
	INDIAN SCHOOL AL WADI AL KABIR	
Class: XI	Department: SCIENCE 2025 – 26 SUBJECT: PHYSICS	Date: 17/01/2026
Worksheet No: 11 WITH ANSWERS	CHAPTER / UNIT: THERMODYNAMICS	Note: A4 FILE FORMAT
NAME OF THE STUDENT:	CLASS & SEC:	ROLL NO.:

OBJECTIVE TYPE OF QUESTIONS (1 MARK):

- 1) Which is not a path function
 - a) ΔQ
 - b) $\Delta Q + \Delta W$
 - c) ΔW
 - d) $\Delta Q - \Delta W$
- 2) The amount of work done by the gas during expansion is greatest for
 - a) Isobaric process
 - b) Isothermal process
 - c) Adiabatic process
 - d) Same in each process
- 3) Which of the following statements is correct?
 - a) Two isothermal curves may intersect
 - b) Two adiabatic curves may intersect
 - c) Two different stages of gas can be connected by an isothermal process as well as an adiabatic process on a P-V diagram
 - d) An isothermal curve may intersect an adiabatic
- 4) For isothermal expansion of an ideal gas
 - a) $\Delta U = +ve$
 - b) $\Delta Q = +ve$
 - c) $\Delta W = +ve$
 - d) Both b) and c)
- 5) During a phase change, which of the following is a constant?
 - a) Temperature
 - b) Entropy
 - c) Volume
 - d) Both pressure and volume
- 6) Find the change in internal energy if heat supplied to the gaseous system is 100 J and work done by the system is 80 J
 - a) 5 J
 - b) 30 J

- c) 10 J
 - d) 20 J
- 7) In a cyclic process, the change in the internal energy of a system over one complete cycle
- a) is always zero
 - b) is always positive
 - c) depends on the path
 - d) is always negative
- 8) The maximum amount of work done, which can be obtained by supplying 400 cal of heat, will be
- a) 1 kJ
 - b) 1.2 kJ
 - c) 1.76 kJ
 - d) 1.68 kJ

ASSERTION AND REASONING TYPE OF QUESTIONS (1 MARK):

DIRECTIONS: In the following questions, a statement of assertion (A) is followed by a statement of reason (R). Mark the correct choice as:

- a) Both A and R are true, and R is the correct explanation of A.
 - b) Both A and R are true, and R is not the correct explanation of A.
 - c) A is true, but R is false.
 - d) A is false, but R is true
- 9) **Assertion:** When a box containing gas is moving as a whole with some velocity, the kinetic energy of the box is not included in the internal energy of the gas.
Reason: Internal energy includes only the (disordered) energy associated with the random molecules.
- 10) **Assertion:** In an isothermal process, the temperature of the system remains constant.
Reason: In an isothermal process, heat is added or removed slowly to maintain constant temperature.
- 11) **Assertion:** In an adiabatic compression, the internal energy and temperature of the system decrease.
Reason: Adiabatic compression is a rapid process.
- 12) **Assertion:** By doing some work on the system, we can change the internal energy of a system.
Reason: If work is done by the system, its internal energy may decrease.
- 13) **Assertion:** When a bottle of cold carbonated drink is opened, fog forms around the opening.
Reason: Adiabatic expansion of the gas causes a lowering of temperature and condensation of water vapour.

VERY SHORT ANSWER TYPE OF QUESTIONS: (2 MARKS)

- 14) Can a system be heated and its temperature remain constant?
- 15) Is it possible to increase the temperature of a gas without adding heat to it? Explain.

SHORT ANSWER TYPE OF QUESTIONS (3 MARK):

16) Two bodies at different temperatures, T_1 and T_2 , are brought in contact. Under what condition they settle to a mean temperature? (after they attain equilibrium)

17) State and explain the First Law of Thermodynamics.

18) Explain why?

i) 500 J of work is done on a gas to reduce its volume by compression adiabatically. What is the change in the internal energy of the gas?

ii) The climate of a harbour town has a higher temperature than that of a town in the desert at the same latitude.

LONG ANSWER TYPE OF QUESTIONS (5 MARKS):

19) At 0°C and normal atmospheric pressure, the volume of 1g of water increases from 1cm^3 to 1.091cm^3 on freezing. What will be the change in its internal energy? Normal atmospheric pressure is $1.013 \times 10^5\text{N/m}^2$ and the latent heat of melting of ice is 80cal/g .

CASE STUDY TYPE OF QUESTIONS (4 MARKS):

20) The first law of thermodynamics is a statement of conservation of energy applied to any system in which energy transfer from or to the surroundings is taken into account. It states that given to a system, either used in doing external work or it increases the internal energy of the system, or both. i.e, Heat supplied, $\Delta Q = \Delta U + \Delta W$, where, ΔQ = heat supplied to the system by the surroundings, ΔW = work done by the system on the surroundings, and ΔU = change in internal energy of the system.

