

INDIAN SCHOOL AL WADI AL KABIR



Class: XI	Department: SCIENCE- 2023 -2024 PHYSICS	Date: 31/01/2024
Worksheet No: 12	CHAPTER: THERMODYNAMICS & KINETIC THEORY OF GASES	Note: A4 FILE FORMAT
Name of the student:	Class & Sec:	Roll No:

- 1. A gas behaves as an ideal gas at
- (a) low pressure and high temperature (b) low
- (c) high pressure and low temperature Ans; - (a)
- (b) low pressure and low temperature
- (d) high pressure and high temperature
- 2. The translational kinetic energy of gas molecules for 1 mol of gas is equal to

(a)	$\frac{3}{2}$ RT	(b)	$\frac{2 \text{ KT}}{3}$
(c)	$\frac{\mathrm{RT}}{2}$	(d)	$\frac{3 \text{ KT}}{2}$

Ans; - (a)

- 3. The work done by (or on) a gas per mole per kelvin is called
- (a) Universal gas constant(c) Gravitational constant

(b) Boltzmann's constant(d) Entropy

- , Ans; - (a)
- 4. The root mean square speed of the molecules of a gas is
- (a) independent of its pressure but directly proportional to its Kelvin temperature
- (b) directly proportional to two square roots of both its pressure and its Kelvin temperature
- (c) independent of its pressure but directly proportional to the square root of its Kelvin temperature.

(d) directly proportional to its pressure and its Kelvin temperature. Ans; - (c)

5. The root mean square velocity of gas molecules is 10 km/s. The gas is heated till its pressure becomes four times. The velocity of gas molecules will be

(a)10 Km/s	(b) 20 Km/s	(c) 40 Km/s	(d) 80 Km/s
Ans; - (b)			

6. Dimensional formula for universal gas constant R is given by

(a)	$[ML^2T^{-2}K^{-2}]$	(b)	$[ML^2T^{-3}K^{-1}]$
(c)	$[M^{\circ}L^{2}T^{-3}K^{-1}]$	(d)	$[ML^2T^{-2}K^{-4}]$

