



**2021/TDC/CBCS/ODD/
PHSDSC/GE-301T/153**

**TDC (CBCS) Odd Semester Exam., 2021
held in March, 2022**

PHYSICS

(3rd Semester)

Course No. : PHSDSC/GE-301T

(Thermal Physics and Statistical Mechanics)

Full Marks : 50

Pass Marks : 20

Time : 3 hours

*The figures in the margin indicate full marks
for the questions*

SECTION—A

Answer any *fifteen* of the following as directed :

1×15=15

1. State zeroth law of thermodynamics.
2. What is the difference between heat and temperature?
3. State Carnot's theorem.
4. Name the thermodynamic process for which $PV^\gamma = \text{constant}$.



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5. What are various thermodynamic potentials?
6. Define enthalpy.
7. What is a thermodynamic relation?
8. During free expansion, which thermodynamic function remains same?
9. The mean free path of a gas molecule depends on
 - (a) the number of molecules per unit volume
 - (b) the collision cross-section
 - (c) Both (a) and (b)
 - (d) collision frequency(Choose the correct answer)
10. Blood is more viscous than water.
(Write True or False)
11. The viscosity of a fluid in motion is 1 poise. What will be its viscosity when it is at rest?
12. How much is the degrees of freedom of a triatomic gas?

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13. The radiations emitted by hot bodies are called
 - (a) X-rays
 - (b) γ -radiation
 - (c) visible light
 - (d) blackbody radiation(Choose the correct answer)
14. A blackbody is defined as a perfect absorber of radiations. It may or may not be a perfect emitter.
(Write True or False)
15. Name the scientist who first studied spectrum of blackbody radiation.
16. The distribution of energy of blackbody at a given temperature is
 - (a) uniform
 - (b) non-uniform
 - (c) straight line
 - (d) None of the above(Choose the correct answer)
17. Define entropy.



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18. Entropy of an isolated system can never
- (a) increase
 - (b) decrease
 - (c) be zero
 - (d) None of the above
- (Choose the correct answer)
19. Fermi-Dirac statistics can not be applied to photons.
- (Write True or False)
20. If two parts A and B in a system are considered to be in equilibrium and having thermodynamic probabilities W_A and W_B respectively, then what will be the thermodynamic probability of the system?

SECTION—B

Answer any *five* of the following questions : $2 \times 5 = 10$

21. Prove that adiabats are steeper than isotherms using indicator diagram.
22. What is meant by thermodynamic process? How is it represented on an indicator diagram?
23. Briefly explain Joule-Thomson effect.

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(Continued)

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24. Write four Maxwell's equations.
25. On what factors does conduction depend on?
26. Write down the expression of viscous force and from that expression obtain the dimension of coefficient of viscosity.
27. Explain why a blackbody looks black.
28. Discuss Planck's hypothesis.
29. Distinguish between microstate and macrostate.
30. Distinguish between classical and quantum statistics.

SECTION—C

Answer any *five* of the following questions : $5 \times 5 = 25$

31. What is meant by the term internal energy of a system? Is it a state function? What is the difference between state function and path function? Give an example of each. $1+1+3=5$
32. A gas at 10 atm pressure and 1 litre volume expands adiabatically to 2 atm and 3.16 litres volume. Calculate the amount of work done by the gas in joule. (Assume $\gamma = 1.4$)

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(Turn Over)



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33. Prove Maxwell's thermodynamical relation

$$\left(\frac{\partial T}{\partial V}\right)_S = -\left(\frac{\partial P}{\partial S}\right)_V$$

34. Deduce the relation

$$C_P - C_V = \left\{ P + \left(\frac{\partial U}{\partial V}\right)_T \right\} \left(\frac{\partial V}{\partial T}\right)_P$$

where symbols have their usual meanings.

35. Derive Maxwell's velocity distribution formula for gas.

36. Show that $\eta = \frac{1}{3} \rho \bar{c} \lambda$, where η is the viscosity of a gas, ρ is the density, \bar{c} is the mean molecular velocity and λ is the mean free path. What is the name of a fluid which does not have any viscosity? 4+1=5

37. Deduce Planck's radiation formula.

38. Deduce Wein's law and Rayleigh-Jeans law from Planck's formula. Draw the graph showing the comparison of Planck's law, Wein's law and Rayleigh-Jeans law. 2+3=5

39. Deduce Maxwell-Boltzmann distribution law.

40. Distinguish among MB, BE and FD statistics in detail.
