

**St. Joseph's College of Arts & Science (Autonomous)
Cuddalore – 607001**

**SUBJECT : THERMAL AND STATISTICAL PHYSICS
SUBJECT CODE: PH202**

SUBJECT INCHARGE: Dr.S.Sebastian (Shift-I), Mrs.M. Marie Julie

SECTION – A

1. Give the statement of Prevost's theory of heat exchanges.
2. Define solar constant.
3. What is meant by degrees of freedom?
4. What is Brownian motion?
5. Define c_p and C_v of a gas.
6. Why do you mean regenerative cooling?
7. Give any one statement of second law of thermodynamics.
8. Define entropy?
9. Give any two applications of Maxwell thermodynamical relations.
10. State Stefan's law of radiation
11. Mention the source of solar energy.
12. Define the coefficient of thermal conductivity.
13. Define mean free path.
14. Mention any two important results of Andrew's experiment on CO_2 .
15. State the third law of thermodynamics.
16. Define the efficiency of a heat engine.
17. What are macro states?
18. Write the relation between thermodynamic probability and entropy.
19. State Wien's displacement law.
20. Define γ of a gas.
21. What is an isothermal change for a gas?
22. What is the importance of Andrew's experiment?
23. What is an irreversible process?
24. Give the principle of pressure cooker.
25. What is the black body radiation?
26. State the law of equipartition theory.
27. Mention any two applications of low temperatures.
28. What is meant by super fluidity?
29. Write down the first latent heat equation.
30. What are micro and macro states?
31. State Newton's law of cooling.
32. Define thermal diffusivity of gases.
33. What is an isothermal change?
34. What are intensive variables?
35. Draw T-S diagram.
36. What is phase-space?
37. State Kirchoff's law.

38. Write the four principal thermodynamic potentials.
39. State Wiedman -franz law.
40. What do you mean by transport phenomenon?
41. State the law of equipartition of energy.
42. Explain super fluidity.
43. State the first law of thermodynamics.
44. Differentiate reversible and irreversible process?
45. Write the second latent heat equation.
46. State plank's law of transmission of heat.
47. State wien's displacement law of heat radiation.
48. What is the outcome of Perrin's experiments?
49. What are the effects of chlorine on Ozone layer?
50. What do you mean by electro flux refrigerator?
51. Write down clausius – clapeyron heat equation.
52. Kirchoff's law of heat radiation.
53. What you adiabatic process.
54. Thermodynamics.
55. Arogadro number.
56. Ozone layer.
57. Define Engine.
58. Principle of Refrigeration.
59. What is Air-conditioning?.
60. State Zeroth law of thermodynamics.
61. What is the change of entropy in an irreversible process?
62. What is the effect of change of pressure on borling points of liquids?

SECTION – B

1. Briefly discuss the Forbe's method of determining thermal conductivity of a metal.
2. state and explain Wien's law and Rayleigh-jean's law . what are their drawbacks?
3. what is mean free path? Deduce an expression for mean free path.
4. State and explain law of equipartition of energy?
5. Describe the clement and Desormers method of determining ratio of specific heat of a gas
6. describe the method of liquefaction of Helium with a neat diagram.
7. calculate the increase in efficiency of Otto engine if its compression ratio is increased 6 to 8. Take $\gamma=1.4$.
8. calculate the change in entropy when 102 kg of ice at 0 (deg) c is converter into water at the same temperature. Give that the specific latent heat of fusion of ice is $3.36 \times 10^5 \text{ j kg}^{-1}$.
9. what is Black body radiation? Explain Fery's black body.
10. Describe the construction and working of disappearing filament pyrometer.