7. An ant is walking on the horizontal surface. The number of degrees of freedom of ant will be(a)1(b) 2(c) 3(d) 6Ans; - (b)8. The specific heat of a gas (a) has only two values Cp & Cv(b) has a unique value of given temperature (c) can have any values from O to \propto (d) depends upon the mass of the gas Ans; - (c)ASSERTION - REASON BASED QUESTIONS Direction: - In the following questions, a statement of assertion is followed by a statement of reason. Mark the correct choice as: (a) If both assertion and reason are true and reason is the correct explanation of assertion. (b) If both assertion and reason are true but reason is not correct explanation of assertion. (c) If assertion is true, but reason is false. (d) If both assertion and reason are false.1. Assertion: If a gas container in motion is suddenly stopped, the temperature of the gas rises. Reason: The kinetic energy of ordered mechanical motion is converted into the kinetic energy of random motion of gas molecules. (a) A (b) B (c) C (d)D2. Assertion: The total translational kinetic energy of all the molecules of a given mass of an ideal gas is 1.5 times the product of its pressure and its volume. Reason: The molecules of a gas collide with each other and the velocities of the molecules change due to collision. (a) A (b) B (c) C (d)D3. Assertion: Gases do not settle to the bottom of a container. Reason: The molecules of a gas collide with each other and the velocities of the molecules change due to collision. (a) A (b) B (c) C (d)D4. Assertion: A gas can be liquified at any temperature by increase of pressure alone. Reason: On increasing pressure the temperature by increases. (a)A (b) B (c) C (c) C (d)D <td< th=""><th>Ans; - (a)</th><th></th><th></th></td<>	Ans; - (a)		
 7. An ant is walking on the horizontal surface. The number of degrees of freedom of ant will be (a)1 (b) 2 (c) 3 (d) 6 Ans; - (b) 8. The specific heat of a gas (a) has only two values Cp & Cv (b) has a unique value of given temperature (c) can have any values from O to ∝ (d) depends upon the mass of the gas Ans; - (c) ASSERTION - REASON BASED QUESTIONS Direction: - In the following questions, a statement of assertion is followed by a statement of reason. Mark the correct choice as: (a) If both assertion and reason are true and reason is the correct explanation of assertion. (b) If both assertion and reason are true but reason is not correct explanation of assertion. (c) If assertion is true, but reason is false. (d) If both assertion and reason are false. 1. Assertion: If a gas container in motion is suddenly stopped, the temperature of the gas rises. Reason: The kinetic energy of ordered mechanical motion is converted into the kinetic energy of random motion of gas molecules. (a) A (b) B (c) C (d)D 2. Assertion: The total translational kinetic energy of all the molecules of a given mass of an ideal gas is 1.5 times the product of its pressure and its volume. Reason: The molecules of a gas collide with each other and the velocities of the molecules change due to collision. (a)A (b) B (c) C (d)D 3. Assertion: A gas can be liquified at any temperature by increase of pressure alone. Reason: On increasing pressure the temperature by increases. (a)A (b) B (c) C (d)D 4. Assertion: A gas can be liquified at any temperature by increase of pressure alone. Reason: On increasing pressure the temperature of gas decr			
7. An ant is walking on the horizontal surface. The number of degrees of freedom of ant will be (a)1 (b) 2 (c) 3 (d) 6 Ans; - (b) 8. The specific heat of a gas (a) has only two values Cp & Cv (b) has a unique value of given temperature (c) can have any values from 0 to \propto (d) depends upon the mass of the gas Ans; - (c) ASSERTION - REASON BASED QUESTIONS Direction: - In the following questions, a statement of assertion is followed by a statement of reason. Mark the correct choice as: (a) If both assertion and reason are true and reason is the correct explanation of assertion. (b) If both assertion and reason are true but reason is not correct explanation of assertion. (c) If assertion is true, but reason is false. (d) If both assertion and reason are false. 1. Assertion: If a gas container in motion is suddenly stopped, the temperature of the gas rises. Reason: The kinetic energy of ordered mechanical motion is converted into the kinetic energy of random motion of gas molecules. (a)A (b)B (c)C (d)D 2. Assertion: The total translational kinetic energy of all the molecules of a given mass of an ideal gas is 1.5 times the product of its pressure and its volume. Reason: The molecules of a gas collide with each other and the velocities of the molecules change due to collision. (a)A (b)B (c)C (d)D 3. Assertion: Gases do not settle to the bottom of a container. Reason: Gases have high kinetic energy. (a)A (b)B (c)C (d)D 4. Assertion: A gas can be liquified at any temperature by increase of pressure alone. Reason: On increasing pressure the temperature by increases. (a)A (b)B (c)C (d)D 5. Assertion: Equal masses of helium and oxygen gases are given equal quantities of heat. There will be a transta tio is the a temperature by increases of pressure alone.			
 7. An ant is walking on the horizontal surface. The number of degrees of freedom of ant will be (a)1 (b)2 (c)3 (d)6 Ans; - (b) 8. The specific heat of a gas (a) has only two values Cp & Cv (b) has a unique value of given temperature (c) can have any values from 0 to α (d) depends upon the mass of the gas Ans; - (c) ASSERTION - REASON BASED QUESTIONS Direction: - In the following questions, a statement of assertion is followed by a statement of reason. Mark the correct choice as: (a) If both assertion and reason are true and reason is the correct explanation of assertion. (b) If both assertion and reason are true but reason is not correct explanation of assertion. (c) If assertion is true, but reason is false. (d) If both assertion and reason are false. 1. Assertion: If a gas container in motion is suddenly stopped, the temperature of the gas rises. (a) A (b) B (c) C (d)D 2. Assertion: The total translational kinetic energy of all the molecules of a given mass of an ideal gas is 1.5 times the product of its pressure and its volume. Reason: The molecules of a gas collide with each other and the velocities of the molecules change due to collision. (a)A (b) B (c) C (d)D 3. Assertion: Gases do not settle to the bottom of a container. Reason: Gases have high kinetic energy. (a)A (b) B (c) C (d)D 4. Assertion: A gas can be liquified at any temperature by increase of pressure alone. Reason: On increasing pressure the temperature of gas decreases. (a)A (b) B (c) C (d)D 4. Assertion: Equal masses of helium and oxygen gases are given equal quantities of heat. There will be a true by output the follower daysen gase are given equal quantities of heat. There will be a true to the follower daysen gase are given equal quantities of heat. There will be a true to the open output of the follower daysen gase are given equal quantities of heat. There will be a true to the open output of gas content the day the follower day the follower day the follower day			
