

STELLA MARIS COLLEGE (AUTONOMOUS) CHENNAI – 600 086.
(For candidates admitted during the academic year 2015-16)

SUBJECT CODE: 15PH/MC/TS24

B.Sc. DEGREE EXAMINATION APRIL 2016
BRANCH III - PHYSICS
SECOND SEMESTER

REG. No. _____

COURSE : MAJOR – CORE
PAPER : THERMAL PHYSICS AND STATISTICAL MECHANICS
TIME : 30 MINS. MAX. MARKS: 30

SECTION – A

TO BE ANSWERED IN THE QUESTION PAPER ITSELF

ANSWER ALL QUESTIONS: (30 x 1 = 30)

I CHOOSE THE CORRECT ANSWER:

1. Planck's law reduces to Rayleigh-Jeans law at
a) entire range wavelengths
b) any wavelengths
c) small wavelengths
d) longer wavelengths
2. Energy emitted in the form of quanta is called
a) radiation
b) phonon
c) photon
d) wave packet
3. The relative emittance for a perfect black body is
a) 0
b) 1
c) greater than 1
d) less than 1
4. Temperature remains constant in
a) isothermal process
b) adiabatic process
c) isochloric process
d) isobaric process
5. The differential form of the first law of thermodynamics is
a) $dQ=dU-dW$
b) $dQ=dU+dW$
c) $dW = dU+dQ$
d) $dW = dU-dQ$
6. A device which converts heat into work is called
a) petrol engine
b) diesel engine
c) heat engine
d) Otto engine
7. The area enclosed in the temperature-Entropy figure represents
a) heat energy absorbed
b) heat energy liberated
c) work converted to energy
d) energy converted to work
8. The unit of entropy is
a) JK
b) $J^{-1}K$
c) JK^{-1}
d) $JKg^{-1}K^{-1}$
9. In a Carnot's refrigerator if the source temperature is double that of a sink, then the coefficient of performance is
a) 1.5
b) 1
c) 0.5
d) 0.25

10. If a process is isothermal and isobaric then ----- function remains constant
a) Gibbs b) Helmholtz c) enthalpy d) entropy
11. Internal energy, Helmholtz function, Gibbs function and enthalpy are thermodynamic
a) functions b) potentials c) states d) systems
12. The total energy function of a system is
a) Helmholtz b) Gibbs c) enthalpy d) entropy
13. Curie's law says that the paramagnetic susceptibility of a substance is----- to temperature.
a) directly proportional b) equal c) independent d) inversely proportional
14. A system of large number of macroscopic particles is called
a) microscopic state b) Macroscopic state c) ensemble d) Phase space
15. Phase space is a -----dimensional coordinates to represent a single particle.
a) 6 b) 4 c) 3 d) 1

II **FILL IN THE BLANKS:**

16. Newton's law of cooling is supported by _____ law.
17. In adiabatic compression, volume decreases as _____ increases.
18. _____ is the degree of disorder.
19. Maxwell's second TdS equation is _____.
20. Helium II has zero viscosity. So it is called _____.

III **STATE WHETHER TRUE OR FALSE:**

21. The wavelength of the radiation emitted by the black body depends on the temperature of the body.
22. If two bodies are at same temperature, then they are in thermal equilibrium with each other.
23. There is no change in entropy in the isothermal process at 0 K.
24. For a perfect gas, $C_v - C_p = R$.
25. Maxwell-Boltzmann statistic is applicable to particles of zero or integral spin.

IV ANSWER BRIEFLY:

26. According to Stefan's law if the temperature of the black body is doubled, by how many times are the emitted radiations increased?

27. State Zeroth law of thermodynamics.

28. What is an ideal gas?

29. Write Maxwell's first TdS equation.

30. What is magnetocaloric effect?



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SECTION – B

ANSWER ANY FIVE QUESTIONS: (5 x 5 = 25)

1. Describe the energy distribution of the Black body.
2. Find the efficiency of a Carnot's engine working between steam point and ice point. If the engine receives 840 J of heat from the source, calculate the amount of heat rejected to the sink.
3. A Carnot's refrigerator receives 2100J of heat from the reservoir at 260K. Calculate the amount of heat given to the reservoir at 300K. Calculate the work done.
4. 1mol of a perfect gas doubled its volume isothermally. Calculate change in entropy. $R = 8.3\text{J/K-mol}$
5. Calculate the change in entropy when 1 Kg of ice at 273K converted into steam at 373K. Latent heat of fusion of ice is $3.34 \times 10^5 \text{ J/kg}$ and that of steam is $226 \times 10^4 \text{ J/kg}$. Specific heat capacity of water is $4190 \text{ Jkg}^{-1}\text{K}^{-1}$.
6. Calculate the specific heat capacity of saturated steam. Specific heat capacity of water at 373K is 4228 J/Kg-K , specific latent heat of vaporization of steam is $226 \times 10^4 \text{ J/Kg}$. and the rate of decrease of specific latent heat of vaporization of steam with temperature is 2679 J/Kg-K .
7. Discuss the anomalous properties of liquid helium at the transition temperature.

SECTION – C

ANSWER ANY THREE QUESTIONS: (3 x 15 = 45)

8. State and explain Plank's radiation formula. Deduce Wien's and Rayleigh-Jeans formula from the same.
9. State Clausius' and Kelvin's laws of thermodynamics. Explain the thermodynamics of heat engine and the refrigerator using PV graph and the block diagram.

10. What are reversible and irreversible processes? Discuss the change in entropy in such processes.
11. Derive Maxwell's thermodynamic relations from thermodynamic potentials.
12. Derive Maxwell-Boltzmann law of distribution of energy.

