

## INSTRUCTIONS :

1. Attempt ALL the 25 questions. Questions 1-15 (objective questions) carry six marks each and questions 16-25 (subjective questions) carry twenty one marks each.
2. Write the answers to the objective questions ONLY in the *Answer Table for Objective Questions* provided on page 7.
3. The answers obtained in terms of logarithms, irrational numbers and fundamental constants need not be simplified any further.
4. The final answers can be left as a ratio or product of two numbers without further simplification.
5. Mention units wherever applicable.

1. A solid sphere of mass  $m$  and radius  $a$  is rolling with a linear speed  $v$  on a flat surface without slipping. The magnitude of the angular momentum of the sphere with respect to a point along the path of the sphere on the surface is
  - (A)  $\frac{2}{5} m a v$
  - (B)  $\frac{7}{5} m a v$
  - (C)  $m a v$
  - (D)  $\frac{3}{2} m a v$
2. The susceptibility of a diamagnetic material is
  - (A) positive and proportional to temperature
  - (B) negative and inversely proportional to temperature
  - (C) negative and independent of temperature
  - (D) positive and inversely proportional to temperature
3. The molar specific heat of a gas as given from the kinetic theory is  $\frac{5}{2} R$ . If it is not specified whether it is  $C_p$  or  $C_v$ , one could conclude that the molecules of the gas
  - (A) are definitely monatomic
  - (B) are definitely rigid diatomic
  - (C) are definitely non-rigid diatomic
  - (D) can be monatomic or rigid diatomic