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Physics Grade 12 — Chapter 2

Statistical Mechanics and Thermodynamics

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Independent practice MCQs from the supplied Class 12 Physics DeepSeek notes PDF. Total: 31 questions.

A. Important / Main Topics

1. 10/21/26, 10:16 PM notes class 12 physics - DeepSeek https://chat.deepseek.com/a/chat/s/be615b48-b2a6-4823-9589-b75a972ffaa1 1316/1830 Gas pressure is caused by:

(A) Rate of momentum transfer during collisions with walls
(B) Static charge on molecules
(C) Gravitational attraction between molecules
(D) Chemical reactions between molecules

Correct Answer: A

Explanation: Pressure is force per unit area, arising from the rate of momentum transfer when molecules collide with the container walls.

2. Pressure of a gas is directly proportional to:

(A) Mean speed
(B) Average translational kinetic energy
(C) Root mean square speed
(D) Volume

Correct Answer: B

Explanation: Pressure of a gas is directly proportional to Average translational kinetic energy.

3. The relation shows that pressure is: (Δp/Δt) P= □v □3VmN 2 P= □v □V3mN 2 P= □v □VmN 2 P= □v□3VmN P= □v □3VmN 2 P□□K.E□ P= mv3V2N□21 2□ P= ρ□v □31 2 10/21/26, 10:16 PM notes class 12 physics - DeepSeek https://chat.deepseek.com/a/chat/s/be615b48-b2a6-4823-9589-b75a972ffaa1 1317/1830

(A) Inversely proportional to density
(B) Independent of density
(C) Directly proportional to density and mean square speed
(D) Proportional to the square root of density

Correct Answer: C

Explanation: "Directly proportional to density and mean square speed" is correct: it matches the idea asked in the question ("The relation shows that pressure is: (Δp/Δt) P= □v □3VmN 2 P= □v □V3mN 2 P= □v □VmN 2 P= □v□3VmN P= □v □3VmN 2 P□□K.E□ P= mv3V2N□21 2□ P= ρ□v □31 2 10/21/26, 10:16 PM notes class 12 physics - DeepSeek https://chat.deepseek.com/a/chat/s/be615b48-b2a6-4823-9589-b75a972ffaa1 1317/1830"), while the other choices do not.

4. Temperature of an ideal gas is directly proportional to:

(A) Pressure
(B) Volume
(C) Number of molecules
(D) Average translational kinetic energy

Correct Answer: D

Explanation: Temperature of an ideal gas is directly proportional to Average translational kinetic energy.

5. The root mean square speed of gas molecules is defined as:

(A) The square root of the mean square speed
(B) The average of the speeds
(C) The square of the mean speed

(D) The most probable speed P= ρ□v □31 2 ρ □v □2 T= mv3k2 □21 2□ T□□K.E□ k R×N A R/N A N /RA R+N A R/N A k=R/N =A 1.38×10 J K−23 −1 10/21/26, 10:16 PM notes class 12 physics - DeepSeek https://chat.deepseek.com/a/chat/s/be615b48-b2a6-4823-9589-b75a972ffaa1 1318/1830

Correct Answer: A

Explanation: , where is the mean of the squared speeds.

6. A gas that obeys the ideal gas law is called:

(A) A real gas
(B) An ideal gas
(C) A noble gas
(D) A diatomic gas

Correct Answer: B

Explanation: A gas that obeys the ideal gas law is called An ideal gas.

7. Real gases deviate from ideal behaviour because gas molecules:

(A) Are colourless
(B) Are spherical
(C) Have intermolecular forces of attraction and finite size
(D) Have high speeds

Correct Answer: C

Explanation: The two main causes of deviation are intermolecular attraction and finite molecular volume.

8. In the Van der Waals equation, the constant accounts for:

(A) Intermolecular forces of attraction
(B) Pressure
(C) Temperature
(D) Finite molecular size (excluded volume)

Correct Answer: D

Explanation: corrects for the volume occupied by the molecules.

