Important Questions for Class 11 Physics Chapter 11: Chapter 11 of Class 11 Physics, Thermodynamics, focuses on the principles governing heat, work, and energy in physical systems. Key concepts include the laws of thermodynamics, the first law (conservation of energy), and the second law (entropy).

The chapter covers topics such as internal energy, work done in thermodynamic processes, heat transfer, and the efficiency of heat engines. Important derivations include the work done in isothermal and adiabatic processes and the concept of reversible and irreversible processes. Understanding these principles is essential for solving problems related to energy conservation, engines, and entropy in thermodynamic systems.

Important Questions for Class 11 Physics Chapter 11 Overview

Chapter 11 of Class 11 Physics, Thermodynamics, is crucial for building a strong foundation in understanding energy, heat, and work in physical systems. Key topics include the laws of thermodynamics, work and heat in different processes (isothermal, adiabatic), and the concept of entropy.

Important questions often focus on applying the first and second laws to various thermodynamic processes, understanding the derivations of work done, and calculating the efficiency of heat engines. These concepts are vital not only for Class 11 exams but also for higher studies and competitive exams like JEE, as they form the basis for energy-related applications in physics and engineering.

Important Questions for Class 11 Physics Chapter 11 Thermodynamics

Below is the Important Questions for Class 11 Physics Chapter 11 Thermodynamics -

1. If an air is a cylinder is suddenly compressed by a piston. What happens to the pressure of air?

Ans: If the piston suddenly compresses then it causes heating and rise in temperature and if the piston is maintained at same Position, then the pressure falls as temperature decreases.

2. What is the ratio of find volume to initial volume if the gas is compressed adiabatically till its temperature is doubled?

Ans: We know that for an adiabatic Process,

$\mathrm{PV^Y}$ = constant

Since, $\mathrm{PV = RT}$

$$\mathrm{P} = \frac{RT}{V}$$

So, $\frac{\mathrm{RTV}_Y}{\mathrm{V}} = \text{constant}$

Or $TV_{\mathrm{y}-1}$ = constant $\mathrm{T_1,\ V_1}$ = Initial temperature and Initial Volume

$\therefore \mathrm{T_1\ V_{1y} - 1 = T_2\ V_{2Y-1} T_2,\ V_2}$ = Final temperature and Final volume.

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

Since $\mathrm{T_2 = 2\ T_1}$ (Given)

$$\frac{T_1}{T_2} = \frac{1}{2}$$

So, $\frac{V_2}{V_1} = \left(\frac{1}{2}\right)^{\frac{1}{\bar{I}-1}}$

Since $\frac{4}{Y} > 1, \frac{V_2}{V_1}$ is less than $\frac{1}{2}$.

3. What is the ratio of slopes of P-V graphs of adiabatic and isothermal process?

Ans: Let, the slope of P-V graph is $\frac{dP}{dV}$

We know that for an isothermal process, (PV = constant)

So, $\frac{dP}{dV} = \frac{P}{V} \rightarrow (1)$

For an adiabatic process ($\mathrm{PV^Y}$ = constant)

$$\frac{\mathrm{dP}}{\mathrm{dV}} = \frac{\mathrm{YP}}{\mathrm{V}} \rightarrow (2)$$

Divide 2) by 1)

So, the ratio of adiabatic slope to isothermal slope is Y.

4. What is the foundation of Thermodynamics?

Ans: The law of conservation of energy and the observation that heat travels from a hot body to a cool body are the foundations of thermodynamics.

5. Differentiate between isothermal and adiabatic process?

	Isothermal process	**Adiabatic process**
1	The temperature remains constant in this scenario.	There is no heat generated or withdrawn in this method.
2	Isothermal process is slowly.	Adiabatic process is suddenly.
3	The system is thermally conductive to the environment in this case.	The system is thermally isolated from the environment here.
4	State equation: → PV = constant	State equation: → PVY = constant

Ans: The difference between Isothermal and Adiabatic process is given below:

6. A Carnot engine develops 100 H.P. and operates between $27^0\mathrm{C}$ and $227^0\mathrm{C}$. Find:

1. Thermal efficiency

Ans: Here, energy $= \mathrm{W} = 100\mathrm{H.P.}$

$= 100 \times 746\ \mathrm{W}$ ($1\mathrm{H.P.} = 746\ \mathrm{W}$)

$= \frac{(100 \times 746)}{4.2} \mathrm{cal} \mid \mathrm{s} \left(1\ \mathrm{W} = \frac{\mathrm{cal} \mid \mathrm{s}}{4.2}\right)$

