Thermodynamics JEE Main PYQ - 2

Total Time: 25 Minute **Total Marks:** 40

Instructions

Instructions

1. Test will auto submit when the Time is up.
2. The Test comprises of multiple choice questions (MCQ) with one or more correct answers.
3. The clock in the top right corner will display the remaining time available for you to complete the examination.

Navigating & Answering a Question

1. The answer will be saved automatically upon clicking on an option amongst the given choices of answer.
2. To deselect your chosen answer, click on the clear response button.
3. The marking scheme will be displayed for each question on the top right corner of the test window.

Thermodynamics

1. A Carnot freezer takes heat from water at $0^{\circ}C$ inside it and rejects it to the room at a temperature of $27^{\circ}C$. The latent heat of ice is $336 \times 10^{3} J\, kg^{-1}$. If $5\, kg$ of water at $0^{\circ}C$ is converted into ice at $0^{\circ}C$ by the freezer, then the energy consumed by the freezer is close to : **(+4, -1)**

[Online April 10, 2016]

a. $1.67 \times 10^{5}\, J$

b. $1.68 \times 10^{6}\, J$

c. $1.51 \times 10^{5}\, J$

d. $1.71 \times 10^{7}\, J$

---

2. A gas can be taken from A to B via two different processes ACB and ADB. When path ACB is used $60\, J$ of heat flows into the system and $30\, J$ of work is done by the system. If path ADB is used work done by the system is $10\, J$. The heat Flow into the system in path ADB is : **(+4, -1)**

[9 Jan. 2019 I]

a. 80 J

b. 20 J

c. 100 J

d. 40 J

---

3. A gas is compressed from a volume of $2\, m^{3}$ to a volume of $1\, m^{3}$ at a constant pressure of $100\, N/m^{2}$. Then it is heated at constant volume by supplying $150\, J$ of energy. As a result, the internal energy of the gas : **(+4, -1)**

[10-Apr-2023 shift 2]

a. Increases by 250 J

b. Decreases by 250 J

c. Increases by 50 J

d. Decreases by 50 J

4. A rigid diatomic ideal gas undergoes an adiabatic process at room temperature,. The relation between temperature and volume of this process is TV^x = constant, then x is : [20 Jul 2021 Shift 1] **(+4, -1)**

a. $\frac{5}{3}$

b. $\frac{2}{5}$

c. $\frac{2}{3}$

d. $\frac{3}{5}$

---

5. A sample of an ideal gas is taken through the cyclic process abca as shown in the figure. The change in the internal energy of the gas along the path ca is $-180\,J$. The gas absorbs $250\,J$ of heat along the path ab and $60\,J$ along the path bc. The work done by the gas along the path abc is : [28-Jun-2022-Shift-2] **(+4, -1)**

a. 100 J

b. 120 J

c. 140 J

d. 130 J

---

6. A thermally insulated vessel contains $150\,g$ of water at $0^\circ C$. Then the air from the vessel is pumped out adiabatically. A fraction of water turns into ice and the rest evaporates at $0^\circ C$ itself. The mass of evaporated water will be closest to : (Latent heat of vaporization of water $= 2.10 \times 10^6\ J\ kg^{-1}$ and Latent heat of Fusion of water = $3.36 \times 10^5\ J\ kg^{-1}$) [26-Jun-2022-Shift-1] **(+4, -1)**

a. 130 g

b. 35 g

c. 20 g

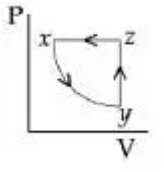
d. 150 g

---

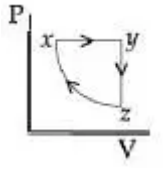
7. A thermodynamic cycle $xyzx$ is shown on a $V-T$ diagram. The $P-V$ diagram that best describes this cycle is : (Diagrams are schematic and not to scale) **(+4, -1)**

[8 Jan. 2020 I]

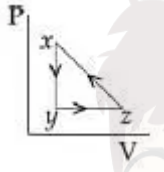
a.



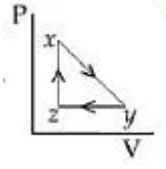
b.



c.



d.



