

D 32496

(Pages : 2)

Name.....

Reg. No.....

FIRST SEMESTER B.Sc. DEGREE EXAMINATION, JANUARY 2013

(CCSS)

Physics : Complementary

PH 1C 01—PROPERTIES OF MATTER AND THERMODYNAMICS

Time : Three Hours

Maximum : 30 Weightage

I. Answer *all* questions.

Choose the correct alternative :

1 Theoretical value of Poisson's ratio varies between :

- (a)  $-1$  and  $+1$ . (b)  $-1$  and  $0.5$ .  
(c)  $-1$  and  $0$ . (d)  $-0.5$  and  $+0.5$ .

2 With increase of temperature surface tension of a liquid :

- (a) Always increases. (b) Always decreases.  
(c) Remains unchanged. (d) Changes depending on the nature of the liquid.

3 T-S diagram of a Carnot cycle is :

- (a) Ellipse. (b) Rectangle.  
(c) Circle. (d) Parabola.

4 Gibb's potential  $G =$

- (a)  $U + PV$ . (b)  $U - TS$ .  
(c)  $A + H - U$ . (d) None of the above.

(H—enthalpy, A—Helmholtz free energy)

Fill in the blanks :

5 Young's modulus of a material \_\_\_\_\_ with thickness.

6 Excess pressure inside a soap bubble of radius  $r$  and surface tension  $T$  is \_\_\_\_\_.

7 Dimensional formula for coefficient of viscosity is \_\_\_\_\_.

8 For a Carnot engine of efficiency 50 %, the ratio of source and sink temperature is \_\_\_\_\_.

Give one word answers :

9 Write down a relation connecting Young's modulus and Poisson's ratio.

10 Write down a phenomenon exhibiting surface tension.

11 Give an example of a thermodynamic system.

12 Express the entropy change of an ideal gas in terms of pressure (P) and volume (V).

( $12 \times \frac{1}{4} = 3$  weightage)

Turn over

II. Answer *all* nine questions :

- 13 Explain why steel is more elastic than rubber.
- 14 Derive an equation for work done in twisting a rod.
- 15 What is the importance of presence of dust particles in cloud formation ?
- 16 What happens to a soap bubble when it is electrically charged ? Explain.
- 17 Write down the conditions under which Poiseuille's formula is valid.
- 18 State the First law of thermodynamics. Put it in mathematical form.
- 19 The pressure of an ideal gas is doubled at constant temperature. Find the work done.
- 20 Is it possible to cool a room by keeping the refrigerator door open ? Explain.
- 21 How is entropy related to disorder ?

(9 × 1 = 9 weightage)

III. Answer any *five* questions :

- 22 Show that the torsional oscillations executed by a torsion pendulum are simple harmonic and arrive at the frequency of oscillations.
- 23 A cantilever of length 0.4 m. is loaded at the free end. If the depression at a distance 10 cm. from free end is 1 cm., find the depression at the free end.
- 24 Two equal spherical soap bubbles coalesce to form a single drop at constant temperature. If  $\delta V$  is the corresponding change in volume of the contained air and  $\delta A$  is the change in total surface area show that  $4T\delta A = 3P\delta V$  where  $T$  = surface tension of soap solution and  $P$  is atmospheric pressure.
- 25 2 capillary tubes of radii  $a_1$  and  $a_2$  and lengths  $l_1$  and  $l_2$  connected in series. Find the rate of flow of a liquid of coefficient of viscosity  $\eta$  under a pressure  $P$ .
- 26 One mole of Nitrogen expands isothermally from 10 to 20 