INDIAN SCHOOL AL WADI AL KABIR		
CLASS XI	**DEPARTMENT: SCIENCE** **2024-25** **SUBJECT: PHYSICS**	**DATE: 25-01-2025**
WORKSHEET NO: 11 **WITH ANSWERS**	**TOPIC: THERMODYNAMICS**	**NOTE: A4 FILE FORMAT**
CLASS & SEC:	**NAME OF THE STUDENT:**	**ROLL NO.**

MULTIPLE CHOICE 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 up to
   a. 260^0C
   b. 100^0C
   c. 360^0C
   d. 500^0C

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

6. The specific heat of a gas in an isothermal process is
   a. Zero
   b. Infinity
   c. One
   d. Not defined

7. The change in temperature of a body is 50^0C. The change in temperature on the Kelvin scale is
   a. 50K
   b. 323K
   c. 223K
   d. 100K
8. Which of the following is incorrect regarding the first law of thermodynamics?
   A. It is not applicable to any cyclic process.
   B. It is a restatement of the principle of conservation of energy.
   C. It introduces the concept of the internal energy
   D. It introduces the concept of Entropy.

   a. A and D
   b. B and C
   c. C and A
   d. A and B
9. On the absolute scale of temperature given by Kelvin, steam point has a value of
   a. 0K
   b. 373.15 K
   c. 273.15 K
   d. 300 K
10. The specific heat of a gas in an adiabatic process is _____
    a. Infinity.
    b. Not defined.
    c. Zero
    d. Varies from zero to infinity.

11. Zeroth law of thermodynamics.....
    a. Deals with conversion of mass and energy
    b. Deals with reversibility and irreversibility of process
    c. States that if two system are both in equilibrium with a third system, they are in thermal equilibrium with each other
    d. Deals with heat engines.
12. There are two statements A and B
    Statement A. Equal volumes of all gases at the same temperature T and pressure P contain an equal no of Molecules
    Statement B: The no of molecules in one mole of any gas is $6.0255 * 10^{22}$.
    Which one of the following is correct
    a. A and B both
    b. A only
    c. B only
    d. A and B both are incorrect

ANSWER	
1. b	Explanation: A reversible process gives the maximum work.
2. a	Is a bad conductor of heat.
3. c	360^0C
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.b	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. a	50K
8. a	A and D
9.b	373.15K
10.c	Zero
11.c	States that if two system are both in equilibrium with a third system, they are in thermal equilibrium with each other
12.a	A and B both

SHORT ANSWER QUESTIONS

13. State first law of thermodynamics**.**

14. State second law of thermodynamics

15. What is isothermal process? Also give essential conditions for an isothermal process to take place.

16. 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.)

17. 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.)

18. 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)

19. 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)

20. Cooking gas containers are kept in a lorry moving with uniform speed. What will be the effect on temperature of the gas molecules?

Temperature of gas molecules will remain same because temperature of gas molecules depends on their relative kinetic energy with respect to center of mass molecules, as all molecules along with centre of mass will move with same speed, so there velocity with respect to each other would be zero, hence will have zero relative kinetic energy due to motion so it will not affect temperature

LONG ANSWER TYPE QUESTIONS

21. A gas is contained in a cylinder with a movable 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
Fs=560
s=560/F
=560/102*10
s=.54 m)

22. 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 = 4.19 J)

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 $= 9.35 \times 4.2$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.

23. Two cylinders A and B of equal capacity are connected to each other via a stopcock. A contains a gas at standard temperature and pressure. B is completely evacuated. The entire system is thermally insulated. The stopcock is suddenly opened. Answer the following:
(a) What is the final pressure of the gas in A and B ?
(b) What is the change in internal energy of the gas?
(c) What is the change in the temperature of the gas?

