(Pages : 3) M – 2351

Reg. No. : .....

Name : .....

Second Semester B.Sc. Degree Examination, December 2021

First Degree Programme Under CBCSS

Physics

Core Course

PY 1241 — HEAT AND THERMODYNAMICS

(2018 & 2019 Admission)

Time : 3 Hours Max. Marks : 80

SECTION – A

Answer in a word or a sentence. Answer **all** questions. **Each** question carries **1** mark.

1. Give an example each for isothermal and adiabatic change.
2. State Clausius statement of second law of thermodynamics.
3. Give the relation between entropy and disorder.
4. Represent Carnot Cycle in a TS diagram.
5. Give the differential form of first law of thermodynamics.
6. Write Clausius – Clapeyron's equation.
7. What is Clausius inequality?
8. What is an isochoric process?
9. What is an indicator diagram?
10. State Wiedeman-Franz law.

(10 × 1 = 10 Marks)

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SECTION – B

Answer in **two** or **three** sentences. Answer **any eight**. **Each** question carries **2** marks.

11. Explain the effect of pressure on the melting point of a substance.

12. Obtain the relation for the work done in an isothermal process.

13. Explain the third law of thermodynamics.

14. Draw the labeled indicator diagram for the Otto cycle.

15. State and explain Stefan's law.

16. Discuss about the latent heat on the basis of first law of thermodynamics.

17. How entropy is related to available energy?

18. Give four practical applications of heat conductors in daily life.

19. Define thermal conductivity. Obtain its unit.

20. Give the principle of refrigerator.

21. Compare Otto engine and diesel engine in terms of efficiency.

22. What are the characteristics of second order phase transition?

(8 × 2 = 16 Marks)

SECTION – C

Problem - Write **all** relevant formulae all important steps carry separate marks. Answer **any six** questions. **Each** question carries **4** marks.

23. Air at N.T.P is compressed adiabatically to half its volume. Calculate the change in its temperature.

24. A company claims to have developed an engine working between 227°C and 15°C having an efficiency of 45%. Comment on this claim.

25. A Carnot engine whose low temperature is 7°C has an efficiency of 50%. It is desired to increase the efficiency to 60%. By how much should the temperature of the source be increased?

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26. Find the increase in the boiling point of water at 100°C when the pressure is increased by 1 atmosphere. Latent heat of vaporization of steam is 2255×10^3 J/kg and specific volume of steam is 1677×10^{-6} m^3.

27. Calculate the change in entropy when 80 grams of water at 20°C is mixed with 120 grams of water at 50°C. Specific heat capacity of water is equal to 4180 $J/kg^{-1}C^1$.

28. One grain molecule of a gas expands isothermally to 6 times its volume. Calculate the change in entropy in terms of the gas constant.

29. Show that the slope of the adiabatic is γ times the slope of the isothermal.

30. 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} $Wm^{-2}K^{-4}$

31. One mole of a gas at 37°C expands adiabatically until its volume doubled. Calculate the work done $(\gamma = 1.4)$.

(6 × 4 = 24 Marks)

SECTION – D

Answer **any two** questions. **Essay - Each** question carries **15** marks.

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

33. Describe an experiment to determine the thermal conductivity of a poor conductor by Lees disc method.

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. Explain first law of thermodynamics. Prove that PV^γ = *constant*, in an adiabatic process.

(2 × 15 = 30 Marks)

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