Kinetic Energy

- **1. Assertion (A):** Vibrational energy of molecule at temperature T is kT.
 - **Reason (R):** For every molecule, vibrational degree of freedom is 2.
 - (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
 - (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
 - (3) (A) is true but (R) is false
 - (4) Both (A) and (R) are false
- **2. Assertion (A):** There is no change in internal energy for ideal gas at constant temperature.
 - **Reason (R):** Internal energy of an ideal gas is a function of temperature only.
 - (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
 - (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
 - (3) (A) is true but (R) is false
 - (4) Both (A) and (R) are false
- 3. Assertion (A): The atoms of a monoatomic gas have less degrees of freedom as compared to molecules of the diatomic gas.
 - **Reason (R):** The ratio of $\frac{C_p}{C_v}$ for an ideal
 - diatomic gas is more than that for an ideal monoatomic gas (where $\rm C_{\rm p}$ and $\rm C_{\rm v}$ have usual meaning).
 - (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
 - (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
 - (3) (A) is true but (R) is false
 - (4) Both (A) and (R) are false

- 4. Assertion (A): A gas is kept in an insulated cylinder with a movable piston, in compressed state. As the piston is suddenly released, temperature of the gas decreases.
 - **Reason (R):** According to the kinetic theory of gas, a molecule colliding with the piston must rebound with less speed than it had before the collision. Hence average speed of the molecules is reduced.
 - (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
 - (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
 - (3) (A) is true but (R) is false
 - (4) Both (A) and (R) are false
- **5. Assertion (A):** At 0K, pressure of an ideal gas becomes zero.
 - **Reason (R):** At OK, according to ideal gas equation PV = 0, volume cannot be zero hence pressure should be zero to satisfy this equation.
 - (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
 - (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
 - (3) (A) is true but (R) is false
 - (4) Both (A) and (R) are false
- **6. Assertion (A):** Molar heat capacity of an ideal monoatomic gas at constant volume is a constant at all temperatures.
 - **Reason (R):** As the temperature of an monoatomic ideal gas is increased, number of degrees of freedom of gas molecules remains constant.
 - (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
 - (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
 - (3) (A) is true but (R) is false
 - (4) Both (A) and (R) are false





7. Assertion (A): According to kinetic theory of gases the internal energy of a given sample of an ideal gas is only kinetic.

Reason (R): The ideal gas molecules exert force on each other only when they collide.

- (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
- (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
- (3) (A) is true but (R) is false
- (4) Both (A) and (R) are false
- 8. Assertion (A): Internal energy of an ideal gas U = nC_VT is due to random motion of gas molecules.

Reason (R): A container is moving with speed v. It is suddenly stopped by a force, temperature of gas increases.

- (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
- (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
- (3) (A) is true but (R) is false
- (4) Both (A) and (R) are false
- 9. Assertion (A): Experimental results indicate that the molar specific heat of hydrogen gas at constant volume below 50 K is equal to 5/2 R, where R is the universal gas constant.

Reason (R): A diatomic hydrogen molecule possesses three translational and two rotational degrees of freedom at all temperatures.

- (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
- (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
- (3) (A) is true but (R) is false
- (4) Both (A) and (R) are false
- **10. Assertion (A):** When an ideal gas is heated in a rigid non conducting container then pressure becomes double if the temperature is doubled.

Reason (R): Both the frequency of collisions and momentum transferred per collision becomes $\sqrt{2}$ times.

- (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
- (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
- (3) (A) is true but (R) is false
- (4) Both (A) and (R) are false

11. Assertion (A): 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 (R): The molecules of a gas collide with each other and the velocities of the molecules change due to the collision.

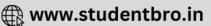
- (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
- (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
- (3) (A) is true but (R) is false
- (4) Both (A) and (R) are false
- 12. Assertion (A): Molar heat capacity at constant pressure can be less than molar heat capacity at constant volume. Reason (R): C_p C_v = R is valid only for ideal monoatomic gas.
 - (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
 - (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
 - (3) (A) is true but (R) is false
 - (4) Both (A) and (R) are false
- 13. Assertion (A): An ideal gas is enclosed within a container fitted with a piston when volume of this enclosed gas is increased at constant temperature. The pressure exerted by the gas on the piston decreases.

Reason (R): In the above situation the rate of molecules striking the piston decreases. Therefore pressure exerted by gas on piston decreases.

- (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
- (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
- (3) (A) is true but (R) is false
- (4) Both (A) and (R) are false







14. Assertion (A): Gas is suddenly compressed, its temperature rises.

Reason (R): Work done in compression of gas increases internal energy of the gas.

- (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
- (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
- (3) (A) is true but (R) is false
- (4) Both (A) and (R) are false
- **15. Assertion (A):** If temperature of gas in a closed container in increased, its mean free path remains unchanged.

Reason (R): Mean free path is inversely proportional to number of molecules per unit volume.

- (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
- (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
- (3) (A) is true but (R) is false
- (4) Both (A) and (R) are false
- **16. Assertion (A):** The average translational kinetic energy per molecule of a gas for various gases at the same temperature is the same.

Reason (R): if a given temperature, all molecules move with nearly the same speed.

