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G – 2471

Reg. No. :

Name :

Second Semester B.Sc. Degree Examination, May 2019

First Degree Programme under CBCSS

Physics

Core Course

PY 1241 : HEAT AND THERMODYNAMICS

(2018 Admission)

Time : 3 Hours

Max. Marks : 80

SECTION – A

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

1. State Wiedemann-Franz law.
2. Define coefficient of thermal conductivity.
3. State Kelvin's statement of second law of thermodynamics.
4. What are the essential parts of a Carnot engine?
5. Why white clothes are preferred in summer?
6. Define solar constant.
7. State Zeroth law of thermodynamics.
8. Give the principle of pressure cooker.
9. State two demerits of diesel engine.
10. What is a PV diagram?

(10 × 1 = 10 Marks)

P.T.O.

SECTION – B

Answer any **eight** questions in **2** or **3** sentences. Each question carries **2** marks.

11. Distinguish between isothermal and adiabatic processes.
12. Explain the effect of pressure on the boiling point of a liquid.
13. Distinguish between first order and second order phase transitions.
14. Obtain the relation for the work done in an adiabatic process.
15. Explain how temperature of the Sun can be calculated from solar constant.
16. Show that entropy remains constant in a reversible process.
17. Draw the indicator diagram for the diesel cycle.
18. Discuss the theory of radial flow of heat.
19. Give the principle of refrigerator.
20. How entropy is related to available energy?
21. Draw the experimental setup for determining Stefan's constant.
22. What are the conditions for a system to be in thermodynamic equilibrium?

(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. A quantity of dry air at 27°C and 1 atmosphere pressure is suddenly compressed to half of its original volume. Find the final :
 - (a) pressure and
 - (b) temperature. ($\gamma = 1.4$).

24. One mole of a gas at 87°C expands isothermally until its volume is doubled. Calculate the work done. $R = 8.3 \text{ J}\cdot\text{mol}^{-1}\text{K}^{-1}$.
25. A Carnot's engine whose low temperature reservoir is at 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?
26. One grain molecule of a gas expands isothermally to six times its volume. Calculate the change in entropy in terms of the gas constant.
27. Calculate the depression in the melting point of ice produced by one atmosphere increase of pressure. Given latent heat of ice = $3.36 \times 10^5 \text{ J/kg}$ and specific volume of 1 gram of ice and water at 0°C are 1.091 cm^3 and 1.00 cm^3 respectively.
28. Calculate the change in entropy when 5 kg of water at 100°C is converted into steam at the temperature. Latent heat of steam = $2268 \times 10^3 \text{ J/kg}$.
29. One kilogram of water at 40 degree Celsius is mixed with 2 kilogram of water at 80 degree Celsius. Calculate the change in entropy of the system. Specific heat capacity of water is equal to $4180 \text{ J kg}^{-1} \text{ K}^{-1}$.
30. The temperature of a perfectly blackbody is 600 K and area of its radiating surface is $2 \times 10^{-3} \text{ m}^2$. Find the energy radiated in 10 minutes. ($\sigma = 5.7 \times 10^{-8} \text{ Wm}^{-2}\text{K}^{-4}$).
31. A cubical ice box of side 50 cm has a thickness of 5 cm. If 5 kg of ice is put in the box, estimate the amount of ice remaining after 5 hours. Outside temperature is equal to 50°C . The thermal conductivity of the material of the box is equal to $0.01 \text{ Wm}^{-1}\text{K}^{-1}$ Latent heat of fusion of ice, $L = 335 \times 10^3 \text{ J/kg}$.

(6 × 4 = 24 Marks)

SECTION – D

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

32. Explain first law of thermodynamics. Obtain the relation $C_p - C_v = R$, for specific heats of an ideal gas.
33. Describe the working of an Otto engine. Derive an expression for its efficiency.
34. Describe an experiment to determine the thermal conductivity of a poor conductor by Lee's disc method.
35. Define entropy. What is its physical significance? What is T-S diagram? Draw the T-S diagram of reversible Carnot's cycle and derive an expression for the efficiency of a Carnot engine.

(2 × 15 = 30 Marks)