High temperature, $\mathrm{T_H} = 227^0\mathrm{C} = 227 + 273 = 500\ \mathrm{K}$

Low temperature, $\mathrm{T_h} = 27^0\mathrm{C} = 27 + 273 = 300\ \mathrm{K}$

Thermal efficiency, $\eta = 1 - \frac{T_L}{T_H}$ $\eta = 1 - \frac{300}{500}$

$\eta = \frac{200}{500} = 0.4$ or 40%

2. Heat supplied

Ans: The heat supplied $\mathrm{Q_H}$ is given by: -

$$Q_H = \frac{W}{\eta} = \frac{100 \times 746}{4.2 \times 0.4} = 4.44 \times 10^4 \mathrm{cal/s}$$

3. Heat rejected

Ans: The heat rejected $\mathrm{Q_L}$ is given by: -

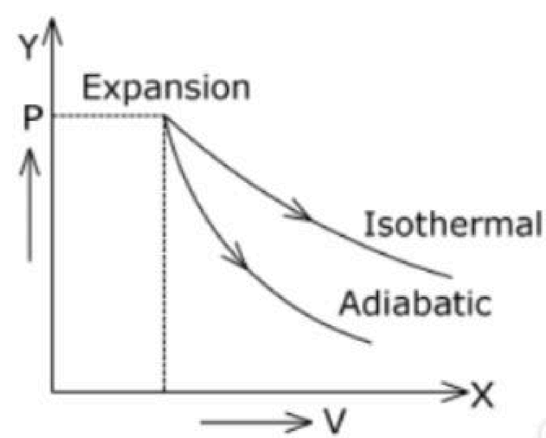
$$Q_L = Q_H \frac{T_L}{T_H} \text{ or } \frac{Q_L}{Q_H} = \frac{T_L}{T_H}$$

$$Q_L = 4.44 \times 10^4 \times \frac{3\emptyset\phi}{5\emptyset\phi'}$$

$$Q_L = 2.66 \times 10^4 \mathrm{cal}/\Delta$$

7. Draw a p - v diagram for isothermal and adiabatic expansion?

Ans: Diagram of P-V for isothermal and adiabatic expansion.



8. State zeroth law of thermodynamics?

Ans: According to Zeroth law, if the thermodynamic system and are each in thermal equilibrium with a third thermodynamic system C, then the system and are also in thermal equilibrium.

9. Can a gas be liquefied at any temperature by increase of pressure alone?

Ans: No, only when the temperature of the gas is below its critical point can it be liquefied by pressure alone.

10. Can you design heat energy of 100% efficiency?

Ans: Since, efficiency of heat engine $= 1 - \frac{T_2}{T_1}$,

So, efficiency will be 100% or 1 if $\mathrm{T_2 = OK}$ or $\mathrm{T_1} =$

a. Since both these conditions cannot be practically attained, so heat engine cannot have 100% efficiency.

11. If air is a bad conductor of heat, why do we not feel warm without clothes?

Ans: We do not feel warm without clothes because, when we are without clothes air carries away heat from our body due to convection and we feel cold.

12. A body with large reflectivity is a poor emitter why?

Ans: This is because a body with large reflectivity is a poor absorber of heat and poor absorbers are poor emitters.

13. Animal's curl into a ball, when they feel very cold?

Ans: When animals curl, their surface area decreases, and because energy radiated varies directly with surface area, heat loss due to radiation is reduced as well.

14. Why is the energy of thermal radiation less than that of visible light?

Ans: The energy of an electromagnetic ware is given by: - $\mathrm{E} = \mathrm{hf}$

$\mathrm{h} =$ Planck's constant; $\mathrm{f} =$ frequency of wave. Since the frequency of thermal radiation is less than that c visible light, the energy associated with thermal radiation is less than associated with visible light.

15. Two rods A and B are of equal length. Each rod has its ends at temperature $\mathrm{T_1}$ and T $(\mathrm{T_1} > \mathrm{T_2})$. What is the condition that will ensure equal rates of flow through the rods A and B?

Ans: Heat flow, $\mathrm{Q} = \dfrac{\mathrm{KA}\left(\mathrm{T_1} - \mathrm{T_2}\right)}{\mathrm{d}}$

$\mathrm{K} =$ Thermal conductivity

$\mathrm{A} =$ Area

$\mathrm{T_1} =$ Temperature of hot body

$\mathrm{T_2} =$ Temperature of cold body

$\mathrm{d} =$ distance between hot and cold body.

