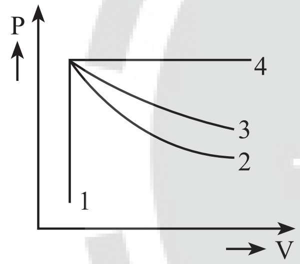
Chapter 11 Thermodynamics

Thermodynamic Processes and First Law of Thermodynamics

1. An ideal gas undergoes four different processes from the same initial state as shown in the figure below. Those processes are adiabatic, isothermal isobaric and isochoric. The curve which represents the adiabatic process among 1, 2, 3 and 4 is: *(2022)*

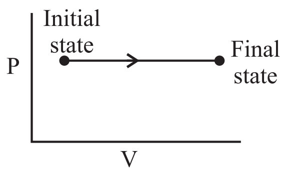


a. 4 b. 1
c. 2 d. 3

2. Two cylinders A and B of equal capacity are connected to each other via a stop cock. A contains an ideal gas at standard temperature and pressure. B is completely evacuated. The entire system is thermally insulated. The stop cock is suddenly opened. The process is: *(2020)*

a. Adiabatic b. Isochoric
c. Isobaric d. Isothermal

3. The P-V diagram for an ideal gas in a piston cylinder assembly undergoing a thermodynamic process is shown in the figure. The process is *(2020-Covid)*

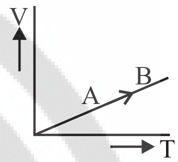


a. Isochoric b. Isobaric
c. Isothermal d. Adiabatic

4. In which of the following processes, heat is neither absorbed nor released by a system? *(2019)*

a. Isothermal b. Adiabatic
c. Isobaric d. Isochoric

5. The volume (V) of a monoatomic gas varies with its temperature (T), as shown in the graph. The ratio of the work done by the gas, to the heat absorbed by it, when it undergoes a change from state A to State B, is *(2018)*

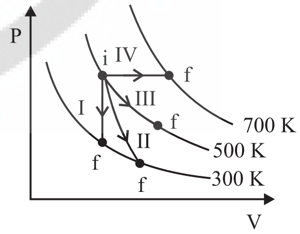


a. $\frac{1}{3}$ b. $\frac{2}{3}$
c. $\frac{2}{5}$ d. $\frac{2}{7}$

6. A sample of 0.1 g of water at 100°C and normal pressure (1.013×10^5 Nm^{-2}) requires 54 cal of heat energy to convert to steam at 100°C. If the volume of the steam produced is 167.1 cc, the change in internal energy of the sample, is: *(2018)*

a. 42.2 J b. 208.7 J
c. 104.3 J d. 84.5 J

7. Thermodynamic processes are indicated in the following diagram. *(2017-Delhi)*



Match the following:

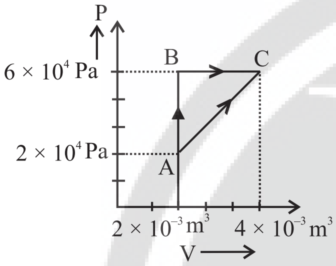
Column-I	Column-II
P. Process I	a. Adiabatic
Q. Process II	b. Isobaric
R. Process III	c. Isochoric
S. Process IV	d. Isothermal

a. P → c, Q → a, R → d, S → b
b. P → c, Q → d, R → b, S → a
c. P → d, Q → b, R → a, S → c
d. P → a, Q → c, R → d, S → b

8. A gas is compressed isothermally to half its initial volume. The same gas is compressed separately through an adiabatic process until its volume is again reduced to half. Then: *(2016 - I)*

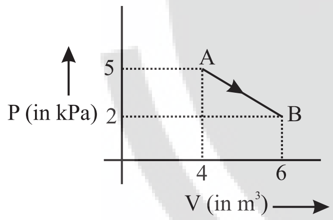
a. Compressing the gas isothermally will require more work to be done
b. Compressing the gas through adiabatic process will require more work to be done
c. Compressing the gas isothermally or adiabatically will require the same amount of work
d. Which of the case (whether compression through isothermal or through adiabatic process) requires more work will depend upon the atomicity of the gas

