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# SIXTH SEMESTER B.Sc. DEGREE EXAMINATION, MARCH/APRIL 2015

(U G–CCSS)

Core Course—Physics

## PH 6B 16—THERMAL AND STATISTICAL PHYSICS

Time : Three Hours Maximum : 30 Weightage

### Section I

*Answer* **all** *questions.*

*Each question carries ¼ weightage.*

1. For water below 4°C an increase of pressure will be accompanied by :
   (a) Heating. (b) Cooling.
   (c) Heating first and then cooling. (d) None of the above.
2. An ideal gas is isothermally expanded. Its internal energy will :
   (a) Increase. (b) Decrease.
   (c) Increases and then decreases. (d) Remains the same.
3. The slope of PV and V for an isobaric process will be :
   (a) – 1. (b) Zero.
   (c) + 1. (d) nRT.
4. The law of equipartition of energy was postulated by :
   (a) Maxwell. (b) Planck.
   (c) Boltzmann. (d) Einstein.
5. The total change in entropy of the working substance during a complete reversible process is :
   (a) 1. (b) Infinity.
   (c) Zero. (d) 1.4.
6. The work done in an isothermal expansion is given by :
   (a) $W = \frac{1}{R} \cdot \theta \log_e \left(\frac{u_2}{u_1}\right)$ (b) $W = R\theta \log_e \left(\frac{u_2}{u_1}\right)$.
   (c) $\frac{1}{R\theta} \log_e \left(\frac{u_1}{u_2}\right)$. (d) $W = R\theta r^{-1} \log_e \left(\frac{u_1}{u_2}\right)$.

Turn over

7. A refrigerator is :

   (a) Heat engine. (b) Melting of ice.

   (c) An electric motor. (d) Heat engine working backward.

8. The efficiency of a Carnot engine working between steam point and ice point is :

   (a) 16.8%. (b) 26.81%.

   (c) 36.8%. (d) 100%.

9. When an ideal diatomic gas is heated at constant pressure, the fraction of the heat energy su that increases the internal energy of the gas is :

   (a) $\frac{2}{5}$. (b) $\frac{3}{5}$.

   (c) $\frac{3}{7}$. (d) $\frac{5}{7}$.

10. A frictionless heat engine can be 100% efficient only if its exhaust temperature is :

    (a) 0°C. (b) 0°K.

    (c) Equal to its input temperature. (d) Equal to half its input temperature.

11. If two or more events are mutually independent of each other then the probability of all happening simultaneously is the :

    (a) Sum of individual events. (b) Product of individual events.

    (c) Difference of individual events. (d) None of the above.

12. Fermions have :

    (a) Odd half integral spin. (b) Even half integral spin.

    (c) Full integral spin. (d) Zero spin.

(12 × ¼ = 3 weig

## Section II

*Answer* **all** *questions.*

*Each question carries* 1 *weightage.*

13. Define Temperature.

14. What is a quasistatic process ?

15. How does temperature fall with height ?

16. Give *two* conditions for obtaining maximum amount of work.

17. *Are spontaneous process reversible ? Justify your answer.*

18. What is free energy ?

19. Define atomicity of a gas. On what factor does it depend ?

20. What is thermodynamic probability ?

21. What do you understand by phase space ?

(9 × 1 = 9 weightage)

## Section III

*Answer any* **five** *questions.*
*Each question carries* 2 *weightage.*

22. An automobile car tyre has a pressure of two atmospheres at the temperature of 27°C. Find the resulting temperature if the tyre suddenly bursts.

23. Can an engine working between temperatures 600 K and 300 K be developed to have an efficiency of 56% ?

24. Calculate the change in entropy when 5 kg of water at 100°C is converted into steam at the same temperature.

25. Distinguish between internal and external latent heats.

26. Do electrons have zero energy at OK ? If not why ? Explain.

27. State and explain Wien's displacement law.

28. Two six faced dice each marked 1 to 6 are thrown. Calculate the probability that one of the dice shows 6 and the other shows 5.

(5 × 2 = 10 weightage)

## Section IV

*Answer any* **two** *questions.*
*Each question carries* 4 *weightage.*

29. Define Entropy. What is its physical significance ? Show that the entropy of a perfect gas remains constant in a reversible process but increases in an irreversible process.

30. Calculate the work done in a Carnot's cycle of operations. Deduce the efficiency of a Carnot's engine in terms of the temperature between which it works.

31. Give the important characteristics of the Maxwell-Boltzmann, Bose Einstein and Fermi dirac statistics. What are the merits and demerits of the three statistics ?

(2 × 4 = 8 weightage)