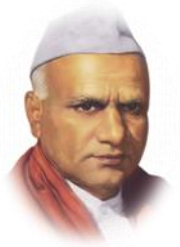

"ज्ञान, विज्ञान आणि सुसंस्कार यासाठी शिक्षण प्रसार"

शिक्षणमहर्षी- डॉ बापूजी साळुंखे .

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DEPARTMENT OF PHYSICS

QUESTION BANK

B.Sc. Part-II, Semester-III, PHYSICS Paper-V

DSC-C1 THERMAL PHYSICS AND STATISTICAL MECHANICS – I

❖Multiple Choice Questions

1. The dependence of coefficient of viscosity η on the higher absolute temperature T of a gas is...

(a) η α T (b) η α 1/T (c) η α T1/2 (d) η α T2

2. Thermal conductivity in gases is due to .....

(a) difference in molecular concentrations (b) difference in temperatures

(c) difference in velocity of molecules (d) none of these

3. In mercury thermometer the principal of……..with rise in temperature is used to measure temperature.

(a) expansion of mercury (b) contraction of mercury

(c) reduction of mercury (d) conduction of mercury

4. The ratio of two specific heats (Cp/Cv) of a diatomic gas is……

(a) 1.67 (b) 1.40 (c) 1.00 (d) 2

5. The temperature of hot junction at which thermo *e. m. f.* becomes maximum is……..

(a) Neutral temperature (b) Inversion temperature

(c) Curie temperature (d) Critical temperature

6. An adiabatic process occurs at constant……

(a) temperature (b) heat (c) pressure (d) volume

7. Thermal equilibrium defines the constancy of .....

(a) volume (b) pressure (c) temperature (d) entropy

8. During isothermal process .....remains constant.

(a) volume (b) pressure (c) temperature (d) composition

9. Entropy is a measure of.....

(a) perfect order (b) available energy

(c) disorder (d) chemical composition of matter

10. In an irreversible process, entropy.....

(a) increases (b) remains unchanged (c) decreases (d) none of these

11. The r.m.s. velocity of a molecule of gas at absolute temperature T is proportional to

(a) 1/T (b) $\sqrt{T}$ (c) T (d) T2

12. The energy of an ideal gas molecule depends only on its .....

(a) volume (b) pressure (c) density (d) temperature

13. The average kinetic energy of a gas molecule at absolute temperature T is proportional to.....

(a) 1/T (b) $\sqrt{T}$ (c) T (d) T^2

14. Average kinetic energy of translation of a molecule of perfect gas is .....

(a) 1/2 kT (b) 3/2 kT (c) kT (d) 5/2 kT

15. The average kinetic energy of a molecule in each degree of freedom is….

(a) 1/2 kT (b) 3/2 kT (c) kT (d) 5/2 kT

16. For monoatomic gas, the number of degree of freedom is .....

(a) 1 (b) 2 (c) 3 (d) 4

17. For diatomic gas, the number of degrees of freedom of....

(a) 1 (b) 3 (c) 5 (d) 6

18. Boltzmann constant k =

(a) R/N (b) RN (c) N/R (d) 1/RN

19. For monoatomic gas, ratio Cp/Cv = …….

(a) 4/3 (b) 7/5 (c) 5/3 (d) 2/3

20. For diatomic gas, ratio Cp/Cv = ……..

(a) 5/3 (b) 7/5 (c) 4/3 (d) 1/2

21. The temperature interval between the ice point and steam point is.....

(a) range of thermometer (b) fundamental interval

(c) basic interval (d) normal interval

22. Mean free path of a gas molecule is.....

(a) $1 / \pi\sigma 2n$ (b) $n / \pi\sigma$ (c) $\pi\sigma 2n$ (d) $\sigma 2/\pi n$

23. Clausius formula for mean free path of a gas molecule is……

(a) $1 / (\pi\sigma 2n)$ (b) $3 /(4 \pi\sigma 2n)$ (c) $1/ (\sqrt{2} \pi\sigma 2n)$ (d) $4 / (3 \pi\sigma 2n)$