freedom of ant will be (a)1 (b) 2 (c) 3 (d) 6 Ans; - (b) 8. The specific heat of a gas (a) has only two values Cp & Cv (b) has a unique value of given temperature (c) can have any values from 0 to \propto (d) depends upon the mass of the gas Ans; - (c) ASSERTION - REASON BASED QUESTIONS Direction: - In the following questions, a statement of assertion is followed by a statement of reason. Mark the correct choice as: (a) If both assertion and reason are true and reason is the correct explanation of assertion. (b) If both assertion and reason are true but reason is not correct explanation of assertion. (c) If assertion and reason are true but reason is not correct explanation of assertion. (d) If both assertion and reason are false. 1. Assertion: If a gas container in motion is suddenly stopped, the temperature of the gas rises. Reason: The kinetic energy of ordered mechanical motion is converted into the kinetic energy of random motion of gas molecules. (a)A (b)B (c)C (d)D 2. Assertion: The total translational kinetic energy of all the molecules of a given mass of an ideal gas is 1.5 times the product of its pressure and its volume. Reason: The molecules of a gas collide with each other and the velocities of the molecules change due to collision. (a)A (b)B (c)C (d)D 3. Assertion: Gases do not settle to the bottom of a container. Reason: Gases have high kinetic energy. (a)A (b)B (c)C (d)D 4. Assertion: A gas can be liquified at any temperature by increase of pressure alone. Reason: On increasing pressure the temperature of gas decreases. (a)A (b)B (c)C (d)D 5. Assertion: Equal masses of helium and oxygen gases are given equal quantities of heat. There will be a transter for the total temperature of balt the totage on the totage of the container. Reason: The is the theorement to the balt on correct on the totage of the container. Reason: On increasing pressure the temperature of gas decreases. (a)A (b)B (c)C (d)D 5. Assertion: Equal masses of helium and oxygen gases are given equal q	7. An ant is walking on the horizontal surfac	e. The number of deg	rees of
 (a)1 (b)2 (c) 3 (d) 6 Ans; - (b) 8. The specific heat of a gas (a) has only two values Cp & Cv (b) has a unique value of given temperature (c) can have any values from 0 to ∝ (d) depends upon the mass of the gas Ans; - (c) ASSERTION - REASON BASED QUESTIONS Direction: - In the following questions, a statement of assertion is followed by a statement of reason. Mark the correct choice as: (a) If both assertion and reason are true and reason is the correct explanation of assertion. (b) If both assertion and reason are true but reason is not correct explanation of assertion. (c) If assertion is true, but reason is false. (d) If both assertion and reason are false. 1. Assertion: If a gas container in motion is suddenly stopped, the temperature of the gas rises. Reason: The kinetic energy of ordered mechanical motion is converted into the kinetic energy of random motion of gas molecules. (a) A (b) B (c) C (d) D 2. Assertion: The total translational kinetic energy of all the molecules of a given mass of an ideal gas is 1.5 times the product of its pressure and its volume. Reason: The molecules of a gas collide with each other and the velocities of the molecules change due to collision. (a) A (b) B (c) C (d) D 3. Assertion: A gas can be liquified at any temperature by increase of pressure alone. Reason: On increasing pressure the temperature of gas decreases. (a) A (b) B (c) C (d) D 5. Assertion: A gas can be liquified at any temperature of gas decreases. (a) A (b) B (c) C (d) D 5. Assertion: Equal masses of helium and oxygen gases are given equal quantities of heat. There will be a transment of a superature is the torease. 	freedom of ant will be		
Ans; - (b) 8. The specific heat of a gas (a) has only two values $Cp \& Cv$ (b) has a unique value of given temperature (c) can have any values from 0 to \propto (d) depends upon the mass of the gas Ans; - (c) ASSERTION - REASON BASED QUESTIONS Direction: - In the following questions, a statement of assertion is followed by a statement of reason. Mark the correct choice as: (a) If both assertion and reason are true and reason is the correct explanation of assertion. (b) If both assertion and reason are true but reason is not correct explanation of assertion. (c) If assertion is true, but reason is false. (d) If both assertion and reason are false. 1. Assertion: If a gas container in motion is suddenly stopped, the temperature of the gas rises. Reason: The kinetic energy of ordered mechanical motion is converted into the kinetic energy of random motion of gas molecules. (a)A (b)B (c)C (d)D 2. Assertion: The total translational kinetic energy of all the molecules of a given mass of an ideal gas is 1.5 times the product of its pressure and its volume. Reason: The molecules of a gas collide with each other and the velocities of the molecules change due to collision. (a)A (b)B (c)C (d)D 3. Assertion: Gases do not settle to the bottom of a container. Reason: Gases have high kinetic energy. (a)A (b)B (c)C (d)D 4. Assertion: A gas can be liquified at any temperature by increase of pressure alone. Reason: On increasing pressure the temperature of gas decreases. (a)A (b)B (c)C (d)D 5. Assertion: Fagual masses of helium and oxygen gases are given equal quantities of heat. There will be a reators in is the theorement of the bottom of a container.	(a)1 (b) 2	(c) 3	(d) 6