$Q =$ heat flow

When the rods have the same rate of conduction,

$\mathrm{Q_1} = \mathrm{Q_2}$

$$\frac{K_1 A_1 \left(T_1 - T_2\right)}{d} = \frac{K_2 A_2 \left(T_1 - T_2\right)}{d}$$

$\mathrm{K_1},\ \mathrm{K_2} \rightarrow$ Thermal conductivity of first and second region

$\mathrm{A_1},\ \mathrm{A_2} \rightarrow$ Area of first and second region

or, $\mathrm{K_1}\ \mathrm{A_1} = \mathrm{K_2}\ \mathrm{A_2}$

or $\dfrac{A_1}{A_2} = \dfrac{K_2}{K_1}$

16.A Sphere is at a temperature of $600\mathrm{k}$. Its cooling rate is R in an external environment of 200k. If temperature falls to $400\mathrm{k}$. What is the cooling rate R_1 in terms of $\mathbf{R}$?

Ans: According to Stefan's law:

$\mathrm{E} =$ constant T^4

Also, $\mathrm{R}_1 =$ constant $\left(\mathrm{T}_2{}^4 - \mathrm{T}_1{}^4\right)$

$\mathrm{R} =$ constant $\left(\mathrm{T}_3{}^4 - \mathrm{T}_1{}^4\right)$

$\mathrm{T}_2 =$ heat of hot junction $= 400\ \mathrm{K}$

$\mathrm{T}_1 =$ heat of cold junction $= 200\ \mathrm{K}$

$\mathrm{T}_3 =$ heat of hot junction $= 600\ \mathrm{K}$

$\mathrm{R}_1 =$ constant $\left[(400)^4 - (200)^4\right]$ **......(1)**

$\mathrm{R}_1 =$ constant $\left[(600)^4 - (200)^4\right]$ **.......(2)**

Divide equation (1) by (2)

$$\frac{R_1}{R} = \frac{\left[(400)^4 - (200)^4\right]}{\left[(600)^4 - (200)^4\right]}$$

$$\frac{R_1}{R} = \frac{256 \times 10^8 - 16 \times 10^8}{1296 \times 10^8 - 16 \times 10^8} = \frac{24\phi \times \phi^{k}}{128\phi' \times \gamma^7}$$

$$\frac{R_1}{R} = \frac{24}{128}$$

$$\frac{R_1}{R} = \frac{3}{16}$$

Therefore, $R_1 = \left(\frac{3}{16}\right) R$

17. If the temperature of the sun is doubled, the rate of energy received on each will increases by what factor?

Ans: By Stefan's law:

Rate of energy radiated $\alpha \mathrm{T}^4$

Where,

T = Temperature

Therefore, initial rate of energy radiated is given by:

$\mathrm{E}_1 =$ constant ${\mathrm{T}_1}^4$ **....(1)**

Where,

$\mathrm{T}_1 =$ Initial temperature

Then, the final rate of energy radiated is given by:

$\mathrm{E}_2 =$ constant T_2^4 **.....(2)**

Where,

$\mathrm{T}_2 =$ Final temperature

Now, if the temperature of the sun is doubled, we get:

$\mathrm{T}_2 = 2\ \mathrm{T}_1$

${\mathrm{T}_2}^4 = (2)^4\ {\mathrm{T}_1}^4$

${\mathrm{T}_2}^4 = 16\ {\mathrm{T}_1}^4$ **.....(3)**

Substituting equation (3) in (2), we get:

$\mathrm{E}_2 =$ constant $\left(16\ \mathrm{T}_1^4\right)$

$\mathrm{E}_2 = 16$ (Constant ${\mathrm{T}_1}^4$)

$E_2 = 16E_1$

Therefore, If the temperature of the sun is doubled, the rate of energy received on each will increases by $16E_1$.

18. On a winter night, you feel warmer when clouds cover the sky than when sky is clear. Why?

Ans: We know that earth absorbs heat in day and radiates at night. When sky is covered, with clouds, the heat radiated by earth is reflected back and earth becomes warmer. But if sky is clear the heat radiated by earth escapes into space.

19. If a body is heated from $27^0\mathrm{C}$ to $927^0\mathrm{C}$ then what will be the ratio of energies of radiation emitted?

Ans: Since, By Stefan's law:

$\mathrm{E}=$ Energy radiated

T = Temperature.

$\mathrm{E_1},\ \mathrm{T_1} \Rightarrow$ Initial energy and temperature

$\mathrm{E_2},\ \mathrm{T_2} \Rightarrow$ Final energy and temperature.