- (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
- (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
- (3) (A) is true but (R) is false
- (4) Both (A) and (R) are false

17. Assertion (A): When temperature rises the coefficient of viscosity of gases decreases.

Reason (R): Gases behave more like ideal gases at lower temperature.

- (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
- (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
- (3) (A) is true but (R) is false
- (4) Both (A) and (R) are false
- **18. Assertion (A):** Maxwell speed distribution graph is symmetric about most probable speed

Reason (R): rms speed of ideal gas, depends upon it's type (monoatomic, diatomic and polyatomic)

- (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
- (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
- (3) (A) is true but (R) is false
- (4) Both (A) and (R) are false
- **19. Assertion (A):** Internal energy of an ideal gas does not depend upon volume of the gas

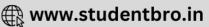
Reason (R): Internal energy of ideal gas depends on temperature of gas.

- (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
- (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
- (3) (A) is true but (R) is false
- (4) Both (A) and (R) are false
- **20. Assertion (A):** An ideal gas has infinitely many molar specific heats.

Reason (R): Molar specific heat is amount of heat needed to raise the temperature of 1 mole of gas by 1 K.

- (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
- (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
- (3) (A) is true but (R) is false
- (4) Both (A) and (R) are false





21. Assertion (A): The specific heat of a monatomic gas may have value between 0 and ∞ .

Reason (R): $C_p = \frac{5}{2}R$ and $C_v = \frac{3}{2}R$ for a monoatomic gas.

- (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
- (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
- (3) (A) is true but (R) is false
- (4) Both (A) and (R) are false
- **22. Assertion (A):** A real gas behaves as an ideal gas at high temperature and low pressure.

Reason (R): At low pressure and high temperature intermolecular forces vanish away and volume of gas molecules is negligible.

- (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
- (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
- (3) (A) is true but (R) is false
- (4) Both (A) and (R) are false
- **23. Assertion (A):** P-T graph of all gases at low density meet at 0 K.

Reason (R): Absolute zero kelvin is less than 0°C in celsius scale.

- (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
- (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
- (3) (A) is true but (R) is false
- (4) Both (A) and (R) are false

24. Assertion (A): An ideal gas has infinitely many molar specific heats.

Reason (R): Specific heat is amount of heat needed to raise the temperature of 1 mole of gas by 1K.

- (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
- (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
- (3) (A) is true but (R) is false
- (4) Both (A) and (R) are false
- **25. Assertion (A):** On increasing the temperature, the height of the peak of the Maxwell's velocity distribution curve increases.

Reason (R): The height of the peak of the Maxwell's velocity distribution curve represents most probable speed.

- (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
- (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
- (3) (A) is true but (R) is false
- (4) Both (A) and (R) are false
- **26. Assertion (A):** All molecular motion ceases at -273.15°C.

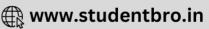
Reason (R): Temperature 0K cannot be attained.

- (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
- (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
- (3) (A) is true but (R) is false
- (4) Both (A) and (R) are false
- **27. Assertion (A):** In Maxwell's speed distribution graph, for a given amount of gas, the area under the graph increases as the temperature of the gas increases.

Reason (R): Decrease in temperature broadening the curve.

- (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
- (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
- (3) (A) is true but (R) is false
- (4) Both (A) and (R) are false





28. Assertion (A): The pressure exerted by an enclosed ideal gas does not depend on the shape of the container.

> Reason (R): The pressure of an ideal gas depends on the number of moles, and volume of the temperature enclosure.

- (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
- (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
- (3) (A) is true but (R) is false
- (4) Both (A) and (R) are false
- **Assertion (A):** The ratio $\frac{C_p}{C_{-}}$ is more for 29.

helium gas than for hydrogen gas.

Reason (R): Atomic mass of helium is more than that of hydrogen.

- (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
- (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
- (3) (A) is true but (R) is false
- (4) Both (A) and (R) are false
- 30. Assertion (A): On a V-T graph, the slope of an isobar increases with pressure.

Reason (R): At constant temperature, for an ideal gas its volume is directly proportional to its pressure.

- (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
- (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
- (3) (A) is true but (R) is false
- (4) Both (A) and (R) are false

Assertion (A): Internal energy of real gas 31. is always negative at absolute zero temperature.

> Reason (R): Potential energy of a bounded system is negative.

- (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
- (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
- (3) (A) is true but (R) is false
- (4) Both (A) and (R) are false
- Assertion (A): The average translational 32. kinetic energy of the molecules in one mole of all ideal gases, at the same temperature is the same.

Reason (R): The average kinetic energy of one mole of any ideal gas at temperature T is given by $\langle E \rangle = \frac{3}{2}RT$.

- (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
- (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
- (3) (A) is true but (R) is false
- (4) Both (A) and (R) are false
- 33. Assertion (A): For an ideal gas, at constant temperature, the product of the pressure and volume is constant.

Reason (R): The mean square velocity of gas molecules is inversely proportional to mass of molecule.

- (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
- (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
- (3) (A) is true but (R) is false
- (4) Both (A) and (R) are false





ANSWER KEY																				
Que.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Ans.	1	1	3	1	3	1	1	2	4	1	2	3	1	1	1	3	4	4	2	2
Que.	21	22	23	24	25	26	27	28	29	30	31	32	33							
Ans.	2	1	2	2	4	2	4	1	2	4	1	3	2							