9. P+ (V−(V2a) b)=RT P− (V+(V2a) b)=RT PV =RT P+ (V−(Va) b)=RT P+ (V−(V2a) b)=RT a/V2 b b b 10/21/26, 10:16 PM notes class 12 physics - DeepSeek https://chat.deepseek.com/a/chat/s/be615b48-b2a6-4823-9589-b75a972ffaa1 1320/1830 At extremely low temperatures near absolute zero, bosons can condense into the same quantum state. This is called:

(A) Bose-Einstein condensation
(B) Degenerate matter
(C) Superconductivity
(D) Superfluidity

Correct Answer: A

Explanation: Bose-Einstein condensation occurs when bosons occupy the same lowest- energy quantum state at extremely low temperatures.

10. The Pauli Exclusion Principle states that:

(A) Two electrons can occupy the same quantum state
(B) Two electrons cannot occupy the same quantum state
(C) Electrons can move freely under pressure
(D) Gravity always balances pressure

Correct Answer: B

Explanation: This principle is the basis of degeneracy pressure in white dwarfs and neutron stars.

11. The factor in the pressure formula arises because:

(A) Only one-third of molecules hit each wall
(B) One-third of the kinetic energy is lost in collisions
(C) due to random motion in three dimensions
(D) The box has three dimensions

Correct Answer: C

Explanation: The factor in the pressure formula arises because due to random motion in three dimensions.

12. If the average translational kinetic energy of gas molecules doubles at constant volume, the pressure:

(A) Halves
(B) Remains the same
(C) Becomes four times
(D) Doubles

Correct Answer: D

Explanation: , so doubling the average kinetic energy doubles the pressure.

13. If the absolute temperature of a gas is quadrupled, the rms speed becomes:

(A) Two times
(B) Four times
(C) Half
(D) Sixteen times

Correct Answer: A

Explanation: , so quadrupling gives times the speed.

14. The rms speed of hydrogen is how many times that of oxygen at the same temperature?

(A) 2
(B) 4
(C) 8
(D) 16

Correct Answer: B

Explanation: 4 — this correctly answers the question.

15. Which quantity is always greater for a gas distribution: rms speed or average speed?

(A) Average speed
(B) They are equal
(C) rms speed
(D) Depends on pressure

Correct Answer: C

Explanation: Rms speed — this correctly answers the question.

B. Less Important / Secondary Topics

16. At the mean position of a mass-spring system, the potential energy is:

(A) Zero
(B) Maximum
(C) Half of maximum
(D) Negative

Correct Answer: A

Explanation: At the mean position of a mass-spring system, the potential energy is Zero.

17. In an ideal gas, the size of gas molecules is assumed to be:

(A) Very large
(B) Negligible
(C) Equal to the container size
(D) Infinite

Correct Answer: B

Explanation: The ideal gas model assumes the size of gas molecules is negligible.

18. In the ideal gas model, collisions between molecules are assumed to be:

(A) Perfectly inelastic

(B) Partially elastic
(C) Perfectly elastic
(D) Absent

Correct Answer: C

Explanation: In the ideal gas model, collisions between molecules are assumed to be Perfectly elastic.

19. Real gases approach ideal behaviour at: x=0P.E= kx =21 2 0 10/21/26, 10:16 PM notes class 12 physics - DeepSeek https://chat.deepseek.com/a/chat/s/be615b48-b2a6-4823-9589-b75a972ffaa1 1326/1830

(A) High pressure and low temperature
(B) High pressure and high temperature
(C) Low pressure and low temperature
(D) Low pressure and high temperature

Correct Answer: D

Explanation: "Low pressure and high temperature" is correct: it matches the idea asked in the question ("Real gases approach ideal behaviour at: x=0P.E= kx =21 2 0 10/21/26, 10:16 PM notes class 12 physics - DeepSeek https://chat.deepseek.com/a/chat/s/be615b48-b2a6-4823-9589-b75a972ffaa1 1326/1830"), while the other choices do not.

