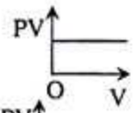
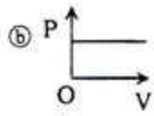
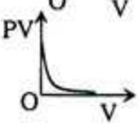
Chapter-10: Ideal Gas and Kinetic Theory of Gases

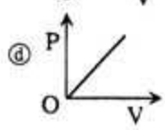
1. Which of the following are the three variables of gas?
ⓐ Volume, mass and density.
ⓑ Volume, temperature and density.
ⓒ Volume, mass and temperature.
ⓓ Volume, temperature and pressure. **ⓓ**

2. Which of the following graphs is valid for Charles' law? *[D.B.-17]*

ⓐ 

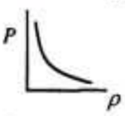
ⓑ 

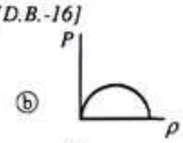
ⓒ 

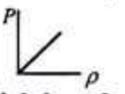
ⓓ 

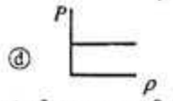
ⓐ

3. Which of the following graphs is valid for gas under constant temperature? *[D.B.-16]*

ⓐ 

ⓑ 

ⓒ 

ⓓ 

ⓒ

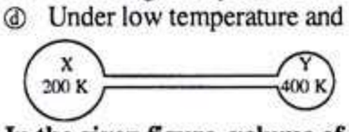
4. Which law does unsaturated vapour follow? *[D.B.-16]*
ⓐ Pressure law ⓑ Charles' law
ⓒ Boyle's law
ⓓ Boyle's and Charles' laws **ⓓ**

5. At normal temperature and pressure, which of the following is the mean square velocity of oxygen molecule? *[Dj.B.-16]*
ⓐ 461 $m \cdot s^{-1}$ ⓑ 361 $m \cdot s^{-1}$
ⓒ 261 $m \cdot s^{-1}$ ⓓ 162 $m \cdot s^{-1}$ **ⓐ**

6. Which of the following is the absolute zero temperature? *[Dj.B.-16]*
ⓐ –273°C ⓑ 0°C ⓒ 273°C ⓓ 373°C **ⓐ**

7. Which of the following is the value of the degrees of freedom for gas consisting of numerous molecules? *[Dj.B*
ⓐ 2 ⓑ 3 ⓒ 5 ⓓ 6 **ⓓ**

8. When do real gases act like ideal ones? *[C.B.-16; B.B.-015]*
ⓐ Under high temperature and pressure
ⓑ Under low temperature and pressure
ⓒ Under high temperature and low pressure
ⓓ Under low temperature and high pressure **ⓒ**

9. 

In the given figure, volume of bulb X is twice that of bulb Y. The system is filled with an ideal gas in such a way that pressures of both bulbs are the same. X bulb contains x mol of gas. Which of the following is the mole number for bulb Y? *[C.B.-16]*
ⓐ $\frac{x}{4}$ ⓑ $\frac{x}{2}$ ⓒ x ⓓ $2x$ **ⓑ**

10. Relation between mean free path and density. *[Ctg.B.-16]*
ⓐ mean free path is proportional to square of density
ⓑ mean free path is proportional to density
ⓒ mean free path is inversely proportional to density
ⓓ mean free path is inversely proportional to square root of density **ⓒ**

11. What does a sudden drop in difference between the temperature readings of the thermometers of a dry and wet bulb hygrometer indicate? *[Ctg.B.-16]*
ⓐ Air is dry ⓑ A storm may occur
ⓒ Air is moist ⓓ It may rain **ⓒ**

12. By dew point, we indicate — *[R.B.-17]*
ⓐ Heat ⓑ Temperature
ⓒ Humidity ⓓ Relative humidity **ⓑ**

13. If at 0°C, pressure of a gas having certain volume is 3×10^5 Pa, which of the following would be its pressure at 60°C? *[S.B -16]*
ⓐ 3.66×10^5 Pa ⓑ 2.45×10^5 Pa
ⓒ 0.27×10^{-5} Pa ⓓ 0.40×10^{-5} Pa **ⓐ**