24. Maxwell's formula for mean free path of a gas molecule is ……..

(a) 1 / (πσ2n) (b) 3 /(4 πσ2n) (c) 1/ (√2 πσ2n) (d) 2 / (3 πσ2n)

25. Coefficient of viscosity of gas corresponds to transfer of ……..of gas.

(a) momentum (b) energy (c) mass (d) entropy

26. Thermal conductivity of gas is due to transfer of……

(a) momentum (b) energy (c) mass (d) volume

27. Coefficient of diffusion of gas corresponds to transfer of…….of gas.

(a) momentum (b) energy (c) mass (d) temperature

28. The coefficient of viscosity of gas is λ = …..

(a) ρ c λ (b) 1 / (2 ρ c λ) (c) 1 / (3 ρ c λ) (d) 3 ρ c λ

29. The coefficient of viscosity of gas at absolute temperature T is proportional to.....

(a) √T (b) T (c) 1 / T (d) T^2

30. The thermal conductivity (K) of gas is related to its coefficient of viscosity (η) by equation.....

(a) K = η /Cv (b) K = η Cv (c) K = 1 / ηCv (d) K = Cv / η

31. Thermal conductivity (K) of gas at absolute temperature T is proportional to…….

(a) T (b) 1 / T (c) √T (d) 1 / √T

32. Coefficient of diffusion (D) of gas is...

(a) D = η ρ (b) D = η / ρ (c) D = ρ / η (d) D = 1 / ρ η

33. Which of the following thermometer is easily accessible?

(a) mercury thermometer (b) platinum-resistance thermometer

(c) thermo-electric thermometer (d) gas thermometer

34. On Fahrenheit scale, fundamental interval is divided into……equal parts.

(a) 180 (b) 100 (c) 80 (d) 200

35. On Reaumer scale, fundamental interval is divided into……..equal parts.

(a) 180 (b) 100 (c) 80 (d) 50

36. On Rankine's scale, fundamental interval is divided into……equal parts.

(a) 80 (b) 100 (c) 180 (d) 120

37. On Fahrenheit scale, ice point is marked at.....

(a) 0° F (b) 32° F (c) 492° F (d) 273° F

38. On Fahrenheit scale, steam point is marked at.....

(a) 0° F (b) 32° F (c) 212° F (d) 273° F

39. On Rankine scale, steam point is marked at.....

(a) 492° Ra (b) 672° Ra (c) 32° Ra (d) 212° Ra

40. The conversion formula from centigrade to Fahrenheit scale is …….

(a) F = (9/5)C + 32 (b) F = (9/5)C – 32 (c) F = C + 273 (d) F = C / 100

41. ……..thermometer works on the principle of increase of resistance with increase in temperature.

(a) mercury (b) platinum-resistance (c) thermo-electric (d) gas

42. Thermocouple thermometer or thermo-electric-thermometer works on principle of…….

(a) increase of resistance of metal with temperature (b) Seebeck effect

(c) change in pressure of gas at constant volume (d) change in volume with temperature

43. The temperature of hot junction at which thermoemf becomes maximum is .....

(a) neutral temperature (b) inversion temperature

(c) curie temperature (d) critical temperature

44. The temperature of hot junction at which thermo e.m.f. beyond neutral temperature again becomes zero is..... temperature.

(a) neutral (b) inversion (c) critical (d) curie

45. Neutral temperature for Cu-Fe thermocouple is.....

(a) 270° C (b) 540° C (c) 200° C (d) 3000° C

46. If θN is neutral temperature and θi, is inversion temperature for a thermocouple then.....

(a) $\theta N = \theta i$ (b) $\theta i = 2\ \theta N$ (c) $\theta N = 2\ \theta i$ (d) $\theta i = 3\ \theta N$

