16U606 (Pages: 3) Name: ……..…….

Reg. No…….……

SIXTH SEMESTER B.Sc. DEGREE EXAMINATION, APRIL 2019

(Regular/Supplementary/Improvement)

(CUCBCSS-UG)

CC15U PH6 B10 - THERMAL AND STATISTICAL PHYSICS

Physics - Core Course

(2015 Admission onwards)

Time: Three Hours Maximum: 80 Marks

Section A

Answer ***all*** questions. Each question carries 1 mark.

1. Passage of electric current through a wire is :

   a) A reversible process b) An irreversible process

   c) An isothermal process d) None of these

2. Which of the following statement is true for a thermodynamic system?

   a) ΔU = -W for an isothermal process b) ΔU = W for an isothermal process

   c) ΔU = -W for an adiabatic process d) ΔU = W for an adiabatic process

3. For a thermodynamic system, work done in a process depends on:

   a) The path b) State of the system

   c) Temperature and pressure d) External pressure

4. In an isothermal, isobaric and reversible process, the Gibb's function is:

   a) Zero b) Infinity

   c) Constant d) Negative

5. Which of the following relations is correct?

   a) dH = TdS -VdP b) dH = TdS - PdV

   c) dH = SdT + PdV d) dH = TdS +VdP

6. In a refrigerator, the heat exhausted to the outer atmosphere is …… than that absorbed from the source.

7. The area of P-V diagram represents ……

8. Entropy of the universe can reach a maximum value. This statement is…… True/False).

9. As the entropy of a thermodynamic system increases, its available energy …… Increases/ Decreases).

10. Classical particles obey …… statistics.

(10 × 1 = 10 Marks)

Section B

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

11. Distinguish between Heat and Temperature.
12. State and Explain Carnot's theorem.
13. Explain Clausius inequality.
14. Discuss the change of entropy in a Carnot cycle.
15. State and explain Nernst theorem.
16. What is the coefficient of performance of a refrigerator?
17. State and explain Equipartition theorem.

(7 × 2 = 14 Marks)

Section C

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

18. Derive the relation between volume and temperature of a perfect gas undergoing adiabatic compression.
19. Explain how second law of thermodynamics enables us to define a scale of temperature independent of the properties of the working substance.
20. Discuss adiabatic and isothermal elasticities of a perfect gas and show that adiabatic elasticity is 'γ' times isothermal elasticity.
21. With the help of entropy –temperature diagram, distinguish between phase changes of the first order and second order.
22. Discuss the effect of pressure on the melting point of solids.
23. Write short note on Planck Radiation law.
24. Distinguish between Bosons and Fermions.

(5 × 4 = 20 Marks)

Section D

Answer any ***four*** questions. Each question carries 4 marks.

25. Calculate the amount of work done when 1 litre of a monoatomic perfect gas, originally at NTP, is compressed adiabatically to half its volume. Given ($R = 8.4\times10^{3}$ J/mole).
26. A Carnot engine has an efficiency of 50% when its sink temperature is 27^{0}C. What should be the change in its source temperature so that its efficiency may become 60%?

27. Water boils at 100.5^{0}C and 99.5^{0}C under pressures of 0.77371 and 0.7465 m of Mercury respectively. Calculate the specific volume of steam at 100^{0}C when latent heat 'L' is 537000 cal/kg.
28. Calculate the change in entropy when 1 litre of water at 27^{0}C is heated to 77^{0}C.
29. An ideal refrigerator takes heat from a cold body and rejects to a hot reservoir at 300K.Calculate the amount of work which must be done in order to remove one calorie of heat when the cold body is at 1k.
30. A cubic meter of atomic Hydrogen at 0^{0}C and at atmospheric pressure contains about 2.7×10^{25} atoms. Find the number of the atoms in their first excited state (n=2) at $0\ ^{0}$C.
31. A copper sphere 5 cm in diameter whose emissivity is 0.3 is heated in a furnace to 400^{0}C. At what rate does it radiate? Stephan's constant $\sigma = 5.670\times10^{-8}$ W/m^{2}K^{4}

(4 × 4 = 16 Marks)

Section E

Answer any ***two*** questions. Each question carries 10 marks.

32. Derive the expression for work done in isothermal, adiabatic and isobaric processes. Discuss about work done in an isochoric process.
33. Discuss the Diesel cycle and obtain an expression for the efficiency.
34. Deduce Maxwell's thermodynamical relations and hence arrive at Clausius-Clapeyron equation.
35. With the help of Maxwell-Boltzmann statistics, find the distribution of energies among the molecules of an ideal gas. Also find the average molecular energy.

(2 × 10 = 20 Marks)

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