(Pages : 3) Name..............................

Reg. No..............................

SIXTH SEMESTER B.Sc. DEGREE EXAMINATION, MARCH 2019

(CUCBCSS)

Physics/Applied Physics

PHY 6B 10/APY 6B 11—THERMAL AND STATISTICAL PHYSICS

Time : Three Hours Maximum : 80 Marks

Section A

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

1. What do you mean by quasi static process ?

2. ———— diagram is also known as indicator diagram.

3. The rate of fall of temperature with distance is called ————.

4. In an isothermal process, heat absorbed by a system, $\Delta Q =$ ————.

5. The efficiency of petrol engine is greater than that of diesel engine. (True or False).

6. A sphere, a cube and a thin circular plate, all made of the same material and having the same mass are initially heated to a temperature of 3000°C. Which of these will cool fastest ?

7. Write down the Clausius -Clapeyron equation.

8. Write down the BE distribution function.

9. Give the Kelvin Plank statement for the second law of thermodynamics.

10. What is Nernst theorem ?

(10 × 1 = 10 marks)

Section B

Answer in a short paragraph three or four sentences.
Answer all questions.
Each question carries 2 marks.

11. Explain isothermal process.

12. What is phase space ?

13. Derive an expression for the efficiency of a Carnot's engine using TS diagram.

Turn over

14. State and explain the zeroth law of thermodynamics.

15. Draw Otto cycle and explain the various strokes.

16. Distinguish between microcanonical and grand canonical ensembles.

17. Explain the conditions under which BE statistics holds good.

$(7 \times 2 = 14$ marks)

Section C

Answer in a paragraph of about **half a page to one page.**
Answer any **five** *questions.*
Each question carries 4 marks.

18. State the first law of thermodynamics. Give its physical significance. What are the limitations of first law ?

19. What is entropy ? Show that entropy remains constant in a reversible process, but increases in an irreversible process.

20. State and explain Nernst's heat theorem.

21. Deduce the second latent heat equation of Clausius $C_2 - C_1 = (dL/dT) - (L/T)$ where C_1 and C_2 represent the specific heat of a liquid and its saturated vapour and L is the latent heat of the vapour.

22. Show that for a perfect gas $(\partial U/\partial V)_T = 0$.

23. What do you mean by breakdown of equipartition theorem ? When does it occur ?

24. Compare the MB, FD and BE statistics.

$(5 \times 4 = 20$ marks)

Section D

Problems- write all relevant formulas.
All important steps carry separate marks.
Answer any **four** *questions.*
Each question carries 4 marks.

25. Show that adiabatic curve is steeper than isothermal curve.

26. A motor car tyre has a pressure of 2 atmospheres at the room temperature of 27°C. If the tyre suddenly bursts find the resulting temperature.

27. Find the efficiency of a Carnot's engine working between the steam point and the ice point.

28. Calculate the increase in entropy of 10 kg of water at 100°C when it changes to vapour.

29. Calculate the specific heat of saturated steam at 100°C from the following data. L at 90°C = 545.25cal L at 100°C = 539.30cal L at 110°C = 533.17cal. Specific heat of water at 100°C = 1.013 cal/g.

*30. Consider 100 molecules and 10 cells of equal energy. Find $\log \Omega$ for (i) the most probable distribution ; (ii) the least probable distribution.

31. Calculate the root mean square speed of a molecule of hydrogen at N.T.P. The Boltzmann's constant is 1.38×10^{-16} erg per degree and Avogadro's number is 6×10^{23} g/mol.

$(4 \times 4 = 16 \text{ marks})$

Section E (Essays)

Answer in about **two pages.**
Answer any **two** *questions.*
Each question carries 10 *marks.*

32. (a) What is an adiabatic process ?

(b) Derive an expression for the work done in an adiabatic process.

33. Derive Maxwell's four thermodynamic relations. Discuss the usefulness of these relations.

34. Describe with necessary theory the construction and working of a diesel engine. Explain its merits over Otto engine.

35. State and prove the theorem of equipartition of energy. Give the merits of this theorem.

$(2 \times 10 = 20 \text{ marks})$