---

8. An engine operates by taking n moles of an ideal gas through the cycle $ABCDA$ shown in figure. The thermal efficiency of the engine is : (Take $C_v = 1.5\,R$, where R is gas constant) **(+4, -1)**

[NA•6•Sep.•2020•(II)]

a. 0.24

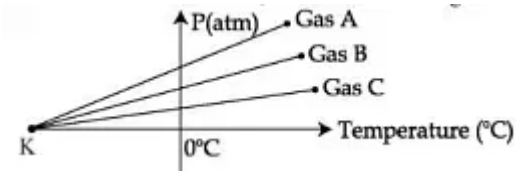
b. 0.15

c. 0.32

d. 0.08

---

9. For three low density gases A, B, C pressure versus temperature graphs are plotted while keeping them at constant volume, as shown in the figure. **(+4, -1)**



[1-Feb-2023 Shift 2]

The temperature corresponding to the point ' K ' is :

a. $-373^{\circ}C$

b. $-40^{\circ}C$

c. $-100^{\circ}C$

d. $-273^{\circ}C$

---

10. The combination of plots which does not represent isothermal expansion of an ideal gas is: **(+4, -1)**

[17 Mar 2021 Shift 1]

a. (A) and (C)

b. (A) and (D)

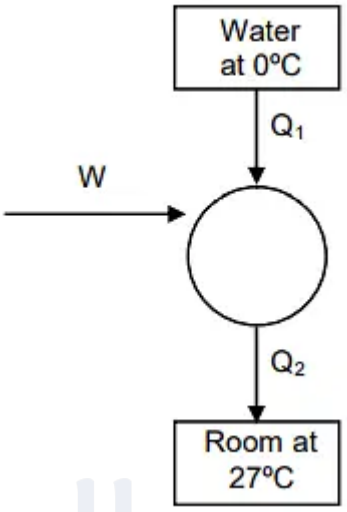
c. (B) and (D)

d. (B) and (C)

Answers

1. **Answer: a**

Explanation:



heat required to freeze $5\,kg$

water $= 5 \times 336 \times 10^3$

$= 1680 \times 10^3$ Joule

$\Rightarrow Q_1 = 1680\,KJ$

for carnot's cycle

$\frac{Q_2}{Q_1} = \frac{T_2}{T_1}$

$\frac{Q_2}{1680} = \frac{300}{273}$

$Q_2 = 1680 \times \frac{300}{273}\,KJ$

$W = Q_2 - Q_1$

$= 1680\left(\frac{300}{273} - 1\right)$

$= \frac{1680 \times 27}{273} \times 10^3\,J$

$= 166.15 \times 10^3\,J$

$= 1.66 \times 10^5\,KJ$

Concepts:

1. **Thermodynamics:**

Thermodynamics in physics is a branch that deals with heat, work and temperature, and their relation to energy, radiation and physical properties of matter.

Important Terms

System

A thermodynamic system is a specific portion of matter with a definite boundary on which our attention is focused. The system boundary may be real or imaginary, fixed or deformable.

There are three types of systems:

- **Isolated System –** An isolated system cannot exchange both energy and mass with its surroundings. The universe is considered an isolated system.
- **Closed System –** Across the boundary of the closed system, the transfer of energy takes place but the transfer of mass doesn't take place. Refrigerators and compression of gas in the piston-cylinder assembly are examples of closed systems.
- **Open System –** In an open system, the mass and energy both may be transferred between the system and surroundings. A steam turbine is an example of an open system.

Thermodynamic Process

A system undergoes a thermodynamic process when there is some energetic change within the system that is associated with changes in pressure, volume and internal energy.

There are four types of thermodynamic process that have their unique properties, and they are:

- **Adiabatic Process** – A process in which no heat transfer takes place.
- **Isochoric Process** – A thermodynamic process taking place at constant volume is known as the isochoric process.
- **Isobaric Process** – A process in which no change in pressure occurs.
- **Isothermal Process** – A process in which no change in temperature occurs.

Laws of Thermodynamics

Zeroth Law of Thermodynamics

The Zeroth law of thermodynamics states that if two bodies are individually in equilibrium with a separate third body, then the first two bodies are also in thermal equilibrium with each other.

First Law of Thermodynamics

The First law of thermodynamics is a version of the law of conservation of energy, adapted for thermodynamic processes, distinguishing three kinds of transfer of energy, as heat, as thermodynamic work, and as energy associated with matter transfer, and relating them to a function of a body's state, called internal energy.

