1. The dimensions of emissive power are
(A) $L^1M^1T^{-2}$ (B) $L^1M^1T^{-3}$
(C) $L^0M^1T^{-3}$ (D) $L^0M^2T^{-4}$

2. For a body emitting and absorbing thermal radiation in thermal equilibrium,
(A) emissivity > absorptivity
(B) emissivity < absorptivity
(C) emissivity = absorptivity
(D) emissivity ≥ absorptivity

3. Amount of heat radiated by a body does not depend on the
(A) absolute temperature of the body
(B) nature of the body
(C) surface area of the body
(D) arrangement of molecules in the body

4. C_P and C_V denote the molar specific heats of a gas at constant pressure and at constant volume respectively.
If $\dfrac{C_P}{C_V} = \gamma$ and $C_P - C_V = R$, then C_V is equal to

(A) $\dfrac{\gamma R}{\gamma - 1}$ (B) $\dfrac{\gamma - 1}{R}$

(C) $\dfrac{R}{\gamma - 1}$ (D) $\sqrt{\dfrac{R}{\gamma - 1}}$

5. Radiation is the continuous emission of energy from the surface of anybody because of its
(A) kinetic energy (B) potential energy
(C) chemical energy (D) thermal energy

6. For a diathermanous substance
(A) coefficient of absorption is zero
(B) coefficient of reflection is not equal zero
(C) coefficient of transmission is not equal to zero
(D) coefficient of absorption is not equal to zero

7. Identify the condition for an object to become a perfect reflector. The symbols have their usual meaning.
(A) $t_r = 0$, $a = 0$ and $r = 1$
(B) $t_r = 1$, $a = 0$ and $r = 0$
(C) $t_r = 0$, $a = 1$ and $r = 0$
(D) $t_r = 0$, $a = 0$ and $r = 0$

8. The ratio of specific heat capacity at constant pressure and the specific heat capacity at constant volume for a monoatomic gas is equal to

(A) $\dfrac{1}{2}$ (B) $\dfrac{3}{2}$

(C) $\dfrac{5}{3}$ (D) $\dfrac{7}{3}$

9. If $\dfrac{R}{C_V} = 0.67$ for a gas, then the gas is made up of molecules which are
(A) Mono atomic (B) Diatomic
(C) Polyatomic (D) Mixture of diatomic and polyatomic

10. A gas is taken in a sealed container at 300 K. If the gas is heated at a constant volume to a temperature of 600 K then the mean K.E. of its molecules is
(A) doubled (B) tripled
(C) quadrupled (D) halved

11. One mole of an ideal gas requires 207 J heat to rise the temperature by 10°K when heated at constant pressure. If the same gas is heated at constant volume, the heat required to raise the temperature by the same 10°K is
(R = 8/3 J/mole °K)
(A) 29 J (B) 124 J
(C) 215.3 J (D) 1987 J

12. The r.m.s. velocity of the molecules in the sample of helium is 5/7th that of the molecules in the sample of hydrogen. If the temperature of the hydrogen sample is 0°C that of helium is
(A) 0°C (B) 0°K
(C) 273°C (D) 100°C

13. The ratio of emissive power of perfectly blackbody at 1327 °C and 527 °C is
(A) 4:1 (B) 16 : 1
(C) 2 : 1 (D) 8 : 1

14. At a given temperature, the r.m.s. velocity of a gas molecule of mass m is proportional to
(A) $\sqrt{m}$ (B) $\dfrac{1}{\sqrt{m}}$
(C) m (D) m^2

15. Average kinetic energy of molecules is
(A) Independent of absolute temperature
(B) Directly proportional to absolute temperature

(C) Directly proportional to square root of temperature
(D) Inversely proportional to absolute temperature

16. A sample of an ideal gas at absolute temperature T and pressure P occupies a volume V. If the mass of each molecules is m, then the density of gas is
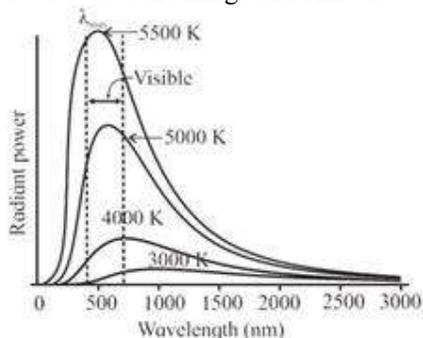(k = Boltzmann constant)