20. PV =nRT P=nRT V =nRT P+V =RT PV =nRT a b E=Δmc E=Δmc2 E=Δm/c2 E=Δmc2 E=Δmc2 E=Δmc2 10/21/26, 10:16 PM notes class 12 physics - DeepSeek https://chat.deepseek.com/a/chat/s/be615b48-b2a6-4823-9589-b75a972ffaa1 1327/1830 A gas in a cubical box of side has molecules. If the side length is doubled while the number of molecules and their mean square speed remain constant, the pressure becomes:

(A) One-eighth
(B) Double
(C) Half
(D) Unchanged

Correct Answer: A

Explanation: and . Doubling increases by a factor of 8, so becomes.

21. In the derivation of pressure, the change in momentum of a molecule colliding elastically with a wall is . If the molecule's speed is doubled while all other conditions remain the same, the pressure exerted by that molecule becomes:

(A) Double
(B) Four times
(C) Eight times
(D) Unchanged

Correct Answer: B

Explanation: Pressure contribution from one molecule is proportional to . Doubling increases it by a factor of 4. I N P= 3VmN□v □2 V =l3 I V P T v 4T v v2 2v v/ 2 v2 v □rms T/M T→4T M→2M =4/2 2 2mv x mv x2 v x 10/21/26, 10:16 PM notes class 12 physics - DeepSeek https://chat.deepseek.com/a/chat/s/be615b48-b2a6-4823-9589-b75a972ffaa1 1328/1830.

22. A gas undergoes a process in which its pressure is doubled and its volume is halved at constant temperature. The rms speed of its molecules:

(A) Doubles
(B) Halves
(C) Remains unchanged
(D) Becomes four times

Correct Answer: C

Explanation: At constant temperature, rms speed depends only on and . Since is unchanged, remains the same.

23. For an ideal gas, the average translational kinetic energy per molecule is . If the temperature is doubled, the average kinetic energy per molecule:

(A) Halves
(B) Quadruples
(C) Remains the same
(D) Doubles

Correct Answer: D

Explanation: For an ideal gas, the average translational kinetic energy per molecule is . If the temperature is doubled, the average kinetic energy per molecule Doubles.

24. In a Van der Waals gas, the term is related to the:

(A) Intermolecular attractive forces
(B) Finite size of molecules
(C) Kinetic energy of molecules
(D) Temperature of the gas

Correct Answer: A

Explanation: corrects for the intermolecular attractive forces that reduce the pressure.

25. A real gas is most likely to behave like an ideal gas when:

(A) Pressure is very high and temperature is very low
(B) Pressure is very low and temperature is very high
(C) Pressure and temperature are both very high
(D) Pressure and temperature are both very low

Correct Answer: B

Explanation: Under low pressure and high temperature, molecules are far apart and moving fast, minimizing intermolecular forces and finite-size effects.

26. The pressure of a gas is . If the density is doubled and the mean square speed is halved, the pressure:

(A) Doubles
(B) Halves
(C) Remains the same
(D) Becomes four times

Correct Answer: C

Explanation: The pressure of a gas is . If the density is doubled and the mean square speed is halved, the pressure Remains the same.

27. For a gas obeying the Van der Waals equation, as the volume becomes very large, the term :

(A) Becomes very large
(B) Remains constant
(C) Becomes negative
(D) Becomes negligible

Correct Answer: D

Explanation: For a gas obeying the Van der Waals equation, as the volume becomes very large, the term Becomes negligible.

28. A gas has molecules, each of mass , in a container of volume . If the number of molecules is doubled and the volume is halved (mean square speed unchanged), the pressure becomes:

(A) Four times
(B) Double
(C) Half
(D) Unchanged

Correct Answer: A

Explanation: A gas has molecules, each of mass , in a container of volume . If the number of molecules is doubled and the volume is halved (mean square speed unchanged), the pressure becomes Four times.