14. How many times higher temperature would double the velocity of an oxygen molecule? *[S.B.-16]*
ⓐ 2 ⓑ 4 ⓒ 8 ⓓ 16 **ⓑ**

15. Which of the following indicates the kinetic energy of gas molecules? *[S.B.-16, 17]*
ⓐ $\frac{1}{2}KT$ ⓑ $\frac{3}{2}KT$ ⓒ $\frac{1}{3}KT$ ⓓ $\frac{2}{3}KT$ **ⓑ**

16. Total energy of a molecule having 12 degrees of freedom is — *[B.B.-17]*
ⓐ $\frac{1}{2}$ KT ⓑ $\frac{3}{2}$ KT ⓒ 6 KT ⓓ 12 KT **ⓒ**

17. The temperature at which air of a certain volume gets saturated with the water vapour present is called — *[S.B.-16]*
ⓐ Dew point ⓑ Absolute humidity
ⓒ Relative humidity ⓓ Standard temperature **ⓐ**

18. Which of the following is the value of *R* (Universal gas constant)? *[J.B-16; C.B.-15]*
ⓐ 8.31 $J \cdot K^{-1} \cdot mol^{-1}$ ⓑ 8.31 $K \cdot J^{-1} \cdot mol^{-1}$
ⓒ 8.31 $J \cdot K^{-1} \cdot mol$ ⓓ 8.13 $J^{-1} \cdot K \cdot mol^{-1}$ **ⓐ**

19. Which of the following is the velocity of each gram of helium molecules at 30°C? [R = 8.3 $J \cdot K^{-1} \cdot mol^{-1}$] *[J.B.-16]*
ⓐ 7544.7 $J \cdot mol^{-1}$ ⓑ 3772.35 $J \cdot mol^{-1}$
ⓒ 1676.6 $J \cdot mol^{-1}$ ⓓ 373.5 J·mol **ⓑ**

20. Volume of an air bubble becomes eight times its initial volume when it comes up to water surface of a lake from the bottom. If atmospheric pressure is equal to the pressure of a water column of H m, depth of the lake — *[J.B.-16]*
ⓐ H ⓑ $3H$ ⓒ $5H$ ⓓ $7H$ **ⓓ**

21. Relation between root mean square velocity and absolute temperature — *[J.B.-16]*
ⓐ $C_{r.m.s} \propto \sqrt{T}$ ⓑ $C_{r.m.s} \propto \frac{1}{T}$
ⓒ $C_{r.m.s} \propto T$ ⓓ $C_{r.m.s} \propto \frac{1}{\sqrt{T}}$ **ⓐ**

22. Which of the following equations provide relation between kinetic energy E of unit volume of molecules and gas pressure P? *[B.B.-16]*
ⓐ $E = \frac{3}{2}P$ ⓑ $E = \frac{2}{3}P$
ⓒ $E = \frac{1}{2} \times \frac{3}{2}P$ ⓓ $E = \frac{1}{2} \times \frac{2}{3}P$ **ⓐ**

23. C in equation $PV = \frac{1}{3}mNC^2$ is — *[C.B.-17]*
ⓐ mean velocity
ⓑ mean square velocity
ⓒ root mean square velocity
ⓓ speed of light **ⓑ**

24. Which of the following is the value of gamma (γ) for nitrogen gas? *[D.B.-15]*
ⓐ 1.67 ⓑ 1.4 ⓒ 1.33 ⓓ 1.28 **ⓑ**

25. 20 gm of oxygen fills a cube having 20cm sides at 100°C. If mass of 1 mole oxygen is 32gm, which of the following is equal to the pressure inside the cube? *[D.B.-15]*
ⓐ 7800 kPa ⓑ 242 kPa ⓒ 65 kPa ⓓ 12 kPa **ⓑ**

26. Temperature of an ideal gas was increased from T to 2T. Which of the following would be doubled? *[D.B.-15]*
ⓐ root mean square velocity of the molecules
ⓑ square of mean velocity of the molecules
ⓒ mean velocity of the molecules
ⓓ mean square velocity of the molecules **ⓓ**

27. Average kinetic energy for ideal gas a temperature T — *[S.B-17; R.B., Dj.B, Ctg.B.-15]*
ⓐ $\frac{2}{3}KT$ ⓑ $\frac{3}{2}KT^2$ ⓒ $\frac{3}{2}KT^4$ ⓓ $\frac{3}{2}KT$ **ⓓ**