 8. The specific heat of a gas (a) has only two values Cp & Cv (b) has a unique value of given temperature (c) can have any values from O to α (d) depends upon the mass of the gas Ans; - (c) ASSERTION - REASON BASED QUESTIONS Direction: - In the following questions, a statement of assertion is followed by a statement of reason. Mark the correct choice as: (a) If both assertion and reason are true and reason is the correct explanation of assertion. (b) If both assertion and reason are true but reason is not correct explanation of assertion. (c) If assertion and reason are false. (d) If both assertion and reason are false. 1. Assertion: If a gas container in motion is suddenly stopped, the temperature of the gas rises. Reason: The kinetic energy of ordered mechanical motion is converted into the kinetic energy of random motion of gas molecules. (a) A (b) B (c) C (d) D 2. Assertion: The total translational kinetic energy of all the molecules of a given mass of an ideal gas is 1.5 times the product of its pressure and its volume. Reason: The molecules of a gas collide with each other and the velocities of the molecules change due to collision. (a) A (b) B (c) C (d) D 3. Assertion: Gases do not settle to the bottom of a container. Reason: Gases have high kinetic energy. (a) A (b) B (c) C (d) D 4. Assertion: A gas can be liquified at any temperature by increase of pressure alone. Reason: On increasing pressure the temperature by increase of pressure alone. Reason: On increasing pressure the temperature of gas decreases. (a) A (b) B (c) C (d) D 5. Assertion: Equal masses of helium and oxygen gases are gi	Ans; - (b)		
 (a) has only two values Cp & Cv (b) has a unique value of given temperature (c) can have any values from O to α (d) depends upon the mass of the gas Ans; - (c) ASSERTION - REASON BASED QUESTIONS Direction: - In the following questions, a statement of assertion is followed by a statement of reason. Mark the correct choice as: (a) If both assertion and reason are true and reason is the correct explanation of assertion. (b) If both assertion and reason are true but reason is not correct explanation of assertion. (c) If assertion is true, but reason is false. (d) If both assertion and reason are false. 1. Assertion: If a gas container in motion is suddenly stopped, the temperature of the gas rises. (a) A (b) B (c) C (d) D 2. Assertion: The total translational kinetic energy of all the molecules of a given mass of an ideal gas is 1.5 times the product of its pressure and its volume. Reason: The molecules of a gas collide with each other and the velocities of the molecules change due to collision. (a) A (b) B (c) C (d) D 3. Assertion: Gases do not settle to the bottom of a container. Reason: Gases have high kinetic energy. (a) A (b) B (c) C (d) D 4. Assertion: A gas can be liquified at any temperature by increase of pressure alone. Reason: On increasing pressure the temperature of gas decreases. (a) A (b) B (c) C (d) D 5. Assertion: A gas can be liquified at any temperature by increase of pressure alone. Reason: On increasing pressure the temperature of gas decreases. (a) A (b) B (c) C (d) D 5. Assertion: A gas can be liquified at any temperature by increase of pressure alone. Reason: On increasing pressure the temperature of gas decreases. (a) A (b) B (c) C (d) D <td>8. The specific heat of a gas</td> <td></td> <td></td>	8. The specific heat of a gas		
 (c) can have any values from O to ∝ (d) depends upon the mass of the gas Ans; - (c) ASSERTION - REASON BASED QUESTIONS Direction: - In the following questions, a statement of assertion is followed by a statement of reason. Mark the correct choice as: (a) If both assertion and reason are true and reason is the correct explanation of assertion. (b) If both assertion and reason are true but reason is not correct explanation of assertion. (c) If assertion is true, but reason is false. (d) If both assertion and reason are false. 1. Assertion: If a gas container in motion is suddenly stopped, the temperature of the gas rises. Reason: The kinetic energy of ordered mechanical motion is converted into the kinetic energy of random motion of gas molecules. (a) A (b) B (c) C (d) D 2. Assertion: The total translational kinetic energy of all the molecules of a given mass of an ideal gas is 1.5 times the product of its pressure and its volume. Reason: The molecules of a gas collide with each other and the velocities of the molecules change due to collision. (a) A (b) B (c) C (d) D 3. Assertion: Gases do not settle to the bottom of a container. Reason: Gases have high kinetic energy. (a) A (b) B (c) C (d) D 4. Assertion: A gas can be liquified at any temperature by increase of pressure alone. Reason: On increasing pressure the temperature of gas decreases. (a) A (b) B (c) C (d) D 5. Assertion: Equal masses of helium and oxygen gases are given equal quantities of heat. There will be a remoter with the tot end to the tot to the tot endorm.	(a) has only two values Cp & Cv	(b) has a unique value	e of given temperature
Ans; - (c) ASSERTION - REASON BASED QUESTIONS Direction: - In the following questions, a statement of assertion is followed by a statement of reason. Mark the correct choice as: (a) If both assertion and reason are true and reason is the correct explanation of assertion. (b) If both assertion and reason are true but reason is not correct explanation of assertion. (c) If assertion is true, but reason is false. (d) If both assertion and reason are false. 1. Assertion: If a gas container in motion is suddenly stopped, the temperature of the gas rises. Reason: The kinetic energy of ordered mechanical motion is converted into the kinetic energy of random motion of gas molecules. (a) A (b) B (c) C (d) D 2. Assertion: The total translational kinetic energy of all the molecules of a given mass of an ideal gas is 1.5 times the product of its pressure and its volume. Reason: The molecules of a gas collide with each other and the velocities of the molecules change due to collision. (a) A (b) B (c) C (d) D 3. Assertion: Gases do not settle to the bottom of a container. Reason: Gases have high kinetic energy. (a) A (b) B (c) C (d) D 4. Assertion: A gas can be liquified at any temperature by increase of pressure alone. Reason: On increasing pressure the temperature of gas decreases. (a) A (b) B (c) C (d) D 5. Assertion: Equal masses of helium and oxygen gases are given equal quantities of heat. There will be a transtartion is the transaction and oxygen gases are given equal quantities of heat. There will be a transtartion is the transtartion of a fargen equal quantities of the transtartion of a container.	(c) can have any values from O to \propto	(d) depends upon the	e mass of the gas