(A) $\dfrac{Pm}{KT}$

(B) $\dfrac{P}{KT}$

(C) $\dfrac{P}{KTV}$

(D) mkT

17. The degrees of freedom of the molecule represented in the image is
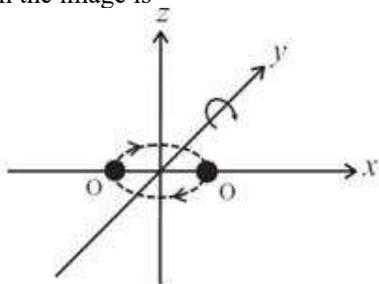
(A) 3
(B) 4
(C) 5
(D) 6

18. Observe the image and Answer.

The area under the curve represents the
(A) total energy emitted per unit area by the blackbody at all wavelengths
(B) total energy emitted per unit time by the blackbody at all wavelengths
(C) total energy emitted per unit volume by the blackbody at all wavelengths
(D) total energy emitted per unit time per unit area by the blackbody at all wavelengths

19. At what temperature, the r.m.s. speed of the molecules of a gas is half its value at NTP?
(A) 0 K
(B) 68.25 K
(C) 150 K
(D) 273 K

20. A jar 'A' filled with a gas characterized by parameter P, V and T. another jar 'B' filled with a gas with parameters 2P, V/2 and 2T, where symbols have their usual meanings. The ratio of the number of molecules of jar 'A' to those of jar 'B' is
(A) 1: 1
(B) 1: 2
(C) 2: 1
(D) 4: 1

21. Identify the INCORRECT relation. The symbols have their usual meaning.
(A) $P \propto N$
(B) $P \propto V$
(C) $P \propto m$
(D) $P \propto v^2$

22. The kinetic energy of a single molecule is given as
(A) $\dfrac{1}{2}mv_x^2$

(B) $\dfrac{1}{2}mv_y^2$

(C) $\dfrac{1}{2}mv_x^2 + \dfrac{1}{2}mv_y^2$

(D) $\dfrac{1}{2}mv_x^2 + \dfrac{1}{2}mv_y^2 + \dfrac{1}{2}mv_z^2$

23. Which of the following molecule does not have 5 degree of freedom?
(A) Helium
(B) Oxygen
(C) Nitrogen
(D) Carbon monoxide

24. Identify the INCORRECT statement.
(A) Mean free path is directly proportional to the size of the molecules.
(B) Mean free path is inversely proportional to the number of the molecules.
(C) Mean free path is inversely proportional to the density of the gas.
(D) Mean free path is directly proportional to the volume of the container.

25. Identify the INCORRECT relationship. The symbols have their usual meanings.
(A) $C_P - C_V = R$

(B) $C_P - C_V = \dfrac{R}{J}$

(C) $S_P - S_V = \dfrac{R}{M_0 J}$

(D) $S_P - S_V = \dfrac{M_0 R}{J}$

26. If at same temperature and pressure, the densities for two diatomic gases are respectively d_1 and d_2, then the ratio of velocities of sound in these will be

(A) $\sqrt{\dfrac{d_1}{d_2}}$

(B) $\sqrt{\dfrac{d_2}{d_1}}$

(C) $\sqrt{d_1 d_2}$

(D) $d_1 d_2$

27. The dimensions of Stefan's constant is
(A) $L^0 M^1 T^{-3} K^{-3}$
(B) $L^0 M^1 T^{-3} K^{-4}$
(C) $L^1 M^1 T^{-4} K^{-3}$
(D) $L^1 M^1 T^{-4} K^{-4}$

28. Identify the correct relation. The symbols have their usual meaning.
(A) $P = E$

(B) $P = \dfrac{2}{3}E$

(C) $P = \dfrac{3}{2}E$

(D) $P = \sqrt{3} E$

29. Identify the INCORRECT statement.
(A) The radiant energy emitted per unit area per unit time by a blackbody depends on its temperature.

(B) Hot objects radiate electromagnetic radiation in a large range of frequencies.
(C) At high temperature, the power radiated is small and primarily lies in the long wavelength region.
(D) At each temperature, the radiant energy contains a mixture of different wavelengths.

30. The r.m.s velocity of hydrogen gas molecules at N.T.P. is v m/se. The gas is heated at constant volume till the pressure becomes 4 times. The final r.m.s. velocity is,
(A) 4v   (B) 2v
(C) v   (D) 0.5 v

31. The specific heat of a gas
(A) is proportional to the square root of its absolute temperature
(B) has two values C_p and C_v
(C) has only one value
(D) can have any value between 0 and infinity

32. On an average for the molecules of an ideal gas in equilibrium, which one of the following quantities can be zero?
(A) Momentum   (B) Kinetic energy
(C) Speed   (D) Density

33. If the temperature of a gas is increased at constant volume then the collision
(A) on walls will decrease
(B) frequency will increase
(C) will be in a straight line
(D) will not change

