C.B.T. January-2024
CLASS-XI (PHYSICS)

SYLLABUS COVERED: Thermal Properties of Matter
Thermodynamics

CASE-STUDY-1

Read the following paragraph and answer the correct option of MCQ: -

The branch dealing with measurement of temperature is called thermometry and the devices used to measure temperature are called thermometers. Heat is a form of energy called thermal energy which flows from a higher temperature body to a lower temperature body when they are placed in contact. Heat or thermal energy of a body is the sum of kinetic energies of all its constituent particles, on account of translational, vibrational and rotational motion. The SI unit of heat energy is joule (J). The practical unit of heat energy is calorie. 1 cal = 4.18 J 1 calorie is the quantity of heat required to raise the temperature of 1 g of water by 1°C.When there is no transfer of heat between two bodies in contact, the bodies are called in thermal equilibrium. The amount of heat required to raise the temperature of unit mass the substance through 1°C is called its specific heat. It is denoted by c or s. Its SI unit is joule/kilogram-°C'(J/kg-°C).

Thermal Expansion: Increase in size on heating is called thermal expansion. There are three types of thermal expansion. 1. Expansion of solids, 2. Expansion of liquids, 3. Expansion of gases

Expansion of Solids: Three types of expansion takes place in solid. 1. Linear Expansion- Expansion in length on heating is called linear expansion. Superficial Expansion- Expansion in area on heating is called superficial expansion. Cubical Expansion- Expansion in volume on heating is called cubical expansion.

1. **S. I. Unit of heat is**
   a. Joule b. Calorie c. Kilocalorie d. Newton

   Anser: Joule

2. **When a body that is conducting heat is under a steady state condition, then the temperature of the body:**
   a. Increases with time
   b. Decreases with time
   c. Does not change with time and is same at all the points of the body
   d. Does not change with time but is different at different cross-sections of a body.

   Answer: Does not change with time but is different at different cross-sections of a body.

3. **Water has the maximum density at:**
   a. 4°C
   b. 100°C
   c. 0°C
   d. 10°C

   Answer: - 4°C

4. **Two bars of copper having same length but unequal diameter are heated to the same temperature. The change in length will be:**
   a. more in thicker bar
   b. more in thinner bar
   c. same for both
   d. determined by the ratio of length and diameter of the bars

   Answer: - same for both

5. **ASSERTION:** A brass tumbler feels much colder than a wooden tray on a chilly day.
   REASON: The thermal conductivity of brass is less than that of wood.
   a. If both Assertion and Reason are correct and the Reason is a correct explanation of the Assertion.
   b. If both Assertion and Reason are correct but Reason is not a correct explanation of the Assertion.
   c. If the Assertion is correct but Reason is incorrect.
   d. If both the Assertion and Reason are incorrect

   Answer: - (c) If the Assertion is correct but Reason is incorrect.

Bernoulli's Equation

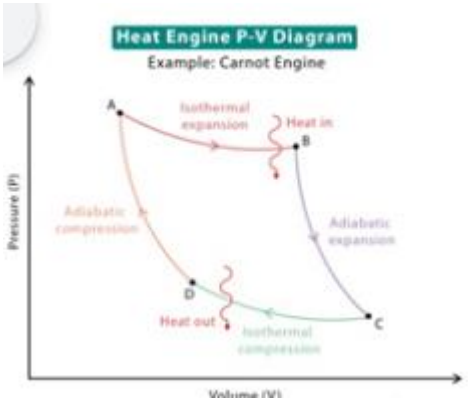
Read the following paragraph and answer the correct option of MCQ: -

The branch of physics which deals with the study of transformation of heat into other forms of energy and vice-versa is called thermodynamics.
Thermodynamics is a macroscopic science. It deals with bulk systems and does not go into the molecular constitution of matter.
• A collection of an extremely large number of atoms or molecules confined within certain boundaries such that it has a certain values of pressure (P), volume (V) and temperature (T) is called a ; thermodynamic system.
• Thermal Equilibrium
A thermodynamic system is in an equilibrium state if the macroscopic variables such as pressure, volume, temperature, mass composition etc. that characterize the system do not change in time. In thermal equilibrium, the temperature of the two systems are equal.
• Zeroth Law of Thermodynamics
This law identifies thermal equilibrium and introduces temperature as a tool for identifying f equilibrium. According to this law "If two systems are in thermal equilibrium with a third system then those two systems themselves are in equilibrium."
First Law of Thermodynamics
The first law of thermodynamics is simply the general law of conservation of energy applied to any system. According to this law, "the total heat energy change in any system is the sum of the internal energy change and the work done."
When a certain quantity of heat dQ is subjected to a system, a part of it is used in increasing the

internal energy by dU and a part is used in performing external work dW, hence
dQ = dU + dW

P-V Diagram
A graph representing the variation of pressure with the variation of volume is called P-V diagram. The work done by the thermodynamic system is equal to the area under P-V diagram. It is given below.

Second Law of Thermodynamics
This principle which disallows certain phenomena consistent with the First law of thermodynamics is known as the second law of thermodynamics.
Following are the two statements of second law of thermodynamics.
Kelvin-Planck Statement: It is impossible to construct an engine, operating in a cycle, to extract heat from hot body and convert it completely into work without leaving any change anywhere i.e., 100% conversion of heat into work is impossible.
Clausius Statement: It is impossible for a self acting machine, operating in a cycle, unaided by any external energy to transfer heat from a cold body to a hot body. In other words heat can not flow itself from a colder body to a hotter body.



6. **The first law of thermodynamics is represented as**
   a. **dQ = dU + dW**
   b. **dQ = 2dU + dW**
   c. **dQ = dU – dW**
   d. **dQ = dU + 2dW**

   Answer: - dQ = dU + dW

7. **When steam is converted into water, internal energy of the system**
   a. **Increases**
   b. **Decreases**
   c. **Remains Constant**
   d. **becomes zero**

   Answer: - Decreases

8. **“Heat cannot by itself flow from a body at lower temperature to a body at higher temperature” is a statement or consequence of:**
   a. **second law of thermodynamics**
   b. **conservation of momentum**

c. conservation of mass
d. first law of thermodynamics

Answer: second law of thermodynamics

9. The state of a thermodynamic system is represented by
a. Pressure, volume and temperature
b. pressure only
c. number of moles
d. volume only

Answer: Pressure, volume and temperature

10. ASSERTION: No heat is removed or added to the system in an adiabatic process.

REASON: 100% conversion of heat into work is possible.

a. If both Assertion and Reason are correct and the Reason is a correct explanation of the Assertion.
b. If both Assertion and Reason are correct but Reason is not a correct explanation of the Assertion.
c. If the Assertion is correct but Reason is incorrect.
d. **If both the Assertion and Reason are incorrect.**

Answer: - (c) If the Assertion is correct but Reason is incorrect.
