

April-2016

Seat Number

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किनार - 006

**PHYSICS PAPER - I : PHY-121**  
**Heat and Thermodynamics**  
**(112201)**

P. Pages : 4

Time : Two Hours

Max. Marks : 60

Instructions to Candidates :

1. Do not write anything on question paper except Seat No.
2. Graph or diagram should be drawn with the black ink pen being used for writing paper or black HB pencil.
3. Students should note, no supplement will be provided.
4. All questions are compulsory and carry equal marks.
5. Figures to the right indicating full marks.
6. Draw neat and labelled diagram wherever necessary.
7. Use logarithmic table or standard electronic calculator is allowed.

1. a) Attempt any six of the following select correct option and rewrite the following.

6

i) A change in the state of gas during which the pressure of the gas remains constant is called----- change.

- |              |               |
|--------------|---------------|
| a) adiabatic | b) isothermal |
| c) isobaric  | d) isochoric  |

ii) ----- is Van der Waals equation of state for real gas.

- |   |   |
|---|---|
| a) $P = \frac{RT}{(v-b)} - \frac{a}{v^2}$ | b) $PV=RT$                                |
| c) $V_c=3b$                               | d) $P = \frac{RT}{(v-b)} + \frac{a}{v^2}$ |

iii) A change in the state of gas during which the temperature of the gas remains constant is called ----- change.

- |              |               |
|--------------|---------------|
| a) adiabatic | b) isothermal |
| c) isobaric  | d) isochoric  |

iv) The working substance in Otto engine is-----

- |                          |           |
|--------------------------|-----------|
| a) petrol vapour and air | b) petrol |
| c) oil and air           | d) oil    |

- v) Unit of refrigeration is -----  
 a) Horse power                      b) Ton of refrigeration.  
 c) Kilogram of refrigeration      d) kilowatt
- vi) The energy stored in a substance or system is known as its ----- energy.  
 a) Internal                              b) potential  
 c) kinetic                                d) pressure.
- vii) In case of solids which contract when they melt, in such cases the melting point ----- with increase in pressure.  
 a) does not change                      b) increases  
 c) decreases                              d) remains constant.
- viii) The relation between Boyle temperature and critical temperature is -----  
 a)  $T_B = \frac{9}{7} T_C$                               b)  $T_B = 21.4 T_C$   
 c)  $T_B = \frac{27}{8} T_C$                               d)  $T_B = 3.14 T_C$

b) Attempt any six of the following.

6

- i) What is Boyle temperature?
- ii) Define critical point.
- iii) What do you understand a term 'System'?
- iv) State third law of thermodynamics.
- v) What is thermal equilibrium of a system?
- vi) State Clausius' statement of second law of thermodynamics.
- vii) Define reversible process.
- viii) Define coefficient of performance of a refrigerator.

2. Attempt any six of the following.

12

- i) State any two defects of Van der Waals equation.
- ii) Define refrigerator.
- iii) Explain the variation of boiling point with pressure.

- iv) State the Carnot's theorem.
- v) Give any two examples of an irreversible process.
- vi) What is refrigerant?
- vii) State zeroth law of thermodynamics.
- viii) What do you understand by critical isothermal?
- ix) State the names of any two refrigerants which are used in vapour compression refrigeration system.

3. Attempt **any four** of the following.

12

- i) Find the critical temperature for helium from the following data:  
 $R = 8.31 \times 10^3 \text{ J/kmole}^\circ\text{K}$ ,  
 $a = 3.44 \times 10^3 \text{ Nm}^4/\text{kmole}$ ,  
 $b = 0.0234 \text{ m}^3/\text{kmole}$
- ii) Derive an expression for work done in an isothermal expansion of a gas.
- iii) A perfect gas at  $27^\circ\text{C}$  is suddenly compressed to 8 times its original pressure. Find its rise in temperature, if  $\gamma = 1.5$ .
- iv) Distinguish between the Diesel engine and Otto engine.
- v) Enlist the applications of refrigeration.
- vi) State and explain the uses of evaporation refrigeration method.

4. Attempt **any three** of the following.

12

- i) The temperature of one mole of a perfect gas undergoing an adiabatic expansion falls from  $27^\circ\text{C}$  to  $-73^\circ\text{C}$ . Calculate the work done by the gas ( $R = 8.3 \text{ J/mole}^\circ\text{K}$ ).
- ii) Obtain expression for the critical constants of a gas in terms of Van der Waals constants.
- iii) Derive second latent heat equation.

- iv) With a neat flow diagram explain the working of vapour compression refrigerator system.
- v) Draw an indicator diagram of an Otto cycle and explain the different strokes.

5. Attempt **any two** of the following.

12

- i) Explain the working of Carnot's heat engine. Draw an indicator diagram to represent the different operations in the Carnot's engine. Calculate the work performed during the cycle of operation and hence obtain an expression for the efficiency of Carnot's engine.
- ii) Describe the Diesel cycle on P-V diagram and hence obtain an expression for its efficiency.
- iii) Describe Andrews experiments on  $\text{CO}_2$ . With the help of graph, discuss the conclusions of Andrews experiments on  $\text{CO}_2$ .

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