47. Thermo e.m.f. produced in a thermocouple is of the order of……

(a) microvolt (b) millivolt (c) volt (d) kilovolt

48. Sensitivity of thermocouple connected using potentiometer is of the order of……..

(a) 1 μV / mm (b) 10 V / cm (c) 0.1 μV / mm (d) 100 V / cm

49. For liquid thermometer the liquid should have ……specific heat.

(a) low (b) high (c) anything (d) none of above

50. The transfer of heat from hot body to a cold body is a ……. process.

(a) mechanical (b) non-mechanical (c) electrical (d) non - thermal

51. The transfer of heat from cold body to a hot body is a ……. process.

(a) mechanical (b) non-mechanical (c) electrical (d) non - thermal

52. For liquid thermometer to be accurate, thermal capacity of the bulb of thermometer should be……

(a) high (b) low (c) does not affect measurement (d) none

❖ Long answer questions

1. Derive an expression for thermal conductivity of a gas and Show that it is directly proportional to the viscosity of a gas.
2. State properties of mercury suitable to construct thermometer. Explain construction of mercury thermometer and discuss errors in it.
3. Explain working of Carnot's heat engine and Carnot’s cycle.
4. Derive Maxwell's law of distribution of velocities.
5. Obtain an expression for coefficient of viscosity of a gas and show that coefficient of viscosity is independent of molecular density.
6. Derive an expression for thermal conductivity of a gas and Show that it is directly proportional to the viscosity of a gas.
7. State law of equipartition of energy. Show that ratio of specific heats for monoatomic, diatomic and triatomic gases are 5/3, 7/5 and 4/3 respectively.
8. State properties of mercury suitable to construct thermometer. Explain construction of mercury thermometer and discuss errors in it.
9. Explain principle construction and working of platinum-resistance thermometer
10. What is fundamental interval of temperature? Explain Fahrenheit, Rankine and Reaumer scales of temperature. State inter-conversion formula for these scales.
11. State and explain first law of thermodynamics.
12. Define two specific heats. Show that Cp- Cv =R. Explain Cp is greater than Cv.
13. What is adiabatic process? Obtain adiabatic relations.
14. Derive expressions for work done during isothermal and adiabatic process.
15. Explain Carnot's ideal heat engine. Obtain an expression for efficiency of Carnot's heat engine.
16. Explain working of Carnot's heat engine.
17. Explain concept of entropy. State important features and physical significance of entropy.
18. State and explain third law of thermodynamics. How it leads to unattainability of absolute zero?

❖ Short answer type questions

1. State properties of mercury suitable for its use in thermometer.
2. State and explain law of equipartition of energy.
3. Write note on temperature scale.
4. Discuss experimental verification of Maxwell’s distribution law of

Velocities.

5. Explain construction of mercury thermometer.

6. Give the principle and theory of platinum resistance thermometer.

7. Derive approximate expression for mean free path of gas molecules.

8. Write note on errors observed in mercury thermometer.

9. State advantages and disadvantages of thermoelectric thermometer

10. State law of equipartition of energy and for diatomic gas show that the ratio of specific heats of a gas is 7/5.

11. State law of equipartition of energy and for monoatomic gas. Show that the ratio of specific heats of a gas is 5/3.

12. State and explain Seebeck effect.

13. Explain construction of platinum resistance thermometer.

14. Define entropy. Give physical significance of entropy.

15. Explain the term thermodynamic equilibrium.

16. Give various statements of second law of thermodynamics.

17. Write note on reversible and irreversible processes.

18. Write note on third law of thermodynamics.

19. Show that entropy increases during heat conduction and free expansion of gas.

20. State and explain Zeroth law of thermodynamics.

21. Write note on first law of thermodynamics.

22. Explain concept of entropy. Give important features of entropy.

23. Show that entropy of a system remains constant during reversible process.

24. Derive an expression for work done during isothermal process.

25. Find the efficiency of the Carnot's engine working between the temperatures 150 oc & 50 oC.

26. Write note on isothermal process.

27. Derive an expression for efficiency of Carnot's heat engine.

28. Write note on reversible and irreversible processes.

29. State and explain reversible process.

30. State and explain equations of state for ideal and real gas.