
- (b) 0 bar
- (c) 0.3 bar
- (d) 0.147 bar

16. The more effective way of increasing efficiency of Carnot engine is to _____.

- (a) Increase higher temperature.
- (b) Decreases higher temperature.
- (c) Increase lower temperature
- (d) Decrease lower temperature

17. The process of sublimation is found to occur in the case of

- (a) Liquid nitrogen
- (b) Solid CO_2
- (c) Solid O_2
- (d) Steel

18. For a particular ideas gas, the value of R is 0.280 kJ/kg K and the value of γ is 1.375. The value of C_p and C_v are, respectively, in kJ/kg K :

- (a) 1.25, 0.8
- (b) 1.0267, 0.7567
- (c) 1.111, 0.66
- (d) 1.2, 0.70

19. When water at atmospheric pressure is heated from 30 to 75 degree Centigrade, then the heat absorbed is known as _____.

- (a) Specific heat
- (b) Sensible heat
- (c) Latent heat
- (d) Normal heat

20. When two gases suddenly mix up with each other then resultant entropy of the system will

- (a) Decrease
- (b) Increase
- (c) Remain same
- (d) May increases or decrease depending upon the initial conditions of the gases

21. A process occurs spontaneously if its entropy _____.

- (a) Increases
- (b) Decreases
- (c) Remains the same
- (d) Becomes zero

22. A heat engine is an device that operates on a thermodynamic cycle

- (a) To convert the heat supplied into complete work energy under reversible conditions
- (b) To convert the heat supplied into complete work energy under all conditions
- (c) To produce useful work from the heat received from a source and also rejects the remaining heat to sink under all conditions
- (d) To produce useful work from the heat received from a source and also rejects the remaining heat to sink under reversible conditions

23. A perpetual motion machine of the first kind i.e. a machine which produces power without consuming any energy is _____.

- Possible according to first law thermodynamics
- Impossible according to first law thermodynamics
- Impossible according to second law thermodynamics
- Possible according to second law of thermodynamics

24. An insulated rigid vessel contains some gas and an electric resistor. In certain interval of time, the resistance connected to an external electric power heats the gas. Considering the vessel and its contents as the system

- heat and work transfer are zero
- heat and work transfer are positive
- heat transfer is zero and work transfer is negative
- heat transfer is positive and work transfer is zero

25. The pressure exerted on the walls of a container by a gas is due to the fact that gas molecules

- stick to the walls of the container
- lose their kinetic energy
- get accelerated towards the wall
- change their momentum due to collision with the wall

26. On a P-V-T surface, the triple point and critical point are seen respectively as

- line, line
- line, point
- point, point
- point, line

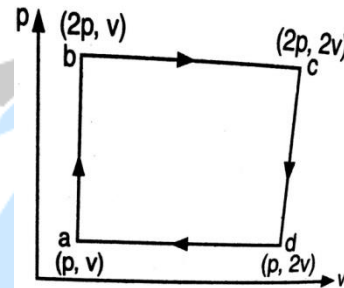
27. Which one of the following is the fluid whose properties in all its three phases are made use of thermodynamics?

- Ammonia
- Freon
- Helium
- Water

28. In a general compression process, 1 kJ of mechanical work is supplied to 2 kg of fluid and 400 J of heat is rejected to the cooling jacket. The change in specific internal energy would be

- 700 J
- 350 J
- 300 J
- 600 J

29. Refer to cycle abcd executed by an ideal gas. The net work done during the cycle equals



- Zero
- pv
- $3pv$
- $4pv$

30. An ideal gas of mass m in state A expands to state point B via three paths (Fig. 9.10). If Q_1 , Q_2 , and Q_3 represent the heat absorbed by the gas along these paths, then

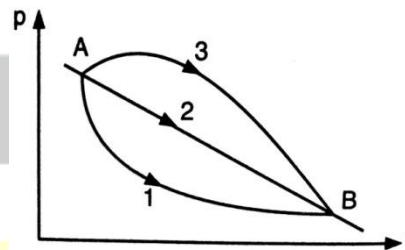
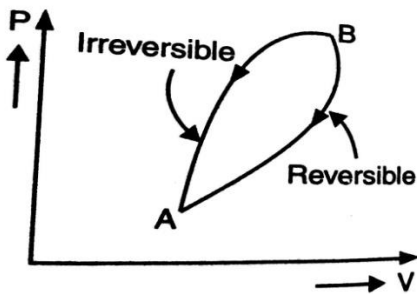


Fig.9.10.