$\mathrm{T_1}=27^0\mathrm{C}=27+273=300\ \mathrm{K}$

$\mathrm{T_2}=927^0\mathrm{C}=927+273\ \mathrm{K}=1200\ \mathrm{K}.$

$\mathrm{E}=$ constant T^4

So, $\mathrm{E_1}=$ constant $\mathrm{T_1}^4$

$\frac{E_1}{T_1^4}=Constant$ ....**(1)**

Also, $\frac{E_2}{T_2^4}=constant$ ......**(2)**

Equating equation (1) & (2)

$\frac{E_1}{T_1^4}=\frac{E_2}{E_2^4}$

or $\frac{E_1}{E_2}=\left(\frac{T_1}{T_2}\right)^4$

$\frac{E_1}{E_2}=\left(\frac{1}{4}\right)^4$

$\frac{E_1}{E_2}=\frac{1}{256}$

or $\mathrm{E_1}:\mathrm{E_2}=1:256$

20. 2Which has a higher specific heat; water or sand?

Ans: Water has higher specific heat than sand as

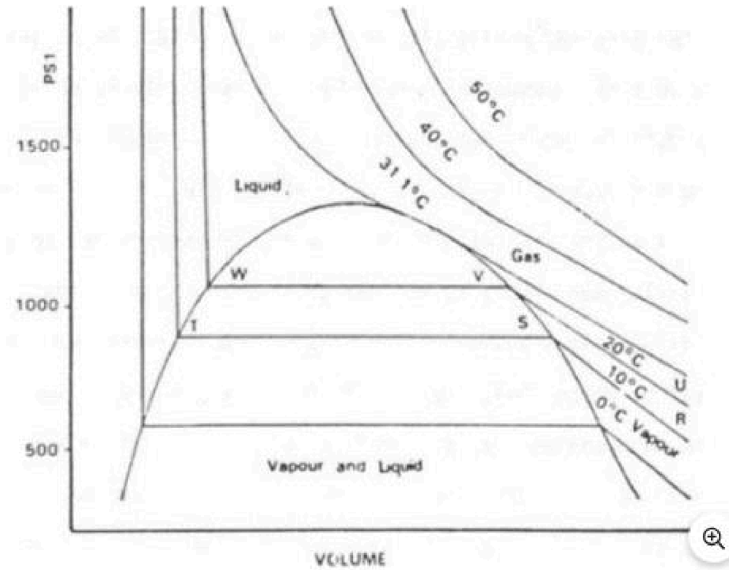
$\Delta T=\frac{Q}{mc}$, where $\mathrm{T}=$ Temperature, $\mathrm{Q}=$ Heat, $\mathrm{m}=$ Mass,

$\mathrm{C}=$ Specific heat; Since for water temperature increases less slowly than sand hence the result.

21. Why is latent heat of vaporization of a material greater than that of latent heat of fusion?

Ans: When a liquid turns into a gas, the volume expands dramatically, and a significant amount of work is required against the surrounding atmosphere. The heat connected with the transition from solid to gas is known as latent heat of vaporisation, and therefore the answer.

22. Draw a P - V diagram for Liquid and gas at various temperatures showing critical point?
Ans:



23. Why is temperature gradient required for flow of heat from one body to another?

Ans: Temperature gradient is required because, Heat flows from higher temperature to lower temperature. Therefore, temperature gradient (i.e., temperature difference) is required for the heat to flow one part of solid to another.

24. Why are Calorimeters made up of metal only?

Ans: Calorimeters are made of metal because metal is a good conductor of heat and thus allows for quick heat exchange, which is essential for calorimeter operation.

25. If a body has infinite heat capacity? What does it signify?

Ans: The term "infinite heat capacity" refers to a substance's ability to maintain its temperature regardless of how much heat it receives or loses.

26. Define triple point of water?

Ans: In all three states of matter, the triple point of water represents the pressure and temperature values at which water coexists in equilibrium.

27. State Dulong and petit law?

Ans: According to Dulong and petit law, the specific heat of all the solids is constant at room temperature and is equal to 3R.

28. Why the clock pendulums are made of invar, a material of low value of coefficient of linear expansion?

Ans: Clock pendulums are made of invar Because, the clock pendulums are made of Inver because it has low value of a (co-efficient of linear expansion) i.e., for a small change in temperature, the length of pendulum will not change much.

Benefits of Using Important Questions for Class 11 Physics Chapter 11

Using Important Questions for Class 11 Physics Chapter 11 Thermodynamics offers several benefits:

Concept Reinforcement: These questions help reinforce key thermodynamics concepts like energy conservation, entropy, and work in thermodynamic processes.

Exam Preparation: Practicing these questions boosts problem-solving skills and enhances preparation for exams.

Time Management: Regular practice improves speed and accuracy, ensuring efficient time management during tests.

Deep Understanding: Working through these questions deepens understanding of complex topics, such as the laws of thermodynamics and heat engines.

Competitive Edge: These questions are aligned with competitive exams, helping students perform better in exams like JEE and NEET.