ASSERTION - REASON BASED QUESTIONSDirection: - In the following questions, a statement of assertion is followed by a statement of reason.Mark the correct choice as:(a) If both assertion and reason are true and reason is the correct explanation of assertion.(b) If both assertion and reason are true but reason is not correct explanation of assertion.(c) If assertion is true, but reason are false.(d) If both assertion and reason are false.1. Assertion: If a gas container in motion is suddenly stopped, the temperature of the gas rises.Reason: The kinetic energy of ordered mechanical motion is converted into the kinetic energy of randommotion of gas molecules.(a) A(b) B(c) C(d) D2. Assertion: The total translational kinetic energy of all the molecules of a given mass of an ideal gas is 1.5times the product of its pressure and its volume.Reason: The molecules of a gas collide with each other and the velocities of the molecules change due tocollision.(a) A(b) B(c) C(d) D3. Assertion: Gases do not settle to the bottom of a container.Reason: Cases have high kinetic energy.(a) A(b) B(c) C(d) D4. Assertion: A gas can be liquified at any temperature by increase of pressure alone.Reason: On increasing pressure the temperature of gas decreases.(a) A(b) B(c) C(d) D5. Assertion: A gas can be liquified at any temperature by increase of pressure alone.Re	Ans; - (c)		
Direction: - In the following questions, a statement of assertion is followed by a statement of reason. Mark the correct choice as: (a) If both assertion and reason are true and reason is the correct explanation of assertion. (b) If both assertion and reason are true but reason is not correct explanation of assertion. (c) If assertion is true, but reason is false. (d) If both assertion and reason are false. 1. Assertion: If a gas container in motion is suddenly stopped, the temperature of the gas rises. Reason: The kinetic energy of ordered mechanical motion is converted into the kinetic energy of random motion of gas molecules. (a) A (b) B (c) C (d) D 2. Assertion: The total translational kinetic energy of all the molecules of a given mass of an ideal gas is 1.5 times the product of its pressure and its volume. Reason: The molecules of a gas collide with each other and the velocities of the molecules change due to collision. (a) A (b) B (c) C (d) D 3. Assertion: Gases do not settle to the bottom of a container. Reason: Gases have high kinetic energy. (a) A (b) B (c) C (d) D 4. Assertion: A gas can be liquified at any temperature by increase of pressure alone. Reason: On increasing pressure the temperature of gas decreases. (a) A (b) B (c) C (d) D 5. Assertion: Equal masses of helium and oxygen gases are given equal quantities of heat. There will be a remote remote of is the total mad oxygen gases are given equal quantities of heat. There will be a remote remote the thet of environe	ASSERTION - REASON BASED QUEST	IONS	
Mark the correct choice as: (a) If both assertion and reason are true and reason is the correct explanation of assertion. (b) If both assertion and reason are true but reason is not correct explanation of assertion. (c) If assertion is true, but reason is false. (d) If both assertion and reason are false. 1. Assertion: If a gas container in motion is suddenly stopped, the temperature of the gas rises. Reason: The kinetic energy of ordered mechanical motion is converted into the kinetic energy of random motion of gas molecules. (a) A (b) B (c) C (d) D 2. Assertion: The total translational kinetic energy of all the molecules of a given mass of an ideal gas is 1.5 times the product of its pressure and its volume. Reason: The molecules of a gas collide with each other and the velocities of the molecules change due to collision. (a) A (b) B (c) C (d) D 3. Assertion: Gases do not settle to the bottom of a container. Reason: Gases have high kinetic energy. (a) A (b) B (c) C (d) D 4. Assertion: A gas can be liquified at any temperature by increase of pressure alone. Reason: On increasing pressure the temperature of gas decreases. (a) A (b) B (c) C (d) D 5. Assertion: Equal masses of helium and oxygen gases are given equal quantities of heat. There will be a recent recent the temperature of the output the of a recent recent term of the temperature of the output terms of the temperature of a recent recent terms of the temperature of the output terms of the temperature of the temperature of the temperature of the temperature of the terms of the temperature of the te	Direction: - In the following questions	s, a statement of asser	rtion is followed by a statement of reason.
 (a) If both assertion and reason are true and reason is the correct explanation of assertion. (b) If both assertion and reason are true but reason is not correct explanation of assertion. (c) If assertion is true, but reason is false. (d) If both assertion and reason are false. 1. Assertion: If a gas container in motion is suddenly stopped, the temperature of the gas rises. Reason: The kinetic energy of ordered mechanical motion is converted into the kinetic energy of random motion of gas molecules. (a) A (b) B (c) C (d) D 2. Assertion: The total translational kinetic energy of all the molecules of a given mass of an ideal gas is 1.5 times the product of its pressure and its volume. Reason: The molecules of a gas collide with each other and the velocities of the molecules change due to collision. (a) A (b) B (c) C (d) D 3. Assertion: Gases do not settle to the bottom of a container. Reason: Gases have high kinetic energy. (a) A (b) B (c) C (d) D 4. Assertion: A gas can be liquified at any temperature by increase of pressure alone. Reason: On increasing pressure the temperature of gas decreases. (a) A (b) B (c) C (d) D 5. Assertion: Equal masses of helium and oxygen gases are given equal quantities of heat. There will be a reaster to is in the temperature of pressure. 	Mark the correct choice as:		