- $Q_1 < Q_2 < Q_3$
- $Q_1 > Q_2 > Q_3$
- $Q_1 < Q_2 > Q_3$
- $Q_1 > Q_2 < Q_3$

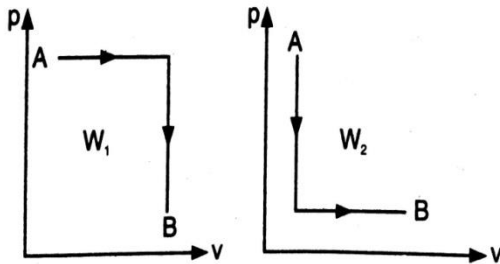
31. With reference to figure given below, consider two paths, one reversible and one irreversible that change the state of the system from state point A to state B.



- (a) ΔU , Q and W are same
 (b) ΔU is same
 (c) Q and W are same
 (d) ΔU and Q are different

32. An ideal gas is made to go from state A to state B in the following two different ways:

- As isobaric and then an isochoric process
- An isochoric and then an isobaric process



The work done by the gas in two cases is W_1 and W_2 respectively. Then

- (a) $W_1 = W_2$
 (b) $W_1 > W_2$
 (c) $W_1 < W_2$
 (d) $W_1 = \frac{1}{4} W_2$

33. During steady flow compression process of a gas with mass flow rate of 2 kg/s, increase in specific enthalpy is 15 kJ/kg and decrease in kinetic energy is 2 kJ/kg. If the rate of heat rejection to the environment is 3 kW, the power needed to drive the compressor would be

- (a) 23 kW
 (b) 26 kW
 (c) 29 kW
 (d) 37 kW

34. In a reversible isothermal expansion process the fluid expands from 10 bar and 2m^3 to 2 bar and 10m^3 . During this expansion process, 100 kW of heat is supplied. Then the work done during the process is

- (a) 33.3 kW
 (b) 100 kW
 (c) 80 kW
 (d) 20 kW

35. Neglecting changes in potential and kinetic energies, the shaft work during a steady flow process is given by

- (a) $\int p dv$
 (b) $\int v dp$
 (c) pv
 (d) $-\Delta h$

36. A perpetual motion of first is represented by

- (a) fully reversible engine
 (b) an engine with 100 per cent thermal efficiency
 (c) a machine that continuously creates its own energy
 (d) a machine that is capable of transferring heat energy from a system at low temperature to a system at high temperature

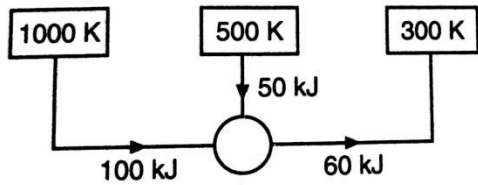
37. A Carnot cycle is having an efficiency of 0.75. If the temperature of the high temperature reservoir is 727°C , what is the temperature of low temperature reservoir?

- (a) 23°C
 (b) -23°C
 (c) 0°C
 (d) 250°C

38. For a heat engine operating on Carnot cycle, the work output is $1/4^{\text{th}}$ of the heat rejected to the sink. The thermal efficiency of the engine would be

- (a) 10%
 (b) 20%
 (c) 30%
 (d) 50%

39. A cyclic device operates between thermal reservoirs as shown in the figure given below:



Heat is transferred to/from the cyclic device and it is assumed that the heat transfer between each thermal reservoir and the cyclic device takes place across negligible temperature difference. The cyclic device can be

- (a) A reversible heat engine
- (b) A reversible heat pump or a reversible refrigeration
- (c) An irreversible heat engine
- (d) An irreversible heat pump or an irreversible refrigerator

40. A system of 100 kg mass undergoes a process in which its specific entropy increases from 0.3 kJ/kg K to 0.4 kJ/kg K. At the same time, the entropy of the surroundings decreases from 80 kJ/kg K to 75 kJ/kg K. The process is:

- (a) Reversible and isothermal
- (b) Irreversible
- (c) Reversible
- (d) Impossible

41. For any natural process, the entropy change would be

- (a) Zero
- (b) Positive
- (c) Negative
- (d) Unpredictable; insufficient data

42. Which one of the following relations defines the Helmholtz function F ?

- (a) $F = H + TS$
- (b) $F = H - TS$
- (c) $F = U - TS$
- (d) $F = U + TV$

43. Slope of constant volume line on temperature entropy diagram is given by

- (a) $\frac{c_p}{T}$
- (b) $\frac{T}{c_p}$
- (c) $\frac{c_v}{T}$
- (d) $\frac{T}{c_v}$

44. For a pure substance, the Maxwell's relation obtained from the fundamental property relation $du = Tds - pdv$ is

- (a) $\left(\frac{\partial T}{\partial v}\right)_s = -\left(\frac{\partial p}{\partial s}\right)_v$
- (b) $\left(\frac{\partial p}{\partial T}\right)_v = \left(\frac{\partial s}{\partial v}\right)_T$
- (c) $\left(\frac{\partial T}{\partial p}\right)_s = \left(\frac{\partial v}{\partial s}\right)_p$
- (d) $\left(\frac{\partial v}{\partial T}\right)_p = \left(\frac{\partial s}{\partial p}\right)_T$

45. Coefficient of volume expansivity is given by

- (a) $\frac{1}{v}\left(\frac{dv}{dT}\right)_p$
- (b) $\left(\frac{dT}{dv}\right)_p$

(c) $-\left(\frac{dP}{dT}\right)_v$

(d) $-\frac{1}{v}\left(\frac{dv}{dP}\right)$

46. The throttling of certain gases may be used for getting the refrigerating effect. The value of Joule co-efficient for such a process is

- (a) $\mu = 0$
- (b) $\mu = 1$
- (c) $\mu < 0$
- (d) $\mu > 1$

47. The Clausius-Clapeyron equation gives the slope of curve on

- (a) $p - v$ plot
- (b) $p - h$ plot
- (c) $p - T$ plot
- (d) $T - s$ plot

48. In the van der Waal's equation

$$\left(p + \frac{a}{v^2}\right)(v - b) = RT$$

The constant b accounts for

- (a) The finite volume occupied by the gas molecules
- (b) The molecular forces of attraction
- (c) The elastic collisions between the gas molecules
- (d) The momentum of gas molecules in random fashion

49. Joule-Thomson co-efficient is given as:

- (a) $\left(\frac{\partial T}{\partial h}\right)_p$
- (b) $\left(\frac{\partial T}{\partial p}\right)_h$
- (c) $\left(\frac{\partial v}{\partial T}\right)_p$
- (d) $\left(\frac{\partial p}{\partial T}\right)_h$

50. A heat source H_1 can supply 6000 kJ/min at 300°C and another heat source H_2 can supply 60000 kJ/min at 100°C . Which one of the following statements is correct if the surroundings are at 27°C ?

- (a) Both the heat sources have the same efficiency
- (b) The first heat source has lower efficiency
- (c) The second heat source has lower efficiency
- (d) The first heat source produces higher power

51. The change in specific entropy of a system undergoing a reversible process is given by

$$s_2 - s_1 = (c_p - c_v) \ln(V_2/V_1)$$

This is valid for which one of the following?

- (a) Adiabatic process undergone by an ideal gas
- (b) Isothermal process undergone by an ideal gas
- (c) Polytrophic process undergone by a real gas
- (d) Isobaric phase change from liquid to vapour

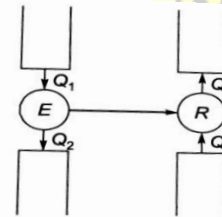
52. A system of 100 kg mass undergoes a process in which its specific entropy increases from 0.3 kJ/kg K to 0.4 kJ/kg K. At the same time, the entropy of the surroundings decreases from 80 kJ/K to 75 kJ/K. The process is:

- (a) Reversible and isothermal
- (b) Irreversible
- (c) Reversible only
- (d) Isothermal only

53. An ideal heat engine, operating on a reversible cycle, produces 9 kW. The engine operates between 27°C and 927°C . What is the fuel consumption given that the calorific value of the fuel is 40000 kJ/kg?