28. Total kinetic energy of 4g of oxygen gas at 27°C — *[R.B.-15]*
ⓐ 116.86 J ⓑ 207.75 J ⓒ 467.44 J ⓓ 149.58 J **ⓒ**

29. Which of the following is equal to the kinetic energy of 2 mole gas at S.T.P? [R = 8.31 J mole^{-1} K^{-1}] *[S.B.-17]*
ⓐ 1300 J ⓑ 2700 J ⓒ 3403 J ⓓ 680 J **ⓓ**

30. Relation between root mean square velocity of a gas and absolute temperature — *[Dj.B.-15]*
ⓐ proportional
ⓑ inversely proportional
ⓒ proportional to square root
ⓓ proportional to square **ⓒ**

31. When relative humidity of air is low, evaporation would occur — *[Dj.B.-15]*
ⓐ Slowly ⓑ Fast
ⓒ Unchanged ⓓ Very slowly **ⓑ**

32. For gases, 'PV' indicates — *[J.B.-17]*
ⓐ Energy ⓑ Power
ⓒ Momentum ⓓ Inertia **ⓐ**

33. Given that density of nitrogen gas at normal temperature and pressure is 1.25 kg·m^{-3}, root mean square velocity (C_{rms}) is — *[C.B.-15]*
ⓐ 491.07 m·s^{-1} ⓑ 492.07 m·s^{-1}
ⓒ 493.07 m·s^{-1} ⓓ 495.07 m·s^{-1} **ⓑ**

34. Which of the following processes does Boyle's law follow? *[S.B.-15]*
ⓐ Constant pressure ⓑ Constant temperature
ⓒ Adiabatic ⓓ Constant volume **ⓑ**

35. Which of the following is equal to the kinetic energy per gram of helium at 15°C? (R = 8.31 J·K^{-1}·mol^{-1}) *[S.B-15]*
ⓐ 12.47 J ⓑ 1196.64 J
ⓒ 3589.92 J ⓓ 7179.84 J **ⓒ**

36. Which of the following doesn't happen due to condensation of water vapour in the atmosphere? *[J.B.-15]*
ⓐ Dew ⓑ Mist ⓒ Storm ⓓ Rain **ⓒ**

37. How many degrees of freedom does a biatomic molecule have? *[J.B.-15]*
ⓐ 2 ⓑ 3 ⓒ 4 ⓓ 5 **ⓓ**

38.

A
40gm O_2
27 ° C

[All Board -18]
R = 8.31JK–1 mole –1, atomic mass of O2 = 32gm
According to the diagram the total kinetic energy of the gas in the container A is —
ⓐ 33.65 × 10J ⓑ 42.07 × 10J
ⓒ 37.39 × 102J ⓓ 46.74 × 102J **ⓓ**

39. The mean free path of a gas is inversely proportional to — *[All Board-18]*
ⓐ the density of the gas
ⓑ the atomic diameter of the gas atom
ⓒ the square of the number of atoms per unit volume
ⓓ the distance travelled by the atom **ⓐ**

40. How would be the change in linear velocity of a gas at absolute zero temperature?
ⓐ it would be zero
ⓑ it would be maximum
ⓒ it would be minimum
ⓓ it would change fractionally **ⓐ**

41. Which of the following would fourfold the volume of an ideal gas?
ⓐ doubling kelvin temperature and pressure
ⓑ halving kelvin temperature and four folding pressure
ⓒ decreasing the temperature to one fourth at constant pressure
ⓓ decreasing the pressure to one fourth at constant temperature **ⓓ**

42. What is mean square velocity to absolute temperature?
ⓐ proportional
ⓑ inversely proportional
ⓒ proportional to square
ⓓ inversely proportional to square of **ⓐ**

43. Which of the following is equal to the kinetic energy per gram of oxygen at 27°C?
ⓐ 1662 J ⓑ 2021 J ⓒ 2535 J ⓓ 3741 J **ⓓ**

44. Which of the following is not true according to kinetic theory of gases?
ⓐ Molecules are in motion at all directions at equal velocity
ⓑ Molecules are small
ⓒ Molecules follow Newton's law
ⓓ Molecules are elastic spheres **ⓒ**