 (b) If both assertion and reason are true but reason is not correct explanation of assertion. (c) If assertion is true, but reason are false. (d) If both assertion and reason are false. 1. Assertion: If a gas container in motion is suddenly stopped, the temperature of the gas rises. Reason: The kinetic energy of ordered mechanical motion is converted into the kinetic energy of random motion of gas molecules. (a)A (b) B (c) C (d)D 2. Assertion: The total translational kinetic energy of all the molecules of a given mass of an ideal gas is 1.5 times the product of its pressure and its volume. Reason: The molecules of a gas collide with each other and the velocities of the molecules change due to collision. (a)A (b) B (c) C (d)D 3. Assertion: Gases do not settle to the bottom of a container. Reason: Gases have high kinetic energy. (a)A (b) B (c) C (d)D 4. Assertion: A gas can be liquified at any temperature by increase of pressure alone. Reason: On increasing pressure the temperature of gas decreases. (a)A (b) B (c) C (d)D 5. Assertion: Equal masses of helium and oxygen gases are given equal quantities of heat. There will be a receiver is in the temperature of oxygen gases. 	(a) If both assertion and reason are tr	rue and reason is the c	correct explanation of assertion.
(c) If assertion is true, but reason is false.(d) If both assertion and reason are false. 1. Assertion: If a gas container in motion is suddenly stopped, the temperature of the gas rises.Reason: The kinetic energy of ordered mechanical motion is converted into the kinetic energy of randommotion of gas molecules.(a)A(b) B(c) C(d)D 2. Assertion: The total translational kinetic energy of all the molecules of a given mass of an ideal gas is 1.5times the product of its pressure and its volume.Reason: The molecules of a gas collide with each other and the velocities of the molecules change due tocollision.(a)A(b) B(c) C(d)D 3. Assertion: Gases do not settle to the bottom of a container.Reason: Gases have high kinetic energy.(a)A(b) B(c) C(d)D 4. Assertion: A gas can be liquified at any temperature by increase of pressure alone.Reason: On increasing pressure the temperature of gas decreases.(a)A(b) B(c) C(d)D 5. Assertion: Equal masses of helium and oxygen gases are given equal quantities of heat. There will be a creater time in the temperature of the the temperature of	(b) If both assertion and reason are tr	rue but reason is not c	correct explanation of assertion.
(d) If both assertion and reason are false. 1. Assertion: If a gas container in motion is suddenly stopped, the temperature of the gas rises.Reason: The kinetic energy of ordered mechanical motion is converted into the kinetic energy of randommotion of gas molecules.(a)A(b) B(c) C(d)D 2. Assertion: The total translational kinetic energy of all the molecules of a given mass of an ideal gas is 1.5times the product of its pressure and its volume.Reason: The molecules of a gas collide with each other and the velocities of the molecules change due tocollision.(a)A(b) B(c) C(d)D 3. Assertion: Gases do not settle to the bottom of a container.Reason: Gases have high kinetic energy.(a)A(b) B(c) C(d)D 4. Assertion: A gas can be liquified at any temperature by increase of pressure alone.Reason: On increasing pressure the temperature of gas decreases.(a)A(b) B(c) C(d)D 5. Assertion: Equal masses of helium and oxygen gases are given equal quantities of heat. There will be a	(c) If assertion is true, but reason is fa	alse.	
1. Assertion: If a gas container in motion is suddenly stopped, the temperature of the gas rises.Reason: The kinetic energy of ordered mechanical motion is converted into the kinetic energy of randommotion of gas molecules.(a)A(b) B(c) C(d)D2. Assertion: The total translational kinetic energy of all the molecules of a given mass of an ideal gas is 1.5times the product of its pressure and its volume.Reason: The molecules of a gas collide with each other and the velocities of the molecules change due tocollision.(a)A(b) B(c) C(d)D3. Assertion: Gases do not settle to the bottom of a container.Reason: Gases have high kinetic energy.(a)A(b) B(c) C(d)D4. Assertion: A gas can be liquified at any temperature by increase of pressure alone.Reason: On increasing pressure the temperature of gas decreases.(a)A(b) B(c) C(d)D5. Assertion: Equal masses of helium and oxygen gases are given equal quantities of heat. There will be acreater trains in the temperature of ballium ecompared to thet of any pressure	(d) If both assertion and reason are fa	alse.	
Reason: The kinetic energy of ordered mechanical motion is converted into the kinetic energy of randommotion of gas molecules.(a)A(b) B(c) C(d)D2. Assertion: The total translational kinetic energy of all the molecules of a given mass of an ideal gas is 1.5times the product of its pressure and its volume.Reason: The molecules of a gas collide with each other and the velocities of the molecules change due tocollision.(a)A(b) B(c) C(d)D3. Assertion: Gases do not settle to the bottom of a container.Reason: Gases have high kinetic energy.(a)A(b) B(c) C(d)D4. Assertion: A gas can be liquified at any temperature by increase of pressure alone.Reason: On increasing pressure the temperature of gas decreases.(a)A(b) B(c) C(d)D5. Assertion: Equal masses of helium and oxygen gases are given equal quantities of heat. There will be a	1. Assertion: If a gas container in motion is s	suddenly stopped, the	temperature of the gas rises.
motion of gas molecules.(a)A(b) B(c) C(d)D2. Assertion: The total translational kinetic energy of all the molecules of a given mass of an ideal gas is 1.5times the product of its pressure and its volume.Reason: The molecules of a gas collide with each other and the velocities of the molecules change due tocollision.(a)A(b) B(c) C(d)D3. Assertion: Gases do not settle to the bottom of a container.Reason: Gases have high kinetic energy.(a)A(b) B(c) C(d)D4. Assertion: A gas can be liquified at any temperature by increase of pressure alone.Reason: On increasing pressure the temperature of gas decreases.(a)A(b) B(c) C(d)D5. Assertion: Equal masses of helium and oxygen gases are given equal quantities of heat. There will be a	Reason: The kinetic energy of ordered mech	nanical motion is conve	erted into the kinetic energy of random
 (a)A (b) B (c) C (d)D 2. Assertion: The total translational kinetic energy of all the molecules of a given mass of an ideal gas is 1.5 times the product of its pressure and its volume. Reason: The molecules of a gas collide with each other and the velocities of the molecules change due to collision. (a)A (b) B (c) C (d)D 3. Assertion: Gases do not settle to the bottom of a container. Reason: Gases have high kinetic energy. (a)A (b) B (c) C (d)D 4. Assertion: A gas can be liquified at any temperature by increase of pressure alone. Reason: On increasing pressure the temperature of gas decreases. (a)A (b) B (c) C (d)D 5. Assertion: Equal masses of helium and oxygen gases are given equal quantities of heat. There will be a granter vice in the tot polymerature of bolium compared to the tot of any gave.	motion of gas molecules.		
