RAMAKRISHNA MISSION VIDYAMANDIRA

(Residential Autonomous College under University of Calcutta)

FIRST YEAR

B.A./B.SC. FIRST SEMESTER (July – December), 2012

Mid-Semester Examination, September 2012

Date : 12/09/2012

Time : 11 am – 12 noon

PHYSICS (General)

Paper : I

Full Marks : 25

Answer any five questions taking at least two from each group.

Group - A

1. What do you mean by Scalar triple product ? Show that this product represents the volume of the body whose dimensions are given by the above triple vectors. 2+3

2.a) State Gauss' theorem. 2

b) If φ (x,y,z) is a scalar function and $\vec{A}$ (x,y,z) is a vector function, show that $\vec{\nabla} \cdot (\varphi \vec{A}) = \varphi \cdot \vec{\nabla} \vec{A} + \vec{A} \cdot \vec{\nabla} \varphi$. 3

3. Deduce expression for the radial and transverse accelerations for a particle moving in a circular path of radius R. 5

4.a) Find out the dimension of gravitational constant (G) using dimensional analysis.

b) Find an expression of gravitational potential inside a solid sphere of radius R at a distance r from the centre. 2+3

Group - B

5. a) Define intensive and extensive variables with example.

b) When the volume of a gas kept at NTP is expanded 3 times to its initial volume adiabatically, what will be its final temperature ? [$\gamma = 1.5$] 2+3

6.a) Prove the relation $C_P - C_V = [(\frac{\partial U}{\partial V})_T + P] (\frac{\partial V}{\partial T})_P$, where the symbols have usual meanings. Hence show that, for ideal gas of n mole, $C_P - C_V = n R$.

b) Why C_P is greater than C_V for gas. 3+2

7.a) From the first law of thermodynamics show that total internal energy of the universe is conserved.

b) What is meant by reversible process ? What will be the change of internal energy for a cyclic process ? 2+3

8.a) Calculate the volume expansion coefficient (α) and isothermal compressibility (κ_T) for ideal gas.

b) Define thermodynamic equilibrium. 3+2

9. a) Prove that the rms. velocity of a molecule is proportional to the absolute temperature of the gas. 3

b) The temperature of a gas is increased from 27 °C to 327 °C. Show that the rms. velocity of the gas at the final temperature will be $\sqrt{2}$ times that was at the initial temperature. 2

10. a) Mention two properties of radiant heat. 2

b) State and explain Kirchoff's law of radiation. 3