45. Ratio of mean velocity, root mean square velocity and maximum probable velocity?
ⓐ 1.0:1.22:2.0 ⓑ 1.5:1.2:1.1
ⓒ 1.22:1.12:1.0 ⓓ 1.12:1.22:1.0 **ⓓ**

46. Which of the following is the saturated water vapour pressure at 0°C?
ⓐ 4.58 mm Hg P ⓑ 5.29 m Hg P
ⓒ 760 mm Hg P ⓓ 76 mm Hg P **ⓐ**

47. What is the value of root mean square velocity of a gas having density of 0.09 kg·m^{-3} at STP?
ⓐ 461 m·s^{-1} ⓑ 1035 m·s^{-1}
ⓒ 1837 m·s^{-1} ⓓ 2135 m·s^{-1} **ⓒ**

48. Considering pressure, temperature and volume, which of the following is wrong?
ⓐ $V = V_0(1 + \theta 273)$ ⓑ $P = P_0(1 + \theta 273)$
ⓒ $PV = \frac{M}{m}RT$ ⓓ $PV = nRT$ **ⓒ**

49. Why is it more uncomfortable in Cox's bazar than in Rajshahi at the same temperature?
ⓐ Lower relative humidity
ⓑ Lower air pressure
ⓒ Higher relative humidity
ⓓ Higher air pressure **ⓒ**

50. Air temperature of some regions is 30°C and dew point is 22°© What is the value of relative humidity? [Saturated water vapour pressure at 30°C is 31.83 and at 22°C it's 19.83 mm mercury pressure]
ⓐ 42% ⓑ 62% ⓒ 72% ⓓ 82% **ⓑ**

51. At 10^5 N·m^{-2} pressure under constant temperature, volume of fixed mass of gas is 0.005 m^3; which of the following is equal to the volume of the gas at 5×10^5 N·m^{-2}?
ⓐ 0.1 m^3 ⓑ 0.05 m^3 ⓒ 0.0001 m^3 ⓓ 0.001 m^3 **ⓓ**

52. At 10°C, heat is applied to 1 litre of air until its volume and pressure double. What will be the final temperature of air?
ⓐ 283°C ⓑ 566°C ⓒ 859°C ⓓ 1132°C **ⓒ**

53. According to kinetic theory, which of the following is correct?
ⓐ Molecules attract each other
ⓑ Molecules repel each other
ⓒ Molecules neither attract nor repel each other
ⓓ There is no attractive or repulsive force between molecules **ⓑ**

54. Average kinetic energy of each gas molecule is $E = \frac{3}{2}$ *KT*, where *K* is gas constant for each molecule. What is the other name of K?
ⓐ Ideal gas constant ⓑ Boltzmann constant
ⓒ Stephen's constant ⓓ Universal constant **ⓑ**

55. There is a gas in a container at 17°C. If mass of gas molecule is 2.4×10^{-25} kg, which of the following is equal to its kinetic energy?
ⓐ 6×10^{-21} J ⓑ 5×10^{-21} J
ⓒ 7×10^{-21} J ⓓ 7.5×10^{-21} J **ⓐ**

56. Why does dew disappear before noon?
ⓐ because temperature drops after noon
ⓑ because air is unsaturated with vapour right after sunrise
ⓒ because air becomes unsaturated before noon
ⓓ because evaporation stops at noon due to unsaturated vapour **ⓒ**

57. What happens according to Newton's law of cooling?
ⓐ temperature of object rises
ⓑ temperature of object drops
ⓒ temperature of object remains constant
ⓓ temperature of object rises first then drops **ⓑ**

58. Which of the following is the relation between mean free path λ and temperature *T*?
ⓐ $\lambda \propto T$ ⓑ $\lambda \propto \frac{1}{T}$ ⓒ $\lambda \propto \frac{1}{T^2}$ ⓓ $\lambda \propto \frac{1}{\sqrt{T}}$ **ⓐ**

59. Helium gas is stored in a container at 27°C. Which of the following is equal to the average kinetic energy of helium molecule?
ⓐ 6.21×10^{-20} J ⓑ 6.21×10^{20} J
ⓒ 6.21×10^{-21} J ⓓ 6.21×10^{20} J **ⓒ**