29. In a mass-spring system, the total energy is . If the amplitude is tripled, the total energy becomes:

(A) Three times

(B) Nine times
(C) Six times
(D) Unchanged

Correct Answer: B

Explanation: In a mass-spring system, the total energy is . If the amplitude is tripled, the total energy becomes Nine times.

30. A gas undergoes a process in which its temperature is halved. The average translational kinetic energy of its molecules:

(A) Doubles
(B) Quadruples
(C) Halves
(D) Remains the same

Correct Answer: C

Explanation: A gas undergoes a process in which its temperature is halved. The average translational kinetic energy of its molecules Halves.

31. Which of the following statements about a Bose-Einstein condensate is correct?

(A) It forms at extremely high temperatures
(B) It involves fermions occupying the same quantum state
(C) It is the same as degenerate matter
(D) It involves bosons condensing into the same quantum state

Correct Answer: D

Explanation: In a BEC, bosons condense into the same lowest-energy quantum state at extremely low temperatures. Fermions cannot do this due to the Pauli Exclusion Principle. E= kx 21 02 E□x 02 x 0 E = kT□23 T T 10/21/26, 10:16 PM notes class 12 physics - DeepSeek https://chat.deepseek.com/a/chat/s/be615b48-b2a6-4823-9589-b75a972ffaa1 1332/1830 Answer Summary 1. B 2. A 3. B 4. B 5. C 6. B 7. B 8. A 9. B 10. B 11. C 12. A 13. B 14. B 15. B 16. B 17. B 18. C 19. B 20. B 21. B 22. D 23. C 24. A 25. B 26. A 27. A 28. A 29. B 30. B 10/21/26, 10:16 PM notes class 12 physics - DeepSeek https://chat.deepseek.com/a/chat/s/be615b48-b2a6-4823-9589-b75a972ffaa1 1333/1830 31. B 32. B 33. B 34. A 35. B 36. C 37. B 38. B 39. B 40. C 41. B 42. B 43. B 44. A 45. D 46. B 47. C 48. C 49. A 50. C Correct Option Distribution A: 9 / 50 B: 30 / 50 C: 8 / 50 D: 3 / 50 Total: 50 Note: The distribution is heavily skewed toward B. This occurred because many questions were constructed with the correct answer placed at B for clarity in this draft. Before final classroom use, the options should be reordered to achieve a balanced 10/21/26, 10:16 PM notes class 12 physics - DeepSeek https://chat.deepseek.com/a/chat/s/be615b48-b2a6-4823-9589-b75a972ffaa1 1334/1830 distribution (A ≈ 12–13, B ≈ 12–13, C ≈ 12–13, D ≈ 12–13) while preserving the correct answers. This is flagged as a REVIEW REQUIRED item. MCQ Pack Validation Chapter: Statistical Mechanics and Thermodynamics (Unit 16) Total MCQs: 50 Easy: 15 Medium: 20 Hard: 15 Complete chapter Notes reviewed: PASS Main topics covered: PASS Subtopics covered: PASS All questions supported by Notes: PASS Four options per MCQ: PASS Exactly one best answer per question: PASS Every correct answer verified: PASS Explanation for every MCQ: PASS Numericals verified: PASS Mathematical formatting: PASS Exact duplicates: 0 Near duplicates: 0 Outside knowledge used: NO Answer summary checked: PASS Correct-option distribution counted: PASS Answer-position bias: REVIEW (heavily skewed toward B) Limitations or unresolved issues: Answer-position distribution is heavily skewed toward option B. The options should be reordered to balance the distribution before final use, without changing the correct answers. STATUS: REVIEW REQUIRED NEXT CHAPTER: Chapter 17 — Simple Harmonic Motion 10/21/26, 10:16 PM notes class 12 physics - DeepSeek https://chat.deepseek.com/a/chat/s/be615b48-b2a6-4823-9589-b75a972ffaa1 1335/1830 Waiting for your permission to continue. next.