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Reg. No. : .....

Name : .....

Second Semester B.Sc. Degree Examination, May 2020

First Degree Programme Under CBCSS

Physics

Core Course

PY 1241 : HEAT AND THERMODYNAMICS

(2018 Admission Onwards)

Time : 3 Hours Max. Marks : 80

SECTION – A

Answer **all** questions; each carries **1** mark.

1. Give the differential form of first law of thermodynamics.
2. Give one example each for isothermal and adiabatic process.
3. What is a quasistatic process?
4. State Clausius statement of second law of thermodynamics.
5. Write Clausius - Clapeyron equation and explain the symbols.
6. State Stefan's law.
7. Represent Carnot cycle on a TS diagram.
8. What is meant by Clausius theorem?
9. How is entropy related to available energy?
10. Give two examples for a second order phase – transition.

(10 × 1 = 10 Marks)

P.T.O.

SECTION – B

Answer any **eight; each** carries **2** marks.

11. Obtain the relation for the work done in an adiabatic process.
12. What is a reversible process? What are the conditions to be satisfied for a process to be reversible?
13. State and explain Carnot's theorem.
14. Draw labelled diagram for the Diesel cycle.
15. Explain the third law of thermodynamics.
16. Give two applications of heat conduction in daily life.
17. Derive Mayer's relation from first law of thermodynamics.
18. Show that entropy remains constant in a reversible process.
19. Define thermal conductivity. Obtain its unit.
20. Explain the effect of pressure on the boiling point of a liquid.
21. What are the conditions for a system to be in thermodynamic equilibrium?
22. What are the advantages of a diesel engine?

(8 × 2 = 16 Marks)

SECTION – C

Answer any **six; each** carries **4** marks.

23. A Carnot engine working between two temperatures has efficiency 0.2. When the temperature of the source is increased by 25°C, the efficiency increases to 0.25. Find the temperature of the source and sink.
24. A motor tyre has a pressure of 2 atmospheres at the room temperature of 27°C. If the tyre suddenly bursts, find the resulting temperature. ($\gamma = 1.4$)
25. Calculate the amount of work done in adiabatically compressing one mole of a perfect gas at normal pressure to 1/3 of its volume. The molecular specific heat of the gas at constant volume is 3/2 R.

26. 2 mole of a gas at 27°C expands isothermally until its volume is doubled. Calculate the work done.

27. 1 Kg of water at 0°C is heated to 100°C. Compute the change in entropy (Specific heat capacity of water = 4200 $JKg^{-1}K^{-1}$)

28. Calculate the change in entropy when 5 Kg of water at 100°C is converted to steam at the same temperature. L = 2.268×10^6 JKg^{-1}.

29. Calculate the depression in the melting point of ice produced by 1 atmosphere increase of pressure. Given latent heat of ice 3.36×10^5 JKg^{-1} and specific volume of 1 gm of ice and water at 0°C are 1.091 cm^3 and 1 cm^3 respectively.

30. The temperature of a perfect black body is 700 K and area of its radiating surface is $2 \times 10^3 m^2$. Find the energy radiated in 30 minutes. ($\sigma = 5.7 \times 10^{-8}$ Wm^{-2}/K^{-4})

31. Calculate the surface temperature of the sun from the following data. Radius of the sun = 6.96×10^5 Km., Mean distance of the sun and earth = 1.497×10^8 Km. Solar constant = 1400 $Jm^{-2}s^{-1}$, Stefan's constant = 5.7×10^{-8} $Wn^{-2}K^{-4}$.

(6 × 4 = 24 Marks)

SECTION – D

Answer any **two; each** question **15** marks.

32. Describe the working of an Otto engine. Derive an expression for its efficiency.

33. Explain first law of thermodynamics. Prove that (a) PV^{γ} = constant (b) $TV^{\gamma-1}$ = constant in an adiabatic process.

34. Define entropy. What is its physical significance? Calculate the total change in entropy when 1 Kg of ice at 0°C is converted into steam at 100°C.

35. With the help of a diagram, explain the determination of the thermal conductivity of a poor conductor by Lee's disc method.

(2 × 15 = 30 Marks)