S.NO: 341 BATCH: 2017 REG. NO.:

END OF SEMESTER EXAMINATIONS, NOVEMBER - 2018
HEAT AND THERMODYNAMICS
SUBJECT CODE: 17UAPH02

MAJOR: B.SC (PHYSICS) **SEMESTER : II**
TIME : 3 HOURS **MAX. MARKS: 75**

SECTION – A (10 X 1 = 10)

Answer All the questions:

1. In producing cooling by adiabatic demagnetisation, we use
   a) Magnetic substance b) Paramagnetic substance
   c) Diamagnetic substance d) Ferromagnetic substance
2. *Zeroth* law of thermodynamics is
   a) Kinetic energy of molecules of a gas is zero
   b) ideal gas does not contain molecules
   c) if two systems are separated in thermal equilibrium with a third system then they themselves are in thermal equilibrium with each other.
   d) absolute zero temperature cannot be attained
3. An engine works between the temperatures 30k and 300k. What is its efficiency?
   a) 50% b) 47% c) 90% d)10%
4. The efficiency of Carnot's engine working between 127°C and 27°C is.
   a) 25% b) 50% c) 75% d) 100%
5. The change in entropy of a mole of an ideal gas,when the gas undergoes free expansion is
   a) positive b) zero c) negative d) one
6. Maxwell's thermodynamic relation is
   a) $\left(\frac{\partial S}{\partial T}\right)_T = \left(\frac{\partial P}{\partial V}\right)_T$ b) $\left(\frac{\partial T}{\partial V}\right)_S = -\left(\frac{\partial P}{\partial S}\right)_V$ c) $\left(\frac{\partial T}{\partial P}\right)_P = \left(\frac{\partial V}{\partial P}\right)_P$ d) None of the above
7. The last gas to be liquefied was
   a) Oxygen b) Hydrogen c) Nitrogen d) Helium
8. Thermal conductivity of bad conductors is measured by
   a) Searle's method b) Lee's disc method
   c) Callendar and Barne's method d) None of the above
9. A perfectly black body is that which
   a) is totally black in colour b) can radiate all its energy
   c) is made of ideal gas d) absorbs all the radiations incident on it
10. For a perfectly black body, the absorptive power is
    a) 1 b) 0.5 c) 0 d) ∞

SECTION – B (5 X 4 = 20)

Answer All the questions:

11. a) Briefly explain (i) Cyclic Process; (ii) Isothermal Process.

    (OR)

    b) Briefly explain (i) Constants of Vander Waals' equation.
    (ii) Limitations of Vander Waals' equation.

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12. a) State and Prove Carnot's Theorem.

(OR)

b) A Carnot's refrigerator takes heat from water at 0°C and discards it to a room temperature at 27°C. 1Kg of water at 0°C is to be changed into ice at 0°C. How many calories of heat are discarded to the room? What is the work done by the refrigerator in this process? What is the coefficient of performance of the machine? (1 cal=4.2joule)

13. a) Prove the principle of increase of Entropy.

(OR)

b) Establish the relation for efficiency of a Carnot's engine using T-S diagram as $\eta = \frac{T_1 - T_2}{T_1}$.

14. a) Briefly explain the Helium vapour pressure thermometer with a neat sketch.

(OR)

b) A bar of length 30cm and uniform area of cross-section 5 cm^2 consists of two halves AB of copper and BC of iron welded together at B. The end A is maintained at 200°C and the end C at 0°C . The sides of the bar are thermally insulated. Find the rate of flow of heat along the bar when the steady state is reached. Thermal conductivity of copper is 0.9 and Iron is 0.12 CGS units.

15. a) State and Prove Kirchhoff's law. Mention its applications.

(OR)

b) Define solar constant. How do you find the temperature of the sun.

SECTION – C (5 X 9 = 45)

Answer All the questions:

16. a) Derive the adiabatic equation of a perfect gas.

(OR)

b) Derive van der Waals' equation of state.

17. a) Define Joule-Thomson effect. Explain the theory of porous plug experiment.

(OR)

b) Describe a Diesel engine. Derive its efficiency.

18. a) Derive an expression for entropy of a perfect gas.

(OR)

b) Deduce Maxwell's four thermodynamical relations.

19. a) Describe Onne's method of liquefying Helium. Mention the peculiar properties of Helium II.

(OR)

b) Discuss Lee's disc method for finding the coefficient of thermal conductivity for bad conductor. Can this method be used for good conductor?

20. a) Derive Stefan's law and describe its experimental verification.

(OR)

b) Describe the Lummer and Pringsheim experiment of distribution of energy in thermal spectrum of a black body.

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