11. The viscosity of the gas is found to be $2.25 \times 10^{-5} \text{ N s m}^{-2}$. The rms velocity of the molecule is $4.5 \times 10^2 \text{ m s}^{-1}$. If the density of the gas is 1 kg m^{-3} . Calculate the mean free path of the molecules.
12. Calculate the r.m.s velocity of a molecule of hydrogen at N.T.P. Give that $K = 1.38 \times 10^{-23} \text{ J K}^{-1}$ and $N = 6.023 \times 10^{23}$ o=per mole. Also calculate the average velocity of the molecule.
13. Derive Mayer's relation
14. Discuss the properties of He-1 and He-11.
15. State and explain the first law of thermodynamics and state the second law of thermodynamics.
16. Derive the first latent heat equation and explain its importance.
17. Deduce the relation between the specific heat capacities of a gas by using Maxwell's thermodynamical relation.
18. Explain transport phenomena
19. Explain Claude's process for the liquefaction of air
20. Derive the equation during an adiabatic change for a perfect gas.
21. The adiabatic compression ratio of an Otto engine is found to be 7 and $\gamma = 1.4$ calculate the efficiency of the engine.
22. Calculate the change in entropy when the temperature of 0.01 kg of water at 373 K is cooled to 331 K. Give that the specific heat capacity of water $= 4200 \text{ J kg}^{-1} \text{ K}^{-1}$.
23. Discuss the effect of pressure on melting point of a solid.
24. Derive and explain second latent equation.
25. Describe the Lee's disc method of determining the thermal conductivity of a bad conductor.
26. Explain Planck's law.
27. Write a note on the thermodynamic scale of temperature.
28. Explain about temperature-Entropy diagram.
29. State and explain Wiedemann Franz law.
30. What is transport phenomenon in a gas? Explain how viscosity and conduction properties are explained on the basis of transport phenomenon.
31. What are degrees of freedom? Explain them for a mono dia and triatomic molecules.
32. Describe the merits of industrial Estate.
33. What are the main contents of a project report?
34. The efficiency of an Otto engine is 50% and the ratio of specific heat capacities is calculate the compression ratio.
35. Calculate the change in entropy when 10^{-3} kg of water at 273 K is heated to 373 K. Give that specific heat capacity of water $4200 \text{ J kg}^{-1} \text{ K}^{-1}$.
36. Two stars radiate maximum energy at wavelengths $3.6 \times 10^{-7} \text{ m}$ and $4.8 \times 10^{-7} \text{ m}$ respectively. What is the ratio of their temperature?
37. The opposite faces of a metal plate of 0.2 cm thickness are at a difference of temperature of 100 degc and the area of the plate is 200 cm^2 . Find the quantity of heat that will flow through the plate in one minute if $k = 80 \text{ W m}^{-1} \text{ K}^{-1}$.
38. Explain Maxwell's distribution of molecular velocities.
39. What's Brownian motion? Explain it with necessary theory.

40. Define CP and CV of a gas . Deduce the Mayer's relation relating Cp and Cv.
41. Describe the method of liquefaction of hydrogen.
42. calculate the change in entropy in a reversible and irreversible process.
43. Briefly explain thermodynamics scale of temperature.
44. Derive Clausius – Clapeyron equation . How does it explain the effect of pressure on melting and boiling points?
45. Explain micro and microstate with relevant examples.
46. Define solar constant . explain the method of determining it experimentally.
47. Write about thermal conductivity and diffusion of gases.
48. Discuss about langein's theory.
49. Discuss with diagrams the working of a diesel engine and deduce an expression for its efficiency.
50. what are intensive and extensive variables? Explain?
51. state & Explain the third law of thermodynamics.
52. Establish the clausius - clapeyron 's equation.
 - a. Discuss the effect of pressure on melting point & boiling point.
53. Define specific heat capacities and obtain an expression relating them.
54. Write a note on refrigerating machines.
55. A carnot's engine whose temperature of the source is 400k take 200 calories of heat at this temp and rejects 150 calories of heat in the sink. What is the temp of the sink? Also calculate the efficiency of the engine.
56. calculate the increase in entropy when one gram of ice at -10(deg)c is converted into steam 100(deg). Specific heat of ice as 0.5 and latent heat of ice is 80 cal/g latent heat of steam is 540 cal/g.
 - a. Explain the method of lee's disc to determine the co-efficiency of thermal conductivity of a bad conductor.
57. what is the wavelength at which human body at 37deg c wein's constant is 2.898×10^{-3} mk.
58. derive an exepression of coefficiency of diffusion of gases.
59. Molecular diameter of nitrogen is 3.5×10^{-10} m. calculate the mean free path at temp 27deg c and pressure I atmosphere.
60. Write a note on practical application of law temp.
61. reversible and irreversible process.
62. calculate the efficiency of a diesel engine having compression ratio 13.8 and expansion 6. Give ratio of specific heat capacitius=1.4.
63. The second latent heat equation.
64. Calculate the pressure required to lower the melting point of ice by 1(deg) c. $L=3.39 \times 10^5$ j/kg. specific volume of ice at 0(deg)c= 1.091×10^{-3} m³, & one atmosphere= 1.013×10^5 pa.
65. state & explain the law of equipartition of energy.