 2. Assertion: The total translational kinetic energy of all the molecules of a given mass of an ideal gas is 1.5 times the product of its pressure and its volume. Reason: The molecules of a gas collide with each other and the velocities of the molecules change due to collision. (a)A (b) B (c) C (d)D 3. Assertion: Gases do not settle to the bottom of a container. Reason: Gases have high kinetic energy. (a)A (b) B (c) C (d)D 4. Assertion: A gas can be liquified at any temperature by increase of pressure alone. Reason: On increasing pressure the temperature of gas decreases. (a)A (b) B (c) C (d)D 5. Assertion: Equal masses of helium and oxygen gases are given equal quantities of heat. There will be a granter vise in the temperature of helium compared to that of average 	(a)A (b) B (c) C	(d)D	
times the product of its pressure and its volume. Reason: The molecules of a gas collide with each other and the velocities of the molecules change due to collision. (a)A (b) B (c) C (d)D 3. Assertion: Gases do not settle to the bottom of a container. Reason: Gases have high kinetic energy. (a)A (b) B (c) C (d)D 4. Assertion: A gas can be liquified at any temperature by increase of pressure alone. Reason: On increasing pressure the temperature of gas decreases. (a)A (b) B (c) C (d)D 5. Assertion: Equal masses of helium and oxygen gases are given equal quantities of heat. There will be a granter rise in the temperature of bolium compared to that of ourgan.	2. Assertion: The total translational kinetic e	energy of all the molec	cules of a given mass of an ideal gas is 1.5
Reason: The molecules of a gas collide with each other and the velocities of the molecules change due to collision. (a)A (b) B (c) C (d)D 3. Assertion: Gases do not settle to the bottom of a container. Reason: Gases have high kinetic energy. (a)A (b) B (c) C (d)D 4. Assertion: A gas can be liquified at any temperature by increase of pressure alone. Reason: On increasing pressure the temperature of gas decreases. (a)A (b) B (c) C (d)D 5. Assertion: Equal masses of helium and oxygen gases are given equal quantities of heat. There will be a	times the product of its pressure and its vol	ume.	
collision.(a)A(b) B(c) C(d)D 3. Assertion: Gases do not settle to the bottom of a container.Reason: Gases have high kinetic energy.(a)A(b) B(c) C(d)D 4. Assertion: A gas can be liquified at any temperature by increase of pressure alone.Reason: On increasing pressure the temperature of gas decreases.(a)A(b) B(c) C(d)D 5. Assertion: Equal masses of helium and oxygen gases are given equal quantities of heat. There will be a	Reason: The molecules of a gas collide with	each other and the ve	locities of the molecules change due to
 (a)A (b) B (c) C (d)D 3. Assertion: Gases do not settle to the bottom of a container. Reason: Gases have high kinetic energy. (a)A (b) B (c) C (d)D 4. Assertion: A gas can be liquified at any temperature by increase of pressure alone. Reason: On increasing pressure the temperature of gas decreases. (a)A (b) B (c) C (d)D 5. Assertion: Equal masses of helium and oxygen gases are given equal quantities of heat. There will be a greater rise in the temperature of bolium compared to that of any container. 	collision.		
 3. Assertion: Gases do not settle to the bottom of a container. Reason: Gases have high kinetic energy. (a)A (b) B (c) C (d)D 4. Assertion: A gas can be liquified at any temperature by increase of pressure alone. Reason: On increasing pressure the temperature of gas decreases. (a)A (b) B (c) C (d)D 5. Assertion: Equal masses of helium and oxygen gases are given equal quantities of heat. There will be a greater rise in the temperature of bolium compared to that of ourgan. 	(a)A (b) B (c) C	(d)D	
Reason: Gases have high kinetic energy.(a)A(b) B(c) C(d)D 4. Assertion: A gas can be liquified at any temperature by increase of pressure alone.Reason: On increasing pressure the temperature of gas decreases.(a)A(b) B(c) C(d)D 5. Assertion: Equal masses of helium and oxygen gases are given equal quantities of heat. There will be a	3. Assertion: Gases do not settle to the bott	om of a container.	
 (a)A (b) B (c) C (d)D 4. Assertion: A gas can be liquified at any temperature by increase of pressure alone. Reason: On increasing pressure the temperature of gas decreases. (a)A (b) B (c) C (d)D 5. Assertion: Equal masses of helium and oxygen gases are given equal quantities of heat. There will be a greater rise in the temperature of bolium compared to that of ourgan. 	Reason: Gases have high kinetic energy.		
 4. Assertion: A gas can be liquified at any temperature by increase of pressure alone. Reason: On increasing pressure the temperature of gas decreases. (a)A (b) B (c) C (d)D 5. Assertion: Equal masses of helium and oxygen gases are given equal quantities of heat. There will be a greater rise in the temperature of helium compared to that of ourgan. 	(a)A (b) B (c) C	(d)D	
 Reason: On increasing pressure the temperature of gas decreases. (a)A (b) B (c) C (d)D 5. Assertion: Equal masses of helium and oxygen gases are given equal quantities of heat. There will be a greater rise in the temperature of helium compared to that of ourgan 	4. Assertion: A gas can be liquified at any ter	mperature by increase	e of pressure alone.
(a)A (b) B (c) C (d)D 5. Assertion: Equal masses of helium and oxygen gases are given equal quantities of heat. There will be a	Reason: On increasing pressure the tempera	ature of gas decreases	
5. Assertion: Equal masses of helium and oxygen gases are given equal quantities of heat. There will be a	(a)A (b) B (c) C	(d)D	
	5. Assertion: Equal masses of helium and ox	tygen gases are given e	equal quantities of heat. There will be a
greater rise in the temperature of neiturn compared to that of oxygen.	greater rise in the temperature of helium co	ompared to that of oxy	/gen.
Reason: The molecular weight of oxygen is more than the molecular weight of helium.	Reason: The molecular weight of oxygen is r	more than the molecu	lar weight of helium.
		(a)U	
CASE STUDY BASED OUESTIONS: -	CASE STUDY BASED OUESTIONS		
CASE STUDY BASED OUESTIONS	CASE STUDY BASED QUESTIONS.		