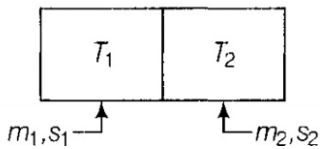
- i. For an ideal gas, internal energy depends on
- only molecular kinetic energy
 - only the potential energy of the molecules
 - Both kinetic and potential energies of the molecules
 - None of the above

- ii. The internal energy of a system could be changed
- By extracting heat from the system
 - By doing work done on the system
 - If the system does some work on the surroundings
 - All the above

- iii. Using the first law of thermodynamics, which is true for isothermal expansion of an ideal gas?
- $\Delta U = +^{\text{ve}}$
 - $\Delta Q = +^{\text{ve}}$
 - $\Delta W = +^{\text{ve}}$
 - Both b) and c)

- iv. A system is provided with 100 cal of heat, and the work done by the system on the surroundings is 20 J. Then, its internal energy
- increases by 600 J

- b) decreases by 800 J
- c) increases by 400 J
- d) decreases by 50 J

ANSWER KEY	
1	d) $\Delta Q - \Delta W$
2	a) Isobaric process
3	d) An isothermal curve may intersect an adiabatic
4	d) Both b) and c)
5	a) Temperature
6	d) 20 J
7	a) is always zero
8	d) 1.68 kJ
9	a) Both A and R are true, and R is the correct explanation of A.
10	a) Both A and R are true, and R is the correct explanation of A.
11	c) A is false, but R is true.
12	a) Both A and R are true, and R is the correct explanation of A.
13	a) Both A and R are true, and R is the correct explanation of A.
14	Yes, it is possible. If the system utilizes the total heat supplied to do work, then the temperature remains constant. The process is isothermal.
15	Yes, when the gas undergoes adiabatic compression, its temperature increases without any heat being added to it.
16	<div style="text-align: center;">  </div> <p>Let m_1 and m_2 are masses of bodies with specific heats s_1 and s_2, then if their temperature after they are in thermal equilibrium is T.</p> <p>Then, if $T_1 > T > T_2$ and assuming no heat loss.</p> <p>Heat lost by hot body = heat gained by cold body</p> $m_1 s_1 (T_1 - T) = m_2 s_2 (T - T_2)$ $\Rightarrow \frac{m_1 s_1 T_1 + m_2 s_2 T_2}{m_1 s_1 + m_2 s_2} = T \text{ [equilibrium temperature]}$ <p>So for, bodies to settle down to mean temperature,</p> <p>$m_1 = m_2$ and $s_1 = s_2$ means bodies have same specific heat and have equal masses.</p> <p>Then,</p> $T = \frac{T_1 + T_2}{2} \text{ [mean temperature]}$
17	<p>According to the First Law of Thermodynamics, if an amount of heat ΔQ is supplied to a thermodynamic system, a part of it may increase the internal energy of the system by ΔU, and the remaining part is used up as the external work done ΔW by the system. Thus, we have $\Delta Q = \Delta U + \Delta W$.</p> <p>The First Law of Thermodynamics follows the conservation law of energy and</p>

	<p>establishes an exact relation between heat transferred and mechanical work done. It provides a valuable concept of internal energy. It is applicable to every process in nature and to all three states of matter, i.e., solid, liquid, and gases. Moreover, a change in internal energy of a system may be due to any cause, like a change in translational, rotational, or vibrational kinetic energy or molecular potential energy, etc.</p>
18	<p>i) Process is adiabatic, $\Delta Q = 0$; Work done on the gas $\Delta W = -500 \text{ J}$ According to the first law of thermodynamics, $\Delta Q = \Delta U + \Delta W$</p> $\Delta U = -\Delta W = 500 \text{ J}$ <p>ii) This is because in a harbour town, the relative humidity is more than in a desert town. Hence, the climate of a harbour town has a higher temperature.</p>
19	<p>Mass of water = $m = 1 \text{ g}$ $L_f =$ Latent heat of melting of ice = 80 cal/g</p> <p>$Q = -(mL_f) = -80 \text{ cal}$ [Negative sign is assigned to Q because it is given out by water]</p> <p>During freezing, the water expands against atmospheric pressure. Hence, external work (W) is done by water :-</p> $W = P \times \Delta V$ <p>$P = 1.013 \times 10^5 \text{ N/m}^2$; $V_1 =$ Initial volume = 1 cm^3 $V_2 =$ final volume = 1.91 cm^3</p> $\Delta V = V_2 - V_1 = 1.091 - 1 = 0.091 \text{ cm}^3 = 0.091 \times 10^{-6} \text{ m}^3$ <p>So, $W = (1.013 \times 10^5) \times (0.091 \times 10^{-6}) \dots\dots(i)$</p> $W = 0.0092 \text{ J}$ <p>Since, $1 \text{ cal} = 4.2 \text{ J}$ so, $W = \frac{0.0092}{4.2} = 0.0022 \text{ cal} \dots\dots(ii)$</p> <p>The work has been done by ice, so it will be taken positive.</p> <p>Acc. to first law of thermodynamics, $\Delta Q = \Delta U + W$ So, $\Delta U = Q - W$ $= (-80) - (-0.0022)$ (using (i) & (ii)) $\Delta U = -80.0022 \text{ cal}$</p> <p>Negative sign indicates that internal energy of water decreases on freezing.</p>
20	<p>i. a) only molecular kinetic energy ii. d) All the above iii. d) Both b) and c) iv. c) increases by 400 J</p>

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