D 9517 (Pages 4) Name.....

Reg. No.....

# FIRST SEMESTER B.Sc. DEGREE EXAMINATION, NOVEMBER 2010

(CCSS)

Physics—Complementary Course

PH1 CO1—PROPERTIES OF MATTER AND THERMODYNAMICS

Time : Three Hours Maximum : 30 Weightage

## Section A

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

1. The Young's modulus of a perfectly plastic material is :

   (a) Zero. (b) Infinite.

   (c) One. (d) None of these.

2. The length L of a metallic wire of Young's modulus Y increases by $l$ on loading it. The potential energy stored in the wire per unit volume :

   (a) $\frac{1}{2}y\frac{l}{L}$. (b) $\frac{1}{2}y\frac{l^2}{L^2}$.

   (c) $\frac{1}{2}y\frac{l^2}{L}$. (d) $\frac{1}{2}y\frac{l}{L^2}$.

3. The coefficient of linear expansion and Young's modulus of copper are respectively 1.5 times and 0.5 times that of iron. The ratio of the forces developed in identical copper and iron bars when held fixed and heated through the same range of temperature is :

   (a) $\frac{3}{4}$. (b) $\frac{4}{3}$.

   (c) $\frac{1}{9}$. (d) 9.

4. The surface tension of a liquid :

   (a) increases with area. (b) decreases with area.

   (c) increases with temperature. (d) decreases with temperature.

Turn over

5. The terminal velocity '$v$' of a small sphere of radius '$r$' falling through a viscous medium varies with '$r$' such that :

   (a) $\frac{v}{r}$ is a constant. (b) $vr$ is a constant.

   (c) $vr^2$ is a constant. (d) $\frac{v}{r^2}$ is a constant.

6. In a cyclic process :

   (a) work done is zero.

   (b) work done by the system is equal to the heat given to the system.

   (c) work done does not depend upon the quantity of heat given to the system.

   (d) none of these.

7. Which of the following statement is true for a thermodynamic system?

   (a) $\Delta u = -w$ for an isothermal process.

   (b) $\Delta u = w$ for an isothermal process.

   (c) $\Delta u = -w$ for an adiabatic process.

   (d) $\Delta u = w$ for an adiabatic process.

8. For an adiabatic change, the pressure and temperature of a mono atomic gas are related as $P \propto T^C$. Then C is :

   (a) 5/2. (b) 5/3.

   (c) 3/5. (d) 2/5.

9. The efficiency of a Carnots heat engine working between 400 K and 300 K is :

   (a) 100%. (b) 75%.

   (c) 33.3%. (d) 25%.

10. The door of a running refrigerator inside a room is left open. Which of the statements is true :

   (a) The room gets cooled.

   (b) The room gets warmed up.

   (c) The room neither gets cooled or warmed.

   (d) None of these.

11. The efficiency of a Carnots engine is 100% when the temperature of the sink is :

   (a) 0°C. (b) 273°C.

   (c) – 273°C. (d) None of these.

12. The excess of pressure inside a soap bubble of surface tension T is ————.

(12 × ¼ = 3 weightage)

## Section B

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

13. Which is more elastic steeler rubber? Why?
14. What is geometric moment of inertia ?
15. Define angle of contact.
16. Small drops of liquid are spherical, why?
17. Define coefficient of viscosity.
18. State Zeroth law of thermodynamics.
19. Give the Mathematical statement of first law of Thermodynamics.
20. What is coefficient of performance of a refrigerator ?
21. How is Entropy and disorder related ?

(9 × 1 = 9 weightage)

## Section C

*Answer any* **five** *questions.*

22. Compute the bulk modulus of water under a pressure of 100 atmospheres. Initial volume = 100 litre final volume = 100.5 litre. One atmosphere = $1.013 \times 10^5$ N/m$^2$.
23. The excess of pressure inside a soap bubble of radius 6 mm is balanced by 2 mm column of oil of density 800 kg/m$^3$. Find the surface tension of soap solution.
24. A metal plate 100 cm$^2$ in area rests on a layer of oil 2 mm thick. Calculate the horizontal force required to move the plate with a velocity of 5 cm/sec $\mu$ = 15.6 Poise.
25. A gas occupying a volume of $10^{-3}$ m$^3$ at a pressure of 5 atmospheres expands isothermally to a pressure of one atmosphere. Calculate the work done one atmosphere = 101325.
26. In a Carnots engine the temperature of the source and sink are 500 K and 375 K. If the engine consumes $25 \times 10^5$ J/cycle to find the work done per cycle.
27. Calculate the change in entrophy when 5 kg of ice is completely converted to water at its melting point 273°K. Latent heat of ice = $335 \times 10^3$ J/kg.
28. Calculate the coefficient of performance of an ideal refrigerator working between – 20°C and 30°C.

(5 × 2 = 10 weightage)

## Section D

*Answer any* **two** *questions.*

29. Obtain an expression for couple per unit twist of a wire.

30. For an irreversible cycle the entrophy increases whereas for reversible cycle there is no change in entropy prove these statements.

31. Deduce the 1st Tds equation $Tds = CvdT + T\left(\frac{\partial P}{\partial T}\right)_v dv$.

(2 × 4 = 8 weightage)