

Code :

UNION CHRISTIAN COLLEGE, ALUVA
CBCSS B Sc Degree First Internal Examination, September, 2015
Core Course- Physics- Fifth Semester
PH5BO3U – Thermal and Statistical Physics

Time: 1.5 Hours

Max. Marks: 30

Part A (Answer all questions. Each question carry one mark)

1. An adiabatic process occurs at constant_____
2. Gibb's potential is defined as $G=$ _____ .
3. A reversible engine can be 100% efficient, if the temperature of the sink is _____.
4. In 7 tosses of a coin, a macrostate with 3 Heads has _____ number of microstates.

Part B (Short answer questions. 2 marks each. Answer any three)

5. Prove that adiabatic elasticity of a gas is γ times isothermal elasticity.
6. Prove the principle of increase of entropy.
7. State and explain zeroth law of thermodynamics.
8. State true or false with reason: Entropy of a system decreases with thermodynamic probability.
9. Energy of a photon is $E= p c$ is linearly proportional to its momentum p . Find the density of states for photons in a box of volume V . (Note : Photon has two possible polarizations).

Part C (Short essay/ problems, 4 marks each. Answer any two)

10. Explain the construction and working of a diesel engine.
11. A quantity of air at 27°C and atmospheric pressure is suddenly compressed to $(1/5)$ of its original volume. Find the (1) final temperature and (2) final pressure.
12. 6 red balls and 3 blue balls are randomly dropped into 3 distinct boxes. The probability of getting a ball is the same for all 3 boxes and the balls of the same colour cannot be distinguished from each other. If n is the number of balls in the 2nd box find the thermodynamic probability for the macrostate $n=5$.

Part D (Essay.12 marks. Answer any one question)

13. Explain first law of thermodynamics along with its significance and limitations. Derive Mayer's relation.
14. Distinguish between isothermal and adiabatic changes. Show that for an adiabatic change in a perfect gas $PV^{\gamma} = \text{const.}$

