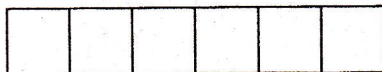कानन - 010

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PHYSICS PAPER - I : PHY - 121
Heat and Thermodynamics
(12125)

P. Pages : 3

Time : Two Hours

Max. Marks : 40

Instructions to Candidates :
1. Do not write anything on question paper except Seat No.
2. Answer sheet should be written with blue ink only. Graph or diagram should be drawn with the same 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 indicates full marks.
6. Draw neat diagrams whenever necessary.
7. Use of logarithmic table or standard electronic calculator is allowed.
8. Symbols have their usual meanings.

1. Attempt **any eight** of the following select correct option.   8

    i) Isothermal change for perfect gas takes place at ------------
        a) Constant pressure   b) Constant volume
        c) Constant temperature   d) None of the above

    ii) The point on the critical isothermal at which the substance passes from gaseous to the liquid state is called ------------
        a) Critical point   b) Melting point
        c) Boiling point   d) None of the above

    iii) A system which neither exchange energy nor matter with its surroundings is known as ------------
        a) Open system   b) Isolated system
        c) Closed system   d) None of the above

    iv) Relation between gas constant (R) van der Waal's constants (a and b) and critical temperature (Tc) is ------------
        a) $T_C = \dfrac{8b}{27Ra}$ b) $T_C = \dfrac{27b}{8Ra}$

        c) $T_C = \dfrac{8a}{9Rb}$ d) $T_C = \dfrac{8a}{27Rb}$

v) In diesel engine heat is absorbed by the working substance at ------------
   a) Constant volume
   b) Constant pressure
   c) Constant temperature
   d) None of the above

vi) Entropy of the system remains constant when it undergoes-----
   a) Reversible change
   b) Irreversible change
   c) Isothermal change
   d) Both a & b

vii) Diesel engine and otto engine both are ------------ engine.
   a) External combustion
   b) Internal combustion
   c) Both a and b
   d) None of the above

viii) In otto engine ----------- vapour is used as a fuel.
   a) Heavy oil
   b) Ethanol
   c) Both a and b
   d) Petrol

ix) The most efficient refrigerator has highest value of it's ----------
   a) Co-efficient of temperature
   b) Coefficient of performance
   c) Coefficient of pressure
   d) None of the above

x) A unit used in the field of refrigeration is ------------
   a) Horse power
   b) Kilowatt
   c) Ton of refrigeration
   d) Megawatt

2. Attempt **any four** of the following.   8

   a) What is law of corresponding states ?

   b) What is Indicator diagram ?

   c) Write First and Second latent heat equations.

   d) Calculate the efficiency of Carnot's engine operating between 170°C and 30°C.

   e) Draw flow diagram of a vapour compression refrigeration system.

   f) Define the term mechanical Equilibrium of the system.

3. Attempt **any two** of the following.   8

   a) Derive an expression for work done by a gas during an isothermal change.

   b) Explain C. O. P. of refrigerator.

c) Calculate the efficiency of an otto engine in which the working substance is adiabatically compressed to one-sixth of it's initial volume in each cycle. Assume the engine to operate on the otto cycle ($\gamma = 1.4$)

4. a) Attempt **any two** of the following. 6

    i) Derive the reduced equation of state.

    ii) Explain indicator diagram.

    iii) Distinguish between otto engine and Diesel engine.

  b) State any four applications of refrigerator. 2

5. Attempt **any one** of the following. 8

  a) Explain diesel cycle in detail.

  b) i) Show that $T_B = \left(\dfrac{27}{8}\right) T_C$ where the symbols have their usual meanings.

    ii) Calculate the critical pressure for nitrogen, van der Waal's constants for nitrogen are $a = 2.72 \times 10^{-3}$, $b = 1.73 \times 10^{-3}$ where the pressure is expressed in atmosphere.

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