Second Law of Thermodynamics

The Second law of thermodynamics is a physical law of thermodynamics about heat and loss in its conversion.

Third Law of Thermodynamics

Third law of thermodynamics states, regarding the properties of closed systems in thermodynamic equilibrium: The entropy of a system approaches a constant value when its temperature approaches absolute zero.

---

2. Answer: d

Explanation:

$$\Delta Q_{ACB} = \Delta W_{ACB} + \Delta U_{ACB}$$
$$\Rightarrow \ 60J = 30J + \Delta U_{ACB}$$
$$\Rightarrow \ \Delta U_{ACB} = 30 \ J$$
$$\Rightarrow \ \Delta U_{ADB} = \Delta U_{ACB} = 30 \ J$$
$$\Delta Q_{ACD} = \Delta U_{ACB} + \Delta W_{ADB}$$
$$= 10 \, J + 30 \, J = 40 \, J$$

Concepts:

1. Thermodynamics:

Thermodynamics in physics is a branch that deals with heat, work and temperature, and their relation to energy, radiation and physical properties of matter.

Important Terms

System

A thermodynamic system is a specific portion of matter with a definite boundary on which our attention is focused. The system boundary may be real or imaginary, fixed or deformable.

There are three types of systems:

- **Isolated System –** An isolated system cannot exchange both energy and mass with its surroundings. The universe is considered an isolated system.
- **Closed System –** Across the boundary of the closed system, the transfer of energy takes place but the transfer of mass doesn't take place. Refrigerators and compression of gas in the piston-cylinder assembly are examples of closed systems.
- **Open System –** In an open system, the mass and energy both may be transferred between the system and surroundings. A steam turbine is an example of an open system.

Thermodynamic Process

A system undergoes a thermodynamic process when there is some energetic change within the system that is associated with changes in pressure, volume and internal energy.

There are four types of thermodynamic process that have their unique properties, and they are:

- **Adiabatic Process** – A process in which no heat transfer takes place.
- **Isochoric Process** – A thermodynamic process taking place at constant volume is known as the isochoric process.
- **Isobaric Process** – A process in which no change in pressure occurs.
- **Isothermal Process** – A process in which no change in temperature occurs.

Laws of Thermodynamics

Zeroth Law of Thermodynamics

The Zeroth law of thermodynamics states that if two bodies are individually in equilibrium with a separate third body, then the first two bodies are also in thermal equilibrium with each other.

First Law of Thermodynamics

The First law of thermodynamics is a version of the law of conservation of energy, adapted for thermodynamic processes, distinguishing three kinds of transfer of energy, as heat, as thermodynamic work, and as energy associated with matter transfer, and relating them to a function of a body's state, called internal energy.

Second Law of Thermodynamics

The Second law of thermodynamics is a physical law of thermodynamics about heat and loss in its conversion.

Third Law of Thermodynamics

Third law of thermodynamics states, regarding the properties of closed systems in thermodynamic equilibrium: The entropy of a system approaches a constant value when its temperature approaches absolute zero.

---

3. Answer: a

Explanation:

The correct answer is (A) : Increases by 250 J
As we know,
$\Delta Q = \Delta u + \Delta w$
(I^{st} law of thermodynamics)
$\Rightarrow \Delta Q = \Delta u + P\Delta v$
or $150 = \Delta u + 100\,(1-2)$
$= \Delta u - 100$
$\therefore \Delta u = 150 + 100 = 250J$
So, the internal energy of the gas increases by $250\,J$

Concepts:

1. Thermodynamics:

Thermodynamics in physics is a branch that deals with heat, work and temperature, and their relation to energy, radiation and physical properties of matter.

Important Terms

System

A thermodynamic system is a specific portion of matter with a definite boundary on which our attention is focused. The system boundary may be real or imaginary, fixed or deformable.

There are three types of systems:

- **Isolated System –** An isolated system cannot exchange both energy and mass with its surroundings. The universe is considered an isolated system.
- **Closed System –** Across the boundary of the closed system, the transfer of energy takes place but the transfer of mass doesn't take place. Refrigerators and compression of gas in the piston-cylinder assembly are examples of closed systems.
- **Open System –** In an open system, the mass and energy both may be transferred between the system and surroundings. A steam turbine is an example of an open system.

