Exam Code 256

UNION CHRISTIAN COLLEGE, ALUVA
B.Sc(Physics) Core Semester V
($PH5B03U$) Thermal and Statistical Physics

Internal Examination **Duration: 90 Minutes** **Max. marks : 30**

Part A

(One mark each, answer **all** questions)

1. The ratio of adiabatic and isothermal elasticities of a gas is _____.
2. In producing cooling by adiabatic demagnetization we use _____ substance.
3. In a toss of 7 coins a macrostate with 5 Heads has _____ number of microstates.
4. Number of ways in which a particular microstate can occur in a toss of N coins is ___.

Part B

(2 Marks each, answer any **three** questions.)

5. Explain isothermal, adiabatic, isobaric and isochoric processes.
6. State first law of thermodynamics.
7. What is the efficiency of a Carnot engine working between $600K$ and $300K$?
8. State true or false with reason: For a free particle in one dimension having energy between E and $E + dE$ the density of microstates decrease with increase in energy E.
9. Draw the phase space trajectory of a simple harmonic oscillator of unit mass and unit spring constant with energy $E = \frac{p^2}{2} + \frac{x^2}{2}$.

Part C

(4 Marks each, answer any **two** question.)

10. Derive Mayers relation.
11. Calculate the work done when one gram mole of an ideal gas expands isothermally at $27°C$ to double its original volume. [$R = 8.3\ JK^{-1}$/mol].
12. 5 dice, each die having six even sides marked $1, 2, \ldots 6$, are tossed. The probability for any one side to occur on top is the same as any other. Find the probability for getting *at least* 3 dice with the number 4 on top.

Part D

(12 Marks each, answer any **one** question.)

13. Describe the parts of a Carnots engine. Explain Carnots cycle and derive the efficiency of an ideal heat engine in terms of temperatures.
14. Draw the phase space curve of a free particle with energy value between E and $E + dE$ that moves along X-axis between $-\frac{L}{2} \leq x \leq \frac{L}{2}$. Derive the expression for density of states.