60. Which of the following is the total energy of each oxygen molecule? *[R.B.-16]*
ⓐ $E = \frac{3}{2}KT$ ⓑ $E = \frac{5}{2}KT$ ⓒ $E = \frac{2}{3}KT$ ⓓ $E = \frac{7}{2}KT$ **ⓐ**

61. How does root mean square velocity change with rise of temperature?
ⓐ increases ⓑ decreases
ⓒ remains constant
ⓓ increases at a rate of square of velocity **ⓐ**

62. Which of the following is the absolute zero temperature?
ⓐ -273^0C ⓑ -273^0 F ⓒ 0^0C ⓓ 273^0C **ⓐ**

63. At constant temperature, change of volume is —
ⓐ proportional to pressure
ⓑ inversely proportional to pressure
ⓒ proportional to square root of pressure
ⓓ proportional to square of pressure **ⓑ**

64. Mean free path is —
ⓐ inversely proportional to gas pressure and proportional to absolute temperature
ⓑ proportional to gas pressure and inversely proportional to absolute temperature
ⓒ proportional to both gas pressure and absolute temperature
ⓓ inversely proportional to both gas pressure and absolute temperature **ⓐ**

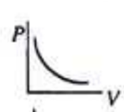
65. Mean velocity of gas molecule is —
ⓐ inversely proportional to square root of absolute temperature
ⓑ proportional to square root of absolute temperature
ⓒ inversely proportional to absolute temperature
ⓓ proportional to absolute temperature **ⓑ**

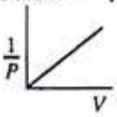
66. Which of the following equations is related to kinetic theory of gases?
ⓐ $P = \frac{nRT}{V}$ ⓑ $P = \frac{K}{V^\gamma}$
ⓒ $P = \frac{V^2\rho}{\gamma}$ ⓓ $P = \frac{1}{3}\rho C_{rms}^2$ **ⓓ**

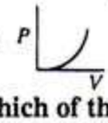
67. The root mean square velocity of a gas would increase due to increase in which of the following?
ⓐ Pressure ⓑ Volume
ⓒ Temperature ⓓ Density **ⓒ**

68. In the case of unsaturated vapour — *[All Board-18]*
i. it can be created in any open or closed space
ii. it can be converted to saturated vapour by increasing the temperature
iii. it obeys Boyle's and Charles's law
Which one is correct?
ⓐ i and ii ⓑ ii and iii
ⓒ i and iii ⓓ i, ii and iii **ⓒ**

69. According to the fundamental postulates of kinetic energy of gases — *[D.B.-17]*
i. Velocity of molecules doesn't increase with temperature rise
ii. Volume of each molecule is negligible compared to distance between them.
iii. Between two consecutive collisions, molecules do not move in a straight line with constant velocity
Which of the following is correct?
ⓐ i & ii ⓑ i & iii
ⓒ ii & iii ⓓ i, ii & iii **ⓐ**

70. Three P-V graphs are given below — *[D.B.-16]*
i. 

ii. 

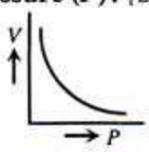
iii. 

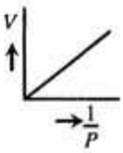
Which of the following is correct for Boyle's law?
ⓐ i & ii ⓑ i & iii
ⓒ ii & iii ⓓ i, ii & iii **ⓐ**

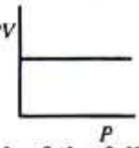
71. When amount of water vapour increases in the air — *[R.B.-16]*
i. Air density decreases ii. Air pressure drops
iii Vapour pressure drops
Which of the following is correct?
ⓐ i & ii ⓑ ii & iii
ⓒ i & iii ⓓ i, ii & iii **ⓐ**

72. It can be said about water vapour that — *[Dj.B.-16]*
i. Saturated vapour creates maximum pressure
ii. Unsaturated vapour pressure obeys Boyle's law
iii. Saturated vapour obeys Charles' law
Which of the following is correct?
ⓐ i & ii ⓑ i & ii
ⓒ i & iii ⓓ i, ii & iii **ⓑ**

73. At constant temperature, which of the following graphs represents relation between volume (V) and pressure (P)? *[Dj.B.-16]*

i. 

ii. 

iii. 

