



QP – 157

I Semester B.Sc. Examination, March/April 2022
(CBCS) (Repeaters) (2016-17 and Onwards)
PHYSICS – I
Mechanics – I, Heat and Thermodynamics – I

Time : 3 Hours

Max. Marks : 70

Instructions : 1) Answer **any five** questions from **each Part**.
2) **Use of non-programmable scientific calculator are allowed.**

PART – A

Answer **any five** questions. **Each** question carries **eight** marks. **(5×8=40)**

1. a) Derive an expression for the displacement of a particle in a resistive medium. Draw displacement time graph.
b) Define time constant. **(7+1)**
2. Obtain an expression for acceleration and velocity of a body moving along an inclined plane without friction. **8**
3. a) State and prove work-energy theorem.
b) Distinguish between conservative and non-conservative forces with examples. **(4+4)**
4. a) Write any two properties of thermal radiation.
b) Assuming Planck's radiation law, deduce Wien's distribution law and Rayleigh-Jeans law for blackbody radiation. **(2+6)**
5. Obtain an expression for the pressure exerted by a gas based on kinetic theory. **8**
6. Derive the relation for the co-efficient of viscosity of a gas on the basis of kinetic theory of gases. **8**
7. a) What is a cyclic process ?
b) Show that $PV^\gamma = \text{constant}$ for an adiabatic process. **(1+7)**
8. a) What is entropy ?
b) Derive an expression for change in entropy in an reversible process. **(2+6)**

P.T.O.



PART – B

Answer **any five** of the following problems. **Each** problem carries **four** marks. **(5×4=20)**

9. A block slides on ice with a velocity of 5 ms^{-1} and comes to rest after moving through a distance of 13.5 m. Find the co-efficient of friction.
10. Determine the escape velocity of a body from the moon. Take the moon to be a uniform sphere of radius $1.74 \times 10^6 \text{ m}$, mass to be $7.36 \times 10^{19} \text{ kg}$ and $G = 6.67 \times 10^{-11} \text{ Nm}^2\text{kg}^{-2}$.
11. A 5 kg body and 8 kg body are moving along the x-axis. At a particular instant the 5 kg body has a velocity of 3 ms^{-1} and 8 kg body has a velocity of -1 ms^{-1} . Find the velocity of the centre of mass.
12. A uniformly heated enclosure is maintained at 2727°C and has a cavity of diameter 4 mm. Assuming that the cavity behaves like a perfectly blackbody, calculate the energy radiated in 2 minutes from the cavity.
13. Calculate the molecular mean free path of nitrogen molecule, given rms velocity of a molecule of nitrogen is $4.56 \times 10^2 \text{ ms}^{-1}$, density at NTP is 1.26 kgm^{-3} and co-efficient of viscosity being $1.65 \times 10^{-5} \text{ NSm}^{-2}$.
14. Calculate the Vander Waal's constants for dry air, given that $T_c = 132 \text{ K}$, $P_c = 38.5 \times 10^5 \text{ Nm}^{-2}$ and $R = 8.314 \text{ J kg}^{-1} \text{ deg mole}^{-1}$.
15. The efficiency of an engine is found to increase from 0.3 to 0.4 when the temperature of sink is lowered by 50°C . Calculate the temperature of source and sink.
16. Calculate the increase in entropy when 1 kg of ice at 273 K is converted into water at 300 K. Specific heat of ice is $4200 \text{ Jkg}^{-1}\text{K}^{-1}$, latent heat of ice is $335 \times 10^3 \text{ J kg}^{-1}$.



PART - C

17. Answer **any five** of the following. **Each** question carries **two** marks. **(5×2=10)**

- a) "Is it easier to make a body roll over a surface than to slide" ? Explain.
- b) Is there any workdone in moving an object from one point to another on spherical shell ? Justify.
- c) A light body and a heavy body have the same kinetic energy. Which one will have greater momentum ?
- d) Can a body have (a) energy without momentum (b) momentum without energy.
- e) Are thermal radiations electromagnetic in nature ? Explain.
- f) Can an ideal gas be converted into solid or liquid states ? Explain.
- g) If the door of a refrigerator is kept open in a room, will it make the room warm or cool ? Explain.
- h) A reversible adiabatic change is isentropic. Justify.