SECTION – C

1. What is pyrometry? Explain how you will measure solar constant with the help of a pyro heliometers.
2. Deduce an expression for thermal conductivity considering the transport of heat in a gas .
3. Explain the principle , construction and working of Frigidaire –the vapour compression machine.
4. Explain the thermodynamic scale of temperature. Show that this agrees with that of a perfect gas scale. Is a negative temperature possible on this scale?
5. Deduce clausius -clapeyron equation from Maxwell thermodynamical relations.
6. Explain micro state and macro state with examples.
7. Derive Maxwell's velocity distribution law.
8. Describe the experimental methods of liquification of Oxygen and Nitrogen.
9. What is quantum theory of radiation? Derive plank's formula for the distribution of energy in the spectrum of a block body. Deduce from it Wien's displacement law and Rayleigh-jeans law.
10. Explain what you mean by degrees of freedom. state the law of equipartition of energy. Prove that for a perfect gas whose molecules have n degrees of freedom. $Y=1+2/n$ and discuss.
11. Describe clement and Desormes method of determining the ratio of the specific heat capacities of a gas.
12. Obtain the express for entropy of a perfect gas.
13. Explain Forbe's method of finding thermal conductivity of metal bar in detail.
14. Obtain an expression for the pressure of a gas.
15. Describe the methods for the liquefaction of hydrogen and helium .
16. With a suitable diagram explain the Working of diesel engine and deduce an expression for the efficiency.
17. Derive an expression for the pressure of a gas on the basis of kinetic theory of gases.
18. Discuss Maxwell –Boltzmann distribution law and derive the relation $n_i = g_i / e^{\epsilon_i / kT}$
19. Derive the Rayleigh -jeans law of radiation.
20. Derive Langevin's theory of Brownian motion.
21. Explain the principle, construction and working of Electro flux refrigerator.
22. Deduce the Clausius - Clapeyron's latent heat equation. Discuss how the boiling point of a liquid and the melting point of a solid are affected by change of pressure.
23. Explain with necessary diagram the Lee's disc method of determining thermal conductivity of a bad conductor.
24. Assuming the transport of mass , derive an expression for the coefficient of diffusion of a gas.
25. What is regenerative cooling ? Describe the method of liquefaction of air by Linde's process with a neat diagram.
26. Describe the working of Otto engine and derive an expression for its efficiency.
27. Derive the four Maxwell's thermodynamic relations.

28. Explain the distribution of energy in a black body spectrum and discuss the result.
29. What are the postulates of kinetic theory of gases? Derive an expression for pressure of a gas.
30. Obtain Mayer's relation for reversible adiabatic and isothermal changes.
31. Describe the efficiency of an ideal heat engine in terms of temperature.
32. What is Brownian motion? Discuss the Langevin's theory of Brownian motion.
33. Explain the principle of regeneration cooling.
34. Give the practical applications of low temperature.
35. What are transport Phenomena in gases? Obtain an expression for the coefficient of thermal conductivity of a gas.