

## FIRST SEMESTER B.Sc. DEGREE EXAMINATION, JANUARY 2012

(CCSS)

Physics—Complementary

## PH 1C 01—PROPERTIES OF MATTER AND THERMODYNAMICS

Time : Three Hours

Maximum Weightage : 30

*Answer all twelve questions.*

I. Choose the correct alternative :

- 1 Which of the following is a correct relationship between various elastic constants (Young's modulus (Y), Rigidity modulus ( $n$ ) Bulk modulus (K) and Poisson's ratio ( $\sigma$ ) ?

(a)  $Y = \frac{K}{3(1-2\sigma)}$

(b)  $\frac{1}{Y} = \frac{1}{3n} + \frac{1}{9K}$

(c)  $\sigma = \frac{(3K+2n)}{(3K-2n)}$

(d)  $n = \frac{2(1+\sigma)}{Y}$

- 2 The excess pressure in side an air bubble of radius  $r$  well within a liquid of surface tension  $T$  is :

(a)  $4T/r$

(b)  $T/r$

(c)  $2T/r$

(d)  $r/4T$

- 3 The slope of the P-V diagram (V along X-axis and P along Y-axis) of an isochoric process is :

(a) zero.

(b) infinity.

(c) P/V.

(d) P.

- 4 Enthalpy H =

(a) U-PV.

(b) A + TS.

(c)  $U^2 + PV$ .

(d) None of the above.

Fill in the Blanks :

- 5 When thickness of a rectangular beam is doubled, Bending Moment becomes \_\_\_\_\_ times.
- 6 When sodium chloride is dissolved in water surface tension \_\_\_\_\_.
- 7 When the volume of an ideal gas is doubled at constant temperature, work done = \_\_\_\_\_.
- 8 Change in Entropy in a \_\_\_\_\_ cycle is zero.

Turn over

Give one word answers :

- 9 What is the equation of motion of a torsion pendulum ?
- 10 What is the unit of coefficient of viscosity ?
- 11 What is the value of universal gas constant ?
- 12 Which law of thermodynamics can be used to explain the working of a refrigerator ?

(12 × ¼ = 3 weight)

Answer **all** nine questions.

- II.
- 13 What is the reason for I-cross section for girders ?
  - 14 Distinguish between Uniform and Non-Uniform bending.
  - 15 A torsion pendulum of length 25 cm has a period 10 seconds. Find its period when length is increased to 50 cm.
  - 16 How does Surface Tension vary with temperature ?
  - 17 What is Brownian motion ?
  - 18 From the T-S diagram of Carnot cycle derive an equation for its efficiency.
  - 19 Derive an equation for work done in Isobaric Process.
  - 20 What is the Principle of increase of entropy ?
  - 21 Write down Clausius-Clapeyron equation.

(9 × 1 = 9 weight)

Answer **any five** questions.

- III.
- 22 Derive an equation for bending moment for a uniformly bent beam.
  - 23 Define Poisson's ratio. Derive the theoretical limiting values of Poisson's ratio.
  - 24 A number of little droplets of water of radius  $r$  each coalesce to form a single drop of radius  $R$ . Show that rise in temperature of water is  $\frac{3S(1 - \frac{1}{n})}{c_p r R}$  where  $S$  is the surface tension,  $c_p$  is the specific heat capacity and  $\rho$  is the density.
  - 25 Calculate the work done in blowing a soap bubble of radius 7 cm and surface tension  $N m^{-1}$ .
  - 26 Two equal drops of water are falling through air with a steady velocity of 2 cm/sec. When the drops coalesce find the new terminal velocity.
  - 27 An ideal gas at S.T.P. is first compressed to  $\frac{1}{4}$ th of its volume adiabatically and then expanded to its initial volume isothermally. Calculate the net amount of work done ( $\gamma = \frac{5}{3}$ ).
  - 28 State and prove Carnot's Theorem.

(5 × 2 = 10 weight)

*Answer any two questions.*

- IV. 29 Define a Cantilever. With necessary theory explain how a cantilever can be used to find the Young's Modulus.
- 30 Derive Poiseuille's formula.
- 31 Explain thermodynamic potentials. Derive Maxwell's thermodynamic relations.

(2 × 4 = 8 weightage)