61501

V Semester B.Sc. Examination, April/May 2023
(CBCS Scheme) (2020 – 21 and Onwards)
PHYSICS (Paper – V)
Statistical Physics, Quantum Mechanics – I, Atmospheric Physics and Nano Materials

Time : 3 Hours Max. Marks : 70

PART – A

Answer **any five** of the following. **Each** question carries **8** marks. **(5×8=40)**

1. a) Deduce an expression for Maxwell-Boltzmann distribution function.
   b) Mention any two limitations of Maxwell-Boltzmann statistics. **(6+2)**

2. a) What are Bosons ? Give an example.
   b) Compare Maxwell-Boltzmann, Bose-Einstein, Fermi-Dirac statistics. **(2+6)**

3. What is meant by Photon gas ? Derive Planck's law of black body radiation from Bose-Einstein distribution law. **8**

4. Describe briefly the failure of classical physics to explain
   i) Atomic spectra
   ii) Black body radiation. **(4+4)**

5. Define the terms phase velocity and group velocity. Derive the relation between them. **8**

6. a) What are fixed and variable gases of earth's atmosphere ? Give one example for each.
   b) Describe the vertical distribution of temperature of earth's atmosphere. **(2+6)**

7. a) Derive Beer's law of absorption of solar radiation by atmosphere.
   b) Write a note on green house effect. **(5+3)**

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8. a) Discuss the classification of nano structures based on their geometrical dimensions.

   b) Mention any four applications of nano materials. **(4+4)**

PART – B

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

9. Calculate the number of ways of arranging 3 particles in 4 cells if the particles are (i) Bosons (ii) Fermions.

10. Calculate the rms velocity and most probable speed of nitrogen molecule at 27°C. Given molecular weight of nitrogen is 28 units.

11. The number of conduction electron per m^3 of aluminium is 1.8×10^{29} and in copper is 8.45×10^{28}. If the Fermi energy of aluminium is 11.6 eV. Calculate the Fermi energy of copper.

12. Calculate the frequency and energy in eV of a photon of wavelength 680 nm. Given $h = 6.625\times10^{-34}$ Js.

13. An electron is moving at a speed of 820 ms^{-1}. Calculate the minimum uncertainty in the determination of its position. Given $m_e = 9.1\times10^{-31}$kg. $h = 6.625\times10^{-34}$ Js.

14. In Davisson Germer experiment electrons accelerated through 54 V showed maximum Bragg's reflection of first order. Calculate the glancing angle if the lattice spacing is 2.15Å.

15. Calculate the pressure gradient force per unit mass between two isobars of pressure 1020 mb and 1005 mb separated by 95 km from each other. Given density of air = 1.2 kgm^{-3}.

16. Calculate the coriolis force at a station situated 30°N having a zonal wind speed of 25ms^{-1}.

PART – C

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

a) Can an electron have zero entropy at 0K ? Explain.

b) Do wave function of identical but distinguishable particles without spin overlap ? Explain.

c) Can electrons reside inside the nucleus ? Explain.

d) Does the wave nature of matter noticed in our daily observations ? Explain.

e) Are de-Broglie waves monochromatic ? Explain.

f) An electron and a proton have same velocity, which one will have greater de-Broglie wavelength ? Explain.

g) Do carbon nano tube have high thermal conductivity ? Explain.

h) 'Fullerenes are stable physically' – Explain.