Answer: (a) Since the final temperature and initial temperature remain the same,

$\therefore$ $P_2V_2 = P_1V_1$

But $P_1 = 1$ atm, $V_1 = V$, $V_2 = 2V$ and $P_2 = ?$

$\therefore$ $P_2 = \frac{P_1V_1}{V_2} = \frac{1 \times V}{2V} = 0.5$ atm

(b) Since the temperature of the system remains unchanged, change in internal energy is zero.

(c) The system being thermally insulated, there is no change in temperature (because of free expansion)

ASSERTION AND REASONING

DIRECTION: In the following questions, a statement of assertion (A) is followed by a statement of reason (R). Mark the correct choice as:
(a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).
(b) Both assertion (A) and reason (R) are true but reason (R) is not the correct explanation of assertion (A).
(c) Assertion (A) is true but reason (R) is false.
(d) Both Assertion and Reason are false.

24. **Assertion:** The heat supplied to a system is always equal to the increase in its internal energy.
Reason: When a system changes from one thermal equilibrium to another, some heat is absorbed by it.

25. **Assertion:** The specific heat of a gas is an adiabatic process is zero and in an isothermal process is infinite.
Reason: Specific heat of a gas in directly proportional to change of heat in system and inversely proportional to change in temperature.

26. **Assertion:** Reversible systems are difficult to find in real world.
Reason: Most processes are dissipative in nature

27. **Assertion:** Work and heat are two equivalent form of energy.
Reason: Work is the transfer of mechanical energy irrespective of temperature difference, whereas heat is the transfer of thermal energy because of temperature difference only.

	ANSWERS
24. Ans. d	(d) Both Assertion and Reason are false.
25. Ans. a	(a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).
26. Ans. a	Ans. a (a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A). In a perfectly reversible system, there is no loss of energy. Losses can be minimised, friction can be reduced, the resistance in L-C oscillating system can also be negligible. But one cannot completely eliminate energy losses. This makes a perfectly reversible system, an ideal.
27.	Answer: (a) (a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A). Heat is similar to work in that both represent ways of transferring energy. Neither heat nor work is an intrinsic property of a system, that is, we cannot say that a system contains a certain amount of heat or work.

CASE STUDY QUESTIONS

28.**Case Study 1:** The first law of thermodynamics is the general law of conservation of energy applied to any system in which energy transfer from or to the surroundings (through heat and work) is taken into account. It states that the energy supplied to the system goes in partly to increase the internal energy of the system and the rest in work on the environment.

Mathematically, $\Delta Q = \Delta U + \Delta W$ where ΔQ is the heat supplied to the system, ΔW is the work done by the system and ΔU is the change in internal energy of the system. ΔQ and ΔW depend on the path taken to go from initial to final states, but the combination $\Delta Q - \Delta W$ is path independent.

(i) The first law of thermodynamics is concerned with the conservation of
(a) number of molecules
(b) number of moles
(c) energy
(d) temperature

(ii) An electric heater supplies heat to a system at a rate of 120 W. If system performs work at a rate of 80 J s^{-1}, the rate of increase in internal energy is
(a) 30 J s^{-1}
(b) 40 J s^{-1}
(c) 50 J s^{-1}
(d) 60 J s^{-1}

(iii) Thermodynamics is the branch of physics that deals with the study of:
(a) Light and sound
(b) Heat, work, and energy transfer
(c) Motion and forces
(d) Electricity and magnetism

(iv) What is the fundamental concept in thermodynamics that involves two bodies in contact reaching a state with no net heat transfer between them?
(a) Thermal equilibrium
(b) Entropy
(c) Conservation of energy
(d) Internal energy

OR

Which law of thermodynamics states that energy cannot be created or destroyed, but can only change from one form to another?
(a) The first law of thermodynamics
(b) The second law of thermodynamics
(c) The law of thermal equilibrium
(d) The law of conservation of energy

A**NSWERS**	
2**8.**	(i) (c) energy
	(ii) (b) 40 J s^{-1}
	(iii) (b) Heat, work, and energy transfer
	(iv) (a) Thermal equilibrium OR (a) The first law of thermodynamics

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