The equipartition of kinetic energy was proposed initially in 1843 and more correctly in 1845, by John James Waterston. In 1859, James Clerk Maxwell argued that the kinetic heat energy of a gas is equally divided between linear and rotational energy. In 1876, Ludwig Boltzmann expanded on this principle by showing that the average energy was divided equally among all the independent components of motion in a system.

Boltzmann applied the equipartition theorem to provide a theoretical explanation of the Dulong-Petit law for the specific heat capacities of solids.

Law of Equipartition of Energy

According to this law, for any system in thermal equilibrium, the total energy is equally distributed among its various degree of freedom. And each degree of freedom is associated with energy $\frac{1}{2}$ kT (where $k = 1.3 \times 10^{-23J}/K$, T = absolute temperature of the system). At a given temperature T; all ideal gas molecules no matter what their mass have th same average translational kinetic energy; namely, $\frac{3}{2}$ kT. When measure the temperature of a gas, we are also measuring the average translational kinetic energy of its molecules. At same temperature gases with different degrees of freedom (e.g., He and H) will have different average energy or internal energy namely $\frac{f}{2}$ kT. (F is different for different gases) Answer the following questions 1. Relation between pressure P and average kinetic energy E per unit volume of a gas is (a) $P = \frac{2E}{3}$ (b) $P = \frac{E}{3}$ (c) $P = \frac{3E}{2}$ (d) P = 3EAns; - (a) 2. At 0 K, which of the following properties of a gas will be zero? (a) kinetic energy (b) potential energy (c) vibrational energy (d) density Ans; - (a) 3. The root mean square velocity of a gas molecule of mass m at a given temperature is proportional to (c) \sqrt{m} (d) $m^{-1/2}$ (a) m^0 (b) m Ans; - (d) 4. An ant is walking on the horizontal surface. The number of degrees of freedom of ant will be (b) 2 (c) 3 (a) 1 (d) 6 Ans; - (b) Or 5. The number of degrees of freedom for a diatomic gas molecule is (a) 2 (b) 3 (c) 5 (d) 6 Ans; - (c) (a) $P = \frac{2E}{3}$ 1. (a) At 0 K, all molecular motion stops, so kinetic energy becomes zero. 2. (d) $V_{\rm rms} = \sqrt{\frac{3K_3T}{m}}$ i.e. $V_{\rm rms} \propto m^{-1/2}$ 3. (b) As the ant can move on a plane, it has 2 degree of freedom. 4. 5. (c) A diatomic molecule has 3 degree of freedom due to translatory motion and 2 degrees of freedom due to rotatory motion.

Numericals

1. An air bubble of volume 1.0 cm3 rises from the bottom of a lake 40 m deep at a temperature of 12°C. To what volume does it grow when it reaches the surface which is at a temperature of 35°C? $V_1 = 10^{-6} \text{ m}^3$

Pressure on bubble P_1 = Water pressure + Atmospheric pressure

$$= pgh + Patm$$

= 4.93 × 10⁵ Pa
T₁ = 285 k, T₂ = 308 k
$$\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2}$$

V₂ =
$$\frac{4.93 \times 10^5 \times 1 \times 10^{-6} \times 308}{285 \times 1.01 \times 10^5} = 5.3 \times 10^{-6} m^3$$
.

2. A vessel is filled with a gas at a pressure of 76 cm of mercury at a certain temperature. The mass of the gas is increased by 50% by introducing more gas in the vessel at the same temperature. Find out the resultant pressure of the gas.

According to kinetic theory of gases,

$$PV = \frac{1}{3}mv_{\rm rms}^2$$

At constant temperature, $v_{\rm rms}^2$ is constant. As v is also constant, so P $\propto m$.

When the mass of the gas increase by 50% pressure also increases by 50%,

Final pressure = $76 + \frac{50}{100} \times 76 = 114$ cm of Hg.

3. An oxygen cylinder of volume 30 liter has an initial gauge pressure of 15 atmosphere and a temperature of 27ºC. After some oxygen is withdrawn from the cylinder, the gauge pressure drops to 11 atmosphere and its temperature drop to17°C. Estimate the mass of oxygen taken out of the cylinder.

 $(R = 8.31/mol^{-1} K^{-1})$ (molecular mass of O2 = 32) $V_1 = 30$ litre $= 30 \times 10^3$ cm³ $= 3 \times 10^{-2}$ m³ $P_1 = 15 \times 1.013 \times 10^5 \text{ N/m}^2$ $T_1 = 300 \text{ K}$ $\mu_1 = \frac{P_1 V_1}{R T_1} = 18.3$ $P_2 = 11 \times 1.013 \times 10^5 \text{ N/m}^2$ $V_2 = 3 \times 10^{-2} m^3$ $T_2 = 290 k$ $\mu_2 = \frac{P_2 V_2}{R T_2} = 13.9$

 $\mu_2 - \mu_1 = 18.3 - 13.9 = 4.4$

Mass of gas taken out of cylinder

 $= 4.4 \times 32$ g = 140.8 g =0.140 kg.

Page 4 of 5

4. At what temperature the rms speed of oxygen atom equal to r.m.s. speed of helium gas atom at -10° C?, Atomic mass of helium = 4, Atomic mass of oxygen = 32.

$$v_{\rm rms} = \left[\frac{3{\rm PV}}{{\rm M}}\right]^{1/2} = \left[\frac{3{\rm RT}}{{\rm M}}\right]^{1/2}$$

Let r.m.s. speed of oxygen is $(v_{rms})_1$ and of helium is $(v_{rms})_2$ is equal at temperature T_1 and T_2 respectively.

$$\frac{(v_{\rm rms})_1}{(v_{\rm rms})_2} = \sqrt{\frac{M_2 T_1}{M_1 T_2}}$$
$$\left[\frac{4T_1}{32 \times 263}\right]^{1/2} = 1$$
$$T_1 = \frac{32 \times 263}{4} = 2104k.$$

5. Estimate the total number of molecules inclusive of oxygen, nitrogen, water vapour and other constituents in a room of capacity 25.0 m³ at a temperature of 27°C and 1 atmospheric pressure.

As Boltzmann's constant,

$$k_{\rm B}$$

$$=\frac{\mathbf{R}}{\mathbf{N}}, \quad \therefore \mathbf{R} = k_{\mathrm{B}} \mathbf{N}$$

Now

$$PV = nRT = nk_B NT$$

 \therefore The number of molecules in the room

$$=nN = \frac{PV}{Tk_{B}}$$
$$= \frac{1.013 \times 10^{5} \times 25.0}{300 \times 1.38 \times 10^{-23}} = 6.117 \times 10^{26}.$$

PREPARED BY	CHECKED BY
Mr RANDHIR K GUPTA	HoD SCIENCE