Thermodynamic Process

A system undergoes a thermodynamic process when there is some energetic change within the system that is associated with changes in pressure, volume and internal energy.

There are four types of thermodynamic process that have their unique properties, and they are:

- **Adiabatic Process** – A process in which no heat transfer takes place.
- **Isochoric Process** – A thermodynamic process taking place at constant volume is known as the isochoric process.
- **Isobaric Process** – A process in which no change in pressure occurs.

- **Isothermal Process** – A process in which no change in temperature occurs.

Laws of Thermodynamics

Zeroth Law of Thermodynamics

The Zeroth law of thermodynamics states that if two bodies are individually in equilibrium with a separate third body, then the first two bodies are also in thermal equilibrium with each other.

First Law of Thermodynamics

The First law of thermodynamics is a version of the law of conservation of energy, adapted for thermodynamic processes, distinguishing three kinds of transfer of energy, as heat, as thermodynamic work, and as energy associated with matter transfer, and relating them to a function of a body's state, called internal energy.

Second Law of Thermodynamics

The Second law of thermodynamics is a physical law of thermodynamics about heat and loss in its conversion.

Third Law of Thermodynamics

Third law of thermodynamics states, regarding the properties of closed systems in thermodynamic equilibrium: The entropy of a system approaches a constant value when its temperature approaches absolute zero.

---

4. **Answer: b**

Explanation:

For adiabatic process : $TV^{\gamma-1}$ = constant
For diatomic process : $\gamma - 1 = \frac{7}{5} - 1$
$\therefore\ x = \frac{2}{5}$

Concepts:

1. **Thermodynamics:**

Thermodynamics in physics is a branch that deals with heat, work and temperature, and their relation to energy, radiation and physical properties of matter.

Important Terms

System

A thermodynamic system is a specific portion of matter with a definite boundary on which our attention is focused. The system boundary may be real or imaginary, fixed or deformable.

There are three types of systems:

- **Isolated System –** An isolated system cannot exchange both energy and mass with its surroundings. The universe is considered an isolated system.
- **Closed System –** Across the boundary of the closed system, the transfer of energy takes place but the transfer of mass doesn't take place. Refrigerators and compression of gas in the piston-cylinder assembly are examples of closed systems.
- **Open System –** In an open system, the mass and energy both may be transferred between the system and surroundings. A steam turbine is an example of an open system.

Thermodynamic Process

A system undergoes a thermodynamic process when there is some energetic change within the system that is associated with changes in pressure, volume and internal energy.

There are four types of thermodynamic process that have their unique properties, and they are:

- **Adiabatic Process** – A process in which no heat transfer takes place.
- **Isochoric Process** – A thermodynamic process taking place at constant volume is known as the isochoric process.
- **Isobaric Process** – A process in which no change in pressure occurs.
- **Isothermal Process** – A process in which no change in temperature occurs.

Laws of Thermodynamics

Zeroth Law of Thermodynamics

The Zeroth law of thermodynamics states that if two bodies are individually in equilibrium with a separate third body, then the first two bodies are also in thermal equilibrium with each other.

First Law of Thermodynamics

The First law of thermodynamics is a version of the law of conservation of energy, adapted for thermodynamic processes, distinguishing three kinds of transfer of energy, as heat, as thermodynamic work, and as energy associated with matter transfer, and relating them to a function of a body's state, called internal energy.

Second Law of Thermodynamics

The Second law of thermodynamics is a physical law of thermodynamics about heat and loss in its conversion.

Third Law of Thermodynamics

Third law of thermodynamics states, regarding the properties of closed systems in thermodynamic equilibrium: The entropy of a system approaches a constant value when its temperature approaches absolute zero.

---

5. Answer: d

Explanation:

	ΔE	ΔW	ΔQ
ab			250
bc		0	60
ca	-180		
	ΔE	ΔW	ΔQ
ab	120	130	250
bc	60	0	60
ca	-180		

Concepts:

1. Thermodynamics:

Thermodynamics in physics is a branch that deals with heat, work and temperature, and their relation to energy, radiation and physical properties of matter.

