

THERMODYNAMICS

OBJECTIVE TYPE QUESTIONS

1. In an open system, for maximum work, the process must be entirely
 - a) irreversible
 - b) reversible
 - c) adiabatic
 - d) isothermal
2. Wooden clothes keep the body warm, because wool
 - a. Is a bad conductor
 - b. Increases the temperature of body
 - c. Decrease the temperature
 - d. All of these
3. Mercury thermometer can be used to measure temperature upto
 - a. 260°C
 - b. 100°C
 - c. 360°C
 - d. 500°C
4. A quantity of heat required to change the unit mass of a solid substance from solid state to liquid state, while the temperature remains constant, is known as
 - a. Latent heat of vaporisation
 - b. Sublimation
 - c. Condensation
 - d. latent heat of fusion
5. At a common temperature, a block of wood and a block of metal feel equally cold or hot. The temperature of block and wood are
 - a. Equal to the temperature of the body
 - b. Less than the temperature of the body
 - c. Greater than temperature of the body
 - d. Either b or c

Answer. 1) Answer: b

Explanation: A reversible process gives the maximum work.

- 2) a) Is a bad conductor of heat.
- 3) c) 360°C
- 4) d. latent heat of fusion

5) (b) equal to the temperature of the body

Explanation: Since both the block of metal and the block of wood feel equally cold or hot, their temperatures must be equal to the temperature of the body. Otherwise there will be heat flow between the body and either of the blocks. And as the thermal conductivity of the metal is more than that of the wood, it would either feel hotter or colder than that the block of wood.

- 6. The specific heat of a gas in an isothermal process _____
- 7. The change in temperature of a body is 50°C. The change in temperature on the Kelvin scale is
- 8. On the absolute scale of temperature given by Kelvin, steam point has a value of
- 9. The specific heat of a gas in an adiabatic process is _____
- 10. Zeroth law of thermodynamics.....
 - i. Deals with conversion of mass and energy
 - ii. Deals with reversibility and irreversibility of process
 - iii. States that if two system are both in equilibrium with a third system, they are in thermal equilibrium with each other
 - iv. Deals with heat engines.

ANSWER- 6) infinity-Given the process is isothermal which means its temperature won't increase. $S = \Delta Q/m \times \Delta T$

$$\Delta T = 0$$

Therefore, specific heat will be infinity, as it is defined as heat supplied per unit increase in temperature.

- 7) 50K
- 8) 373.15K
- 9) Zero as $\Delta Q=0$
- 10) (iii)

VERY SHORT ANSWER QUESTIONS (BASIC LEVEL)

- 11. State first law of thermodynamics
- 12. State second law of thermodynamics
- 13. What is isothermal process? Also give essential conditions for an isothermal process to take place.

SHORT ANSWER QUESTIONS - (INTERMEDIATE LEVEL):

- 14. Why do birds swell their feathers in winter?
(Ans. To maintain a column of air, which acts an insulator and hence to avoid loss of heat from the body to the surroundings.)

15. If a drop of water falls on a hot plate, it takes longer time to evaporate. Why?

(Ans. The vapour formed at the instant of landing of the drop acts as an insulator and prevents the heat being passed on to the water above.)

16. Explain how, cooking is faster in a pressure cooker than an ordinary vessel.

(Ans. Food is **cooked** more quickly in a **pressure cooker** because at the higher **pressure** the boiling point of water rises from 100 °C (212 °F) to 121 °C (250 °F). The hotter steam is able to transmit its thermal energy to the food and hence the food gets cooked faster)

17. Why burns from steam more serious than those from boiling water?

(Ans. Steam at 100°C has 22.6×10^5 J of heat energy more than water at 100°C)

LONG ANSWER TYPE QUESTIONS - ADVANCED LEVEL QUESTIONS

18. A gas is contained in a cylinder with a moveable piston on which a heavy block is placed. Suppose the region outside the chamber is evacuated and the total mass of the block and the movable piston is 102 kg. When 2140 J of heat flows into the gas, the internal energy of the gas increases by 1580 J. What is the distance s through which the piston rises?

(Ans. Total heat supplied = Work done + Change in internal energy

So work done = $2140 - 1580 = 560$ J

Let s be the distance moved then

the work done is given by = Fs

$dq = du + dw$

$2140 = 1580 + dw$ or $dw = 560$ J

$560 = F s$ or $560 = mg \times s$ or $560 = 102 \times 10 \times s$ or $s = 0.54$ m

19. In changing the state of a gas adiabatically from an equilibrium state A to another equilibrium state B, an amount of work equal to 22.3 J is done on the system. If the gas is taken from state A to B via a process in which the net heat absorbed by the system is 9.35 cal, how much is the net work done by the system in the latter case? (Take 1 cal = 4.2J)

Here, when the change is adiabatic, $\Delta Q = 0$, $\Delta W = -22.3$ J

If ΔU is change in internal energy of the system, then

as $\Delta Q = \Delta U + \Delta W$

$0 = \Delta U - 22.3$ or $\Delta U = 22.3$ J

In the second case, $\Delta Q = 9.35$ cal = 9.35×4.2 J = 39.3 J

$\Delta W = ?$

As $\Delta U + \Delta W = \Delta Q$

$\therefore \Delta W = \Delta Q - \Delta U = 39.3 - 22.3 = 17.0$ J.