9. Figure below shows two paths that may be taken by a gas to go from a state A to a state C. In process AB, 400 J of heat is added to the system and in process BC, 100 J of heat is added to the system. The heat absorbed by the system in the process AC will be: *(2015)*



a. 500 J
b. 460 J
c. 300 J
d. 380 J

10. One mole of an ideal diatomic gas undergoes a transition from A to B along a path AB as shown in the figure,



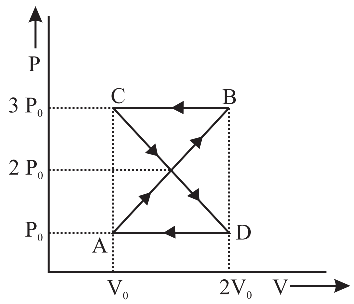
The change in internal energy of the gas during the transition is: *(2015)*

a. –20 kJ
b. 20 J
c. –12 kJ
d. 20 kJ

11. An ideal gas is compressed to half its initial volume by means of several processes. Which of the process results in the maximum work done on the gas? *(2015 Re)*

a. Isothermal
b. Adiabatic
c. Isobaric
d. Isochoric

12. A thermodynamic system undergoes cyclic process ABCDA as shown in figure. The work done by the system in the cycle is: *(2014)*



a. P_0V_0
b. $2\ P_0V_0$
c. $\frac{P_0V_0}{2}$
d. Zero

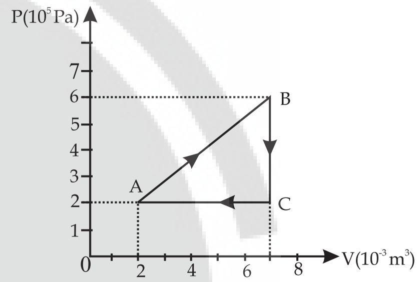
13. A monoatomic gas at a pressure P, having a volume V expands isothermally to a volume 2 V and then adiabatically to a volume 16 V. The final pressure of the gas is (take $\gamma = 5/3$): *(2014)*

a. 64 P
b. 32 P
c. P/64
d. 16 P

14. During an adiabatic process, the pressure of a gas is found to be proportional to the cube of its temperature. The ratio of $\frac{C_P}{C_v}$ for the gas is: *(2013)*

a. 3/2
b. 2
c. 4/3
d. 5/3

15. A gas is taken through the cycle A → B → C → A, as shown. What is the net work done by the gas? *(2013)*



a. –2000 J
b. 2000 J
c. 1000 J
d. Zero

Second Law of Thermodynamics & Refrigerator

16. The temperature inside a refrigerator is t_2°C and the room temperature is t_1°C. The amount of heat delivered to the room for each joule of electrical energy consumed ideally will be: **[RC]** *(2016 - II)*

a. $\frac{t_1° + 273}{t_1° + t_2°}$
b. $\frac{t_1° + t_2°}{t_1° + 273}$
c. $\frac{t_1°}{t_1° + t_2°}$
d. $\frac{t_1° + 273}{t_1° - t_2°}$

17. A refrigerator works between 4°C and 30°C. It is required to remove 600 calories of heat every second in order to keep the temperature of the refrigerated space constant. The power required is
(Take 1 cal = 4.2 joules): **[RC]** *(2016 - I)*

a. 2.365 W
b. 23.65 W
c. 236.5 W
d. 2365 W

18. The coefficient of performance of a refrigerator is 5. If the temperature inside freezer is –20°C, the temperature of the surroundings to which it rejects heat is: **[RC]** *(2015 Re)*

a. 21°C
b. 31°C
c. 41°C
d. 11°C

Carnot Engine

19. The efficiency of a carnot engine depends upon **[RC]** *(2020-Covid)*

a. The temperatures of the source and sink
b. The volume of the cylinder of the engine
c. The temperature of the source only
d. The temperature of the sink only

20. The efficiency of an ideal heat engine working between the freezing point and boiling point of water, is: **[RC]** *(2018)*

a. 6.25% b. 20%
c. 26.8% d. 12.5%

21. A carnot engine having an efficiency of 1/10 as heat engine, is used as a refrigerator. If the work done on the system is 10 J, the amount of energy absorbed from the reservoir at lower temperature is: **[RC]** *(2017-Delhi)*

a. 90 J b. 99 J
c. 100 J d. 1 J

22. Carnot engine, having an efficiency of η =1/10. As heat engine, is used as a refrigerator. If the work done on the system is 10 J, the amount of energy absorbed from the reservoir at lower temperature is: **[RC]** *(2015)*

a. 99 J b. 90 J
c. 1 J d. 100 J

Answer Key

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
c	a	b	b	c	b	a	b	b	a	b	d	c	a	c	d	c
18	19	20	21	22												
b	a	c	a	b												