

P. R. Thakur Govt. College

Department of Physics

B.Sc. Semester-III Internal Examination, 2023-24

Paper – **PHSACOR06T**

Thermal Physics

Time: 1 Hour

Full Marks: 20

1. Answer any five questions from the following: 2×5=10

- (a) State the law of equipartition of energies applicable for gas molecules.
- (b) At what temperature will the a RMS speed of a gas be half its value at 0°C ?
- (c) What are the corrections added to the perfect gas equation so as to get Van der Waals' equation for real gas.
- (d) Find the efficiency of a Carnot's engine working between 127°C and 27°C .
- (e) What is meant by 'quasistatic' process? Is a quasistatic process always reversible?
- (f) State briefly the physical significance of entropy.
- (g) Prove that no engine can be more efficient than a reversible engine working between the same limits of temperatures.
- (h) What is meant by 'degrees of freedom' of a dynamical system?

2. Answer any two questions from the following: 5×2=10

- (a) Write down Maxwell's law of distribution of molecular velocities and explain the symbols you use. Draw velocity distribution curves at different temperatures. Starting from speed distribution law of Maxwell, deduce the energy distribution law of molecules of a gas. 2+1+2
- (b) What are critical constants of a gas? Obtain their values in terms of the constants of van der Waals' equation. 2+3
- (c) Represent a Carnot's cycle on a T-S diagram and hence find the efficiency of a Carnot's engine. 1+4
- (d) Show that no engine can be more efficient than a reversible engine working between the same limits of temperatures. Calculate the change in entropy when 10 gram of ice at 0°C is converted into the vapour at 100°C . 3+2

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B.Sc. Semester-III Internal Examination, 2022

Paper – **PHSACOR06T**

Thermal Physics

Time: 1 Hour

Full Marks: 20

1. Answer any five questions from the following:

2×5=10

- (a) State the law of equipartition of energy applicable for gas molecules.
- (b) Give the kinetic interpretation of temperature.
- (c) At what temperature will the *r.m.s* speed of a gas be half its value at 27°C?
- (d) A shower of 10000 molecules, each originally moving with the same velocity, traverse a gas. Calculate the no. of molecules which will be travelling undeflected even after traversing a length twice the mean free path.
- (e) What is the distinction between the 'gas' and the 'vapour' of the same substance?
- (f) Define 'Boyle temperature' ?
- (g) What is meant by 'quasistatic' process? Is a quasistatic process always reversible?
- (h) Show that lowering the sink temperature is more effective in increasing efficiency of Carnot engine than increasing source temperature.

2. Answer any two questions from the following:

5×2=10

- (a) Deduce Maxwell's velocity distribution law. Hence obtain an expression for the energy distribution of the gas molecules. 4+1
- (b) What are critical constants of a gas? Obtain their values in terms of the constants of van der Waals' equation. 2+3
- (c) Obtain an expression for the coefficient of viscosity of a gas. How does the viscosity of a gas vary with temperature and pressure? 3+2
- (d) Briefly state the operation of a Carnot cycle by plotting them in (I) *p*-*V* diagram (b) *T*-*S* diagram. Calculate the efficiency of the cycle. 3+2

P. R. Thakur Govt. College
B.Sc. Honours Semester III First Internal Examination, 2019
Thermal Physics
Paper - Core-T6

Time: 1 Hour

Full Marks: 20

1. Answer any ten questions:

$2 \times 10 = 20$

- (a) Deduce the expression for most probable speed for gas molecules from the Maxwell's speed distribution.
- (b) Using the law of equipartition of energy find the total energy of 1 mol of gas molecules at temperature T.
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- (c) Find the R.M.S. speed of five molecules having velocities $v, 2v, 3v, 4v, 5v$.
- (d) The temperature of an ideal gas is increased from 27°C to 927°C . Compute the ratio of final to initial rms velocity of a molecule.
- (e) State zeroth law of thermodynamics.
- (f) What are the information do you obtain from the first law of thermodynamics?
- (g) Calculate the work done of a perfect ideal gas in reversible isothermal process.
- (h) Give examples of extensive and intensive variables. What are their characteristics?
- (i) Give Kelvin-Planck statement of second law of thermodynamics. Starting from it can one reach another statement of second law?
- (j) Mention two inexact differentials in thermodynamics and explain their inexactness.
- (k) In the above question can you make any of them exact by integrating factor. What is the name of that exact variable?
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- (l) Mention about the perpetual motion of second kind and comment about it.
- (m) What are results obtain from Carnot's engine?
- (n) What is $T - S$ diagram and what are its advantages over other diagrams?