- (a) 0.8 kg/hr
- (b) 1.02 kg/hr
- (c) 1.08 kg/hr
- (d) 1.28 kg/hr

54. In the figure shown below, E is the heat engine with efficiency of 0.4 and R is the refrigerator. If $Q_2 + Q_4 = 3Q_1$, the COP of the refrigerator will be



- (a) 3.0
- (b) 4.5
- (c) 5.0
- (d) 5.5

55. The COP of an ideal refrigerator is N . If the machine is operated as a heat pump between the same temperature limits, its COP will be

- (a) $N - 1$
- (b) N
- (c) $N + 1$
- (d) $2N$

56. A liquid of heat capacity 5 J/K in an insulated container is heated electrically from 300 K to 600 K . If $\ln 2 = 0.693$, entropy generation of the universe would be

- (a) 6.93 J/K
- (b) 3.465 J/K
- (c) 34.65 J/K
- (d) 10.65 J/K

57. Which of the following relationships represents the change of entropy of a perfect gas?

$$1. C_p \frac{dT}{T} + \frac{R}{V} dV$$

$$2. C_v \frac{dT}{T} - \frac{R}{P} dP$$

$$3. C_v \frac{dT}{T} + C_p \frac{dV}{V}$$

$$4. C_p \frac{dP}{P} - C_v \frac{dV}{V}$$

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

58. For a real thermodynamic cycle, which one of the following is correct?

$$(a) \oint \frac{dQ}{T} > 0$$

$$(b) \oint \frac{dQ}{T} < 0$$

$$(c) \oint \frac{dQ}{T} = 0$$

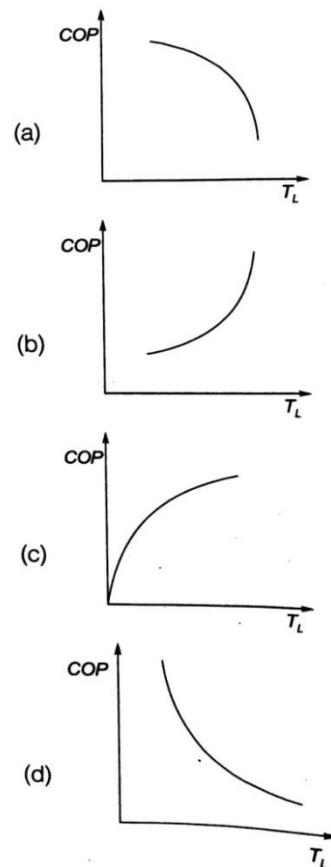
$$(d) \oint ds = 0$$

59. Three engines A, B and C operating on Carnot cycle use working substances as Argon, Oxygen and Air respectively. Which engine will have higher efficiency?

- (a) Engine A
- (b) Engine B
- (c) Engine C

(d) All engines have same efficiency

60. For a given value of T_H (Source temperature) for a reversed Carnot cycle, the variation of T_L (Sink temperature) for different values of COP is represented by which one of the following graphs?



**Basic Thermodynamics Test
Anskey-2018**

- | | |
|-------|-------|
| 1. c | 31. b |
| 2. b | 32. b |
| 3. b | 33. c |
| 4. d | 34. b |
| 5. b | 35. b |
| 6. b | 36. c |
| 7. b | 37. b |
| 8. d | 38. b |
| 9. a | 39. a |
| 10. a | 40. b |
| 11. b | 41. b |
| 12. b | 42. c |
| 13. b | 43. d |
| 14. c | 44. a |
| 15. d | 45. a |
| 16. d | 46. d |
| 17. b | 47. c |
| 18. b | 48. a |
| 19. b | 49. b |
| 20. b | 50. c |
| 21. a | 51. b |
| 22. c | 52. b |
| 23. b | 53. c |
| 24. d | 54. c |
| 25. d | 55. c |
| 26. b | 56. b |
| 27. d | 57. b |
| 28. c | 58. b |
| 29. b | 59. d |
| 30. a | 60. c |



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