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B – 3699

Reg. No. : .....

Name : .....

Third Semester B.Sc. Degree Examination, December 2016
First Degree Programme under CBCSS
PHYSICS
Core Course
PY 1341 : Thermodynamics and Statistical Physics
(2013 Admission)

Time : 3 Hours

Max. Marks : 80

PART – A

Answer **all** the questions. Answer should **not** exceed **two** sentences. **Each** question carries **1** mark.

1. Draw P-V diagrams representing isothermal and adiabatic processes.
2. At what condition Gibb's function equivalent to free energy of the system.
3. What is meant by black body radiation ?
4. Explain why adiabatic processes are known as isentropic processes.
5. The net change in entropy in a irreversible process. Explain.
6. Explain Helmholtz function.
7. Explain the change in entropy when ice is converted into steam.
8. State and explain the zeroth law of thermodynamics.
9. Explain thermal conductivity of a substance.
10. State and explain Stefan's law of radiation.

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PART – B

Answer **any 8** questions. Answer should **not** exceed **one small** paragraph. **Each** question carries **two** marks.

11. Distinguish between Bosons and Fermions.

12. What is equation of state ? Give its limitations.

13. What do you understand by variables of state of a system and equation of state.

14. Give applications of the first law to (a) isobaric (b) adiabatic processes.

15. What do you mean by isobaric process and isochoric process ? Calculate the work done by an ideal gas in these processes.

16. From the first law of thermodynamics, prove that $C_p - C_v = R$.

17. Prove that PV^γ = constant in an adiabatic transformation.

18. Explain why the gases have two specific heats ? Explain why the specific heat at constant pressure C_p is greater than that C_v, the specific heat at constant volume.

19. Prove that adiabatic elasticity of a gas is limes the isothermal elasticity, or $E_s / E_\tau = \gamma$.

20. Define efficiency of a heat engine. Obtain an expression for the efficiency of a reversible Carnot's engine with a perfect gas as the working substance. Mention the effective ways to increase its efficiency.

21. Calculate the work done in a Carnot's cycle of operations. Deduce the efficiency of a Carnot's engine in terms of the temperatures between which it works.

22. State and explain Clausius- Clapeyron latent heat equation.

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PART – C

Answer **any 6** questions. **Each** question carries **4** marks.

23. A Carnot's engine whose lower temperature heat-sink is at 27°C has its efficiency 40%. What is the temperature of the heat sources. By how much should the temperature of the source be raised if the efficiency is to be raised to 70%.

24. Two large closely spaced concentric spheres (both are black body radiators) are maintained at temperatures 200 K and 300 K respectively. The space in between the two spheres is evacuated. Calculate the net rate of energy transfer between the two spheres. [Stefan's constant = 5.672×10^{-8} M.K.S. units].

25. A quantity of air at 27°C at atmospheric pressure is suddenly compressed to half of its original volume. Find the final pressure. (Given $\gamma = 1.4$)

26. Find the efficiency of the Carnot's engine working between the steam point and the ice point.

27. Calculate the change in boiling point of water when the pressure is increased by 1 atmosphere. Boiling point of water is 373 K. Specific volume of steam = 1.671 m^3kg^{-1} specific volume of water $V_1 = 1 \times 10^{-3} m^3kg^{-1}$ and latent heat of steam 2.268×10^6 Jkg^{-1}.

28. Two concentric spherical shells are maintained at temperatures 300°K and 500°K. The narrow space between them is evacuated. Calculate the rate of energy transfer between the two spherical Shells assuming the two spheres to be perfectly black body radiators $\sigma = 5.669 \times 10^{-8} Wm^{-2} K^{-4}$.

29. Calculate the change in entropy when 5 kg of water at 100°C is converted into steam at the same temperature. (Given : Latent heat of steam = 540 cal/gram)

30. Calculate the change in entropy when 0.0273 kg of ice of 0°C is converted into water at the same temperature.

31. Calculate the change in temperature of boiling water when the pressure is increased by 27.12 mm of Hg. The normal boiling point of water at atmospheric pressure is 100°C. (Latent heat of steam = 537 cal/gm and specific volume of steam = 1674 cm^3).

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PART – D

Answer **any 2** questions. **Each** question carries **15** marks.

32. Explain the working of Carnot's engine. Arrive at an expression for the work done in a cycle.

33. Derive the expression for the change of entropy in a reversible isothermal process.

34. Derive any two of the Maxwell's thermodynamical relations.

35. Describe with theory how you will determine the thermal conductivity of a poor conductor by the Lee's method.

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