Important Terms

System

A thermodynamic system is a specific portion of matter with a definite boundary on which our attention is focused. The system boundary may be real or imaginary, fixed or deformable.

There are three types of systems:

- **Isolated System –** An isolated system cannot exchange both energy and mass with its surroundings. The universe is considered an isolated system.
- **Closed System –** Across the boundary of the closed system, the transfer of energy takes place but the transfer of mass doesn't take place. Refrigerators and compression of gas in the piston-cylinder assembly are examples of closed systems.
- **Open System –** In an open system, the mass and energy both may be transferred between the system and surroundings. A steam turbine is an example of an open system.

Thermodynamic Process

A system undergoes a thermodynamic process when there is some energetic change within the system that is associated with changes in pressure, volume and internal energy.

There are four types of thermodynamic process that have their unique properties, and they are:

- **Adiabatic Process** – A process in which no heat transfer takes place.
- **Isochoric Process** – A thermodynamic process taking place at constant volume is known as the isochoric process.
- **Isobaric Process** – A process in which no change in pressure occurs.
- **Isothermal Process** – A process in which no change in temperature occurs.

Laws of Thermodynamics

Zeroth Law of Thermodynamics

The Zeroth law of thermodynamics states that if two bodies are individually in equilibrium with a separate third body, then the first two bodies are also in thermal equilibrium with each other.

First Law of Thermodynamics

The First law of thermodynamics is a version of the law of conservation of energy, adapted for thermodynamic processes, distinguishing three kinds of transfer of energy, as heat, as thermodynamic work, and as energy associated with matter transfer, and relating them to a function of a body's state, called internal energy.

Second Law of Thermodynamics

The Second law of thermodynamics is a physical law of thermodynamics about heat and loss in its conversion.

Third Law of Thermodynamics

Third law of thermodynamics states, regarding the properties of closed systems in thermodynamic equilibrium: The entropy of a system approaches a constant value when its temperature approaches absolute zero.

---

6. **Answer: c**

Explanation:

Suppose'm' gram o f water evaporates then, heat required
$\Delta Q_{req} = mL_V$
Mass that converts into ice = (150 - m)
So, heat released in this process
$\Delta Q_{rel} = (150 - m)L_f$
Now,
$\Delta Q_{rel} = \Delta Q_{req}$
$(150 - m)L_f = mL_V$
$m(L_f + L_v) = 150L_f$

$m = \frac{150L_f}{L_f + L_v}$

$m = 20\,g$

Concepts:

1. Thermodynamics:

Thermodynamics in physics is a branch that deals with heat, work and temperature, and their relation to energy, radiation and physical properties of matter.

Important Terms

System

A thermodynamic system is a specific portion of matter with a definite boundary on which our attention is focused. The system boundary may be real or imaginary, fixed or deformable.

There are three types of systems:

- **Isolated System –** An isolated system cannot exchange both energy and mass with its surroundings. The universe is considered an isolated system.
- **Closed System –** Across the boundary of the closed system, the transfer of energy takes place but the transfer of mass doesn't take place. Refrigerators and compression of gas in the piston-cylinder assembly are examples of closed systems.
- **Open System –** In an open system, the mass and energy both may be transferred between the system and surroundings. A steam turbine is an example of an open system.

Thermodynamic Process

A system undergoes a thermodynamic process when there is some energetic change within the system that is associated with changes in pressure, volume and internal energy.

There are four types of thermodynamic process that have their unique properties, and they are:

- **Adiabatic Process** – A process in which no heat transfer takes place.

- **Isochoric Process** – A thermodynamic process taking place at constant volume is known as the isochoric process.
- **Isobaric Process** – A process in which no change in pressure occurs.
- **Isothermal Process** – A process in which no change in temperature occurs.

Laws of Thermodynamics

Zeroth Law of Thermodynamics

The Zeroth law of thermodynamics states that if two bodies are individually in equilibrium with a separate third body, then the first two bodies are also in thermal equilibrium with each other.

First Law of Thermodynamics

The First law of thermodynamics is a version of the law of conservation of energy, adapted for thermodynamic processes, distinguishing three kinds of transfer of energy, as heat, as thermodynamic work, and as energy associated with matter transfer, and relating them to a function of a body's state, called internal energy.

Second Law of Thermodynamics

The Second law of thermodynamics is a physical law of thermodynamics about heat and loss in its conversion.