Which of the following is correct?

ⓐ i & ii ⓑ i & iii
ⓒ ii & iii ⓓ i, ii & iii **d**

74. Value of absolute zero temperature for gas is — *[Ctg.B., S.B.-16]*

i. 0°C ii. 0 K
iii. −273°C

Which is correct?

ⓐ ii ⓑ iii
ⓒ ii & iii ⓓ i, ii & iii **c**

77. According to fundamental postulates of gas — *[B.B.-15]*

i. All the molecules of a gas are identical
ii. Energy of gas is potential energy
iii. Velocity of molecules increases with temperature

Which of the following is correct?

ⓐ i & ii ⓑ ii & iii
ⓒ i & iii ⓓ i, ii & iii **c**

75. When temperature difference between the two thermometers of a dry and wet bulb hygrometer rises suddenly, we can realize that — *[R.B.-15]*

i. Relative humidity has increased
ii. Relative humidity has decreased
iii. Wet clothes would dry faster

Which of the following is correct?

ⓐ i ⓑ i & ii
ⓒ ii & iii ⓓ i, ii & iii **c**

76. Water vapour holding capacity of air —

i. doesn't change with temperature
ii. increases when temperature rises
iii. decreases when temperature rises

Which of the following id correct?

ⓐ i & ii ⓑ ii & iii
ⓒ i & iii ⓓ i, ii & iii **b**

77. Mean free path is —

i. the distance between two molecules
ii. distance between two consecutive collisions
iii. average distance between two consecutive collisions

Which of the following is correct?

ⓐ i ⓑ ii
ⓒ iii ⓓ i, ii & iii **c**

78. Saturated vapour pressure inside a closed container —

i. doesn't depend on volume of gas
ii. doesn't depend on volume of liquid
iii. depends on gas pressure

Which of the following is correct?

ⓐ i & ii ⓑ i & iii
ⓒ ii & iii ⓓ i, ii & iii **d**

Read the stimulus below and answer to questions 79 and 80:

Volume of a gas is doubled keeping its pressure constant at 20°C.

79. Which of the following laws does the stimulus indicate? *[Ctg.B.-17]*

ⓐ Boyle's law ⓑ Charles' law
ⓒ Pressure law ⓓ Avogadro's law **b**

80. Which of the following is the final temperature of the gas? *[Ctg.B.-17]*

ⓐ −273° ⓑ 300°C ⓒ 313°C ⓓ 586°C **c**

Read the stimulus below and answer to questions 81 and 82:

Velocities of three molecules of a gas are 15 $m \cdot s^{-1}$, 20 $m \cdot s^{-1}$ and 25 $m \cdot s^{-1}$. In case of gas molecules, mean velocity, mean square velocity and root mean square velocity are three important concepts. These are related to each other

81. Relation between the three variables —

i. $C_{rms} = \sqrt{\bar{C}^2}$ ii. $C^2 = \sqrt{\bar{C}^2}$

iii. $\bar{C} < \sqrt{\bar{C}^2}$

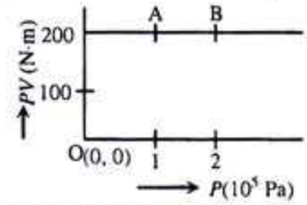
Which of the following is correct?

ⓐ i & ii ⓑ ii & iii
ⓒ i & iii ⓓ i, ii & iii **c**

82. Which of the following is the mean square velocity of the gas?

ⓐ 20.41 $m \cdot s^{-1}$ ⓑ 30.21 $m \cdot s^{-1}$
ⓒ 416.67 $m^2 \cdot s^{-2}$ ⓓ 416.67 $m \cdot s^{-1}$ **a**

Read the stimulus below and answer to questions 83 and 84:



In the above figure, PV vs P graph has been shown for a certain amount of gas. *[R.B.-16]*

83. Which of the following laws does this graph indicate?

ⓐ Boyle's law ⓑ Charles' law
ⓒ Pressure law ⓓ Kelvin's law **a**

84. Which of the following is the ratio of volumes at A and B?

ⓐ 1:1 ⓑ 1:2 ⓒ 1:3 ⓓ 2:1 **d**