34. The average translational K.E. of O_2 molecules (Molecular weight =32) at a particular temperature is 0.035 eV. The average translational K.E. of N_2 Molecules (Molecular weight = 28) at the same temperature is
(A) 0.028 eV   (B) 0.035 eV
(C) 0.055 eV   (D) 0.075 eV

35. Hydrogen molecules have r.m.s. velocity of 3 km/s at a certain temperature. The rms velocity of the oxygen molecules at the same temperature will be
(A) 6 km/s   (B) 0.75 km/s
(C) 0.5 km/s   (D) 0.25 km/s

36. If the difference between the principal specific heats of nitrogen is 300 J/kg °K and ratio of the two specific heats is 1.4, then the value of C_P is
(A) 150 J/kg °K   (B) 650 J/kg °K
(C) 750 J/kg °K   (D) 1050 J/kg °K

37. The mean square velocity of five molecules of velocities 2 m/s, 3 m/s, 4 m/s, 5 m/s and 6 m/s respectively is
(A) 10 m²/s²   (B) 15 m²/s²
(C)18 m²/s²   (D)20 m²/s²

38. At absolute temperature T, the mean kinetic energy of one gram-mole of a perfect gas is
(A) $\frac{3}{2}$ RT   (B) $\frac{3}{2}$ KT

(C) $\frac{1}{2}$ RT   (D) $\frac{1}{2}$ KT

39. If a = 0.72 and r = 0.24, then the value of t_r is
(A) 0.02   (B) 0.04
(C) 0.4   (D) 0.2

40. If pressure of an ideal gas is decreased by 10% isothermally, then its volume will
(A) decrease by 9%   (B) increase by 9%
(C) decrease by 10%   (D) increase by 11.11%

41. Lamp black or platinum black absorbs nearly _____ of incident radiant heat.
(A) 90%   (B) 95%
(C) 97%   (D) 100%

42. In an ideal gas, the molecules possess
(A) only kinetic energy
(B) both kinetic energy and potential energy
(C) only potential energy
(D) neither kinetic energy nor potential energy

43. The mean free path λ of molecules is given by
(A) $\sqrt{\dfrac{2}{\pi nd^2}}$ (B) $\dfrac{1}{\pi nd^2}$

(C) $\dfrac{1}{\sqrt{2}\pi nd^2}$ (D) $\dfrac{1}{\sqrt{2}\pi nd}$

where n is the number of molecules per unit volume and d is the diameter of the molecules.

44. Observe the image and identify the INCORRECT statement.
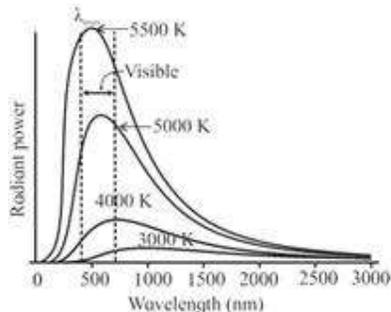
(A) At a given temperature, the energy is not uniformly distributed in the spectrum of blackbody.
(B) At a given temperature, the radiant power emitted initially increases with increase of wavelength, reaches its maximum and then decreases.
(C) The area under the curve represents total energy emitted per unit time per unit area by the blackbody at all wavelengths.
(D) The peak of the curves shifts towards the right – shorter wavelengths.

45. Two spheres P and Q of the same colour having radii 8 cm and 2 cm are kept at temperatures 127ºC and 527ºC respectively. The ratio of energy radiated by P and Q in the same time is
(A) 1   (B) 2
(C) 3   (D) 0.5

46. If temperature of a black body increases from 7ºC to 287ºC, then the rate of energy radiation increases by

(A) $\left(\dfrac{287}{7}\right)^4$ times   (B) 15 times

(C) 4 times   (D) $(287 - 7)^4$ times

47. A spherical black body of radius 12 cm radiates 450 W power at 500 K. If the radius were halved and the temperature doubled, the power radiated in watt would be
(A) 450   (B) 900
(C) 1800   (D) 225

48. If the temperature of a black body is increased by 50%, then the percentage increase in its rate of emission will be, approximately equal to
(A) 100%   (B) 150%
(C) 250%   (D) 400%

49. A body takes 5 minutes to cool from 100ºC to 70ºC. If the room temperature is 25ºC, then the time taken by it to cool from 70ºC to 40ºC will be
(A) 5 min   (B) 7.5 min
(C) 10 min   (D) 15 min

50. A body is heated to a temperature of 75ºC and is allowed to cool. If the temperature of the surrounding is 35ºC, then the temperature at which the rate of cooling will be exactly half of that initially will be
(A) 37.5ºC   (B) 50ºC
(C) 55ºC   (D) 30ºC