Third Law of Thermodynamics

Third law of thermodynamics states, regarding the properties of closed systems in thermodynamic equilibrium: The entropy of a system approaches a constant value when its temperature approaches absolute zero.

---

7. **Answer: b**

Explanation:

$x \rightarrow y \Rightarrow$ Isobaric
$y \rightarrow z \Rightarrow$ Isochoric
$z \rightarrow x \Rightarrow$ Isothermal

Concepts:

1. Thermodynamics:

Thermodynamics in physics is a branch that deals with heat, work and temperature, and their relation to energy, radiation and physical properties of matter.

Important Terms

System

A thermodynamic system is a specific portion of matter with a definite boundary on which our attention is focused. The system boundary may be real or imaginary, fixed or deformable.

There are three types of systems:

- **Isolated System –** An isolated system cannot exchange both energy and mass with its surroundings. The universe is considered an isolated system.
- **Closed System –** Across the boundary of the closed system, the transfer of energy takes place but the transfer of mass doesn't take place. Refrigerators and compression of gas in the piston-cylinder assembly are examples of closed systems.
- **Open System –** In an open system, the mass and energy both may be transferred between the system and surroundings. A steam turbine is an example of an open system.

Thermodynamic Process

A system undergoes a thermodynamic process when there is some energetic change within the system that is associated with changes in pressure, volume and internal energy.

There are four types of thermodynamic process that have their unique properties, and they are:

- **Adiabatic Process** – A process in which no heat transfer takes place.
- **Isochoric Process** – A thermodynamic process taking place at constant volume is known as the isochoric process.
- **Isobaric Process** – A process in which no change in pressure occurs.

- **Isothermal Process** – A process in which no change in temperature occurs.

Laws of Thermodynamics

Zeroth Law of Thermodynamics

The Zeroth law of thermodynamics states that if two bodies are individually in equilibrium with a separate third body, then the first two bodies are also in thermal equilibrium with each other.

First Law of Thermodynamics

The First law of thermodynamics is a version of the law of conservation of energy, adapted for thermodynamic processes, distinguishing three kinds of transfer of energy, as heat, as thermodynamic work, and as energy associated with matter transfer, and relating them to a function of a body's state, called internal energy.

Second Law of Thermodynamics

The Second law of thermodynamics is a physical law of thermodynamics about heat and loss in its conversion.

Third Law of Thermodynamics

Third law of thermodynamics states, regarding the properties of closed systems in thermodynamic equilibrium: The entropy of a system approaches a constant value when its temperature approaches absolute zero.

---

8. **Answer: b**

Explanation:

$w = P_0V_0$
Heat given = $Q_{AB} = Q_{BC}$
$= nC_V dT_{AB} + nC_P dT_{BC}$
$= \frac{3}{2}(nRT_B - nRT_A) + \frac{5}{2}(nRT_C - nRT_B)$
$= \frac{3}{2}(2P_0V_0 - P_0V_0) + \frac{5}{2}(4P_0V_0 - 2P_0V)$
$= \frac{13}{2}P_0V_0$
$n = \frac{w}{Qgiven} = \frac{2}{13} = 0.15$

Concepts:

1. Thermodynamics:

Thermodynamics in physics is a branch that deals with heat, work and temperature, and their relation to energy, radiation and physical properties of matter.

Important Terms

System

A thermodynamic system is a specific portion of matter with a definite boundary on which our attention is focused. The system boundary may be real or imaginary, fixed or deformable.

There are three types of systems:

- **Isolated System –** An isolated system cannot exchange both energy and mass with its surroundings. The universe is considered an isolated system.
- **Closed System –** Across the boundary of the closed system, the transfer of energy takes place but the transfer of mass doesn't take place. Refrigerators and compression of gas in the piston-cylinder assembly are examples of closed systems.
- **Open System –** In an open system, the mass and energy both may be transferred between the system and surroundings. A steam turbine is an example of an open system.

Thermodynamic Process

A system undergoes a thermodynamic process when there is some energetic change within the system that is associated with changes in pressure, volume and internal energy.

There are four types of thermodynamic process that have their unique properties, and they are:

- **Adiabatic Process** – A process in which no heat transfer takes place.
- **Isochoric Process** – A thermodynamic process taking place at constant volume is known as the isochoric process.
- **Isobaric Process** – A process in which no change in pressure occurs.

- **Isothermal Process** – A process in which no change in temperature occurs.

Laws of Thermodynamics

Zeroth Law of Thermodynamics

The Zeroth law of thermodynamics states that if two bodies are individually in equilibrium with a separate third body, then the first two bodies are also in thermal equilibrium with each other.

First Law of Thermodynamics

The First law of thermodynamics is a version of the law of conservation of energy, adapted for thermodynamic processes, distinguishing three kinds of transfer of energy, as heat, as thermodynamic work, and as energy associated with matter transfer, and relating them to a function of a body's state, called internal energy.

Second Law of Thermodynamics

The Second law of thermodynamics is a physical law of thermodynamics about heat and loss in its conversion.

Third Law of Thermodynamics

Third law of thermodynamics states, regarding the properties of closed systems in thermodynamic equilibrium: The entropy of a system approaches a constant value when its temperature approaches absolute zero.

---

9. **Answer: d**

Explanation:

For isochoric process

$\frac{P}{T} = n\frac{R}{V} = constan\ t$

$P = \frac{nR}{V}(t + 273)$

If $P = 0 \Rightarrow t = -273^{\circ}C$

The Correct Option is (D): $-273^{\circ}C$

Concepts:

1. Thermodynamics:

Thermodynamics in physics is a branch that deals with heat, work and temperature, and their relation to energy, radiation and physical properties of matter.

Important Terms

System

A thermodynamic system is a specific portion of matter with a definite boundary on which our attention is focused. The system boundary may be real or imaginary, fixed or deformable.

There are three types of systems:

- **Isolated System –** An isolated system cannot exchange both energy and mass with its surroundings. The universe is considered an isolated system.
- **Closed System –** Across the boundary of the closed system, the transfer of energy takes place but the transfer of mass doesn't take place. Refrigerators and compression of gas in the piston-cylinder assembly are examples of closed systems.
- **Open System –** In an open system, the mass and energy both may be transferred between the system and surroundings. A steam turbine is an example of an open system.

Thermodynamic Process

A system undergoes a thermodynamic process when there is some energetic change within the system that is associated with changes in pressure, volume and internal energy.

There are four types of thermodynamic process that have their unique properties, and they are:

- **Adiabatic Process** – A process in which no heat transfer takes place.
- **Isochoric Process** – A thermodynamic process taking place at constant volume is known as the isochoric process.
- **Isobaric Process** – A process in which no change in pressure occurs.

- **Isothermal Process** – A process in which no change in temperature occurs.

Laws of Thermodynamics

Zeroth Law of Thermodynamics

The Zeroth law of thermodynamics states that if two bodies are individually in equilibrium with a separate third body, then the first two bodies are also in thermal equilibrium with each other.

First Law of Thermodynamics

The First law of thermodynamics is a version of the law of conservation of energy, adapted for thermodynamic processes, distinguishing three kinds of transfer of energy, as heat, as thermodynamic work, and as energy associated with matter transfer, and relating them to a function of a body's state, called internal energy.

Second Law of Thermodynamics

The Second law of thermodynamics is a physical law of thermodynamics about heat and loss in its conversion.

Third Law of Thermodynamics

Third law of thermodynamics states, regarding the properties of closed systems in thermodynamic equilibrium: The entropy of a system approaches a constant value when its temperature approaches absolute zero.

---

10. **Answer: c**

Explanation:

Isothermal expansion PV_m = K(Graph-C) $P = \frac{K}{V_m}(Graph - A)$

Concepts:

1. **Work Done Thermodynamics:**

In thermodynamics, work is a way of energy transfer from a system to surroundings, under the influence of external factors such gravity, electromagnetic forces, pressure/volume etc.

Energy (ΔU) can cross the boundary of a system in two forms -> Work (W) and Heat (q). Both work and heat refer to processes by which energy is transferred to or from a substance.

$$\Delta U = W + q$$

Work done by a system is defined as the quantity of energy exchanged between a system and its surroundings. It is governed by external factors such as an external force, pressure or volume or change in temperature etc.

Work (W) in mechanics is displacement (d) against a resisting force (F).

Work has units of energy (Joule, J)