18U606 (Pages: 2) Name: ……..…….

Reg. No…….……

SIXTH SEMESTER B.Sc. DEGREE EXAMINATION, APRIL 2021

(CUCBCSS-UG)

(Regular/Supplementary/Improvement)

CC15U PH6 B10 - THERMAL AND STATISTICAL PHYSICS

(Physics - Core Course)

(2015 Admission onwards)

Time: Three Hours Maximum: 80 Marks

The symbols used in this question paper have their usual meanings

Section A (Answer in a word **or** phrase)

Answer ***all*** questions: each question carries 1 mark.

1. Name an extensive variable?
2. Differentiate heat and Temperature?
3. The law of equipartition of energy was postulated by ----------
4. Name the process in which dQ = dW?
5. What is Fermi dirac distribution law?

Write True or False:

6. Volume is an intensive quantity
7. The internal energy of an ideal gas increases when expanded isothermally
8. PV = constant represents an adiabatic process
9. Classical particles obey Bose – Einstein Statistics
10. At absolute zero, the value of entropy is zero

(10 x 1 = 10 Marks)

Section B (Answer in two or three sentences)

Answer ***all*** questions. Each question carries 2 marks.

11. Calculate the change in entropy during an irreversible process?
12. Deduce an expression for work done during an adiabatic process?
13. State and explain Wein's displacement law?
14. Distinguish between internal and external latent heats?
15. What are the properties of fermions?
16. Draw the T-S diagram of a Carnot Cycle?
17. Draw the volume versus temperature curve for first and second order phase transitions?

(7 x 2 = 14 Marks)

Section C

(Answer in a paragraph of about half a page to one page)

Answer any ***five*** questions. Each question carriers 4 marks.

18. Obtain the relation between isothermal and adiabatic elasticity of a gas?

19. Deduce an expression for change in entropy of a perfect gas in terms of (a) **P and T** (b) **V and T**
20. From first law of Thermodynamics, derive Mayer's relation?
21. Derive the relation $(\partial H / \partial S)_P = T$.
22. State and explain equipartition theorem?
23. Explain Planck radiation law?
24. Differentiate between r.m.s speed, most probable speed and average speed of gas molecules?

(5 x 4 = 20 Marks)

Section D

(Problems – write all relevant formulas, all important steps carry separate marks)
Answer any ***four*** questions. Each question carriers 4 marks.

25. Calculate the change in entropy when 100g of ice at 0^oC is converted into steam at 100^oC. Given latent heat of ice is 336 kJ/kg and latent heat of steam is 2268 kJ/kg. Specific heat capacity of water is 4200J/KgK?
26. An ideal gas of volume 1 litre and at a pressure of 6 atmospheres expands adiabatically till the pressure is reduced to $(1/3)^{rd}$ of its initial value. If $\gamma = 1.4$ for the gas and 1 atmosphere = 1.013×10^5 N/m^2 . Calculate the new volume, work done and change in internal energy?
27. A carnot engine has its source at 100^oC and its sink is maintained at a constant temperature by means of ice at 0^oC. If it is working at the rate of 100watt, how much ice will melt in one minute?
28. Using Maxwell relation, show that $(\partial Cp / \partial P)_T = -T (\partial^2 V / \partial T^2)_P$
29. If the maximum wavelength of emission of a black body is 2×10^{-9} nm. Find its temperature. The value of Wein's constant is 0.002899mK?
30. Find r.m.s speed of O_2 molecule at 0^oC ($K = 1.38 \times 10^{-23}$ J/K).
31. Using Clausius Clapeyron equation, prove that the boiling point of a liquid rises when the pressure increases?

(4 x 4 = 16 Marks)

Section E (Essays –answer in about two pages)

Answer any ***two*** questions; each question carries 10 marks.

32. Compare Maxwell – Bolzmann, Fermi –Dirac and Bose – Einstein Staistics?
33. Explain the working of a Carnot engine. Derive an expression for its efficiency?
34. Calculate the change in entropy of a perfect gas in terms of temperature and pressure?
35. Derive Maxwell T dS relations from thermodynamic potentials?

(2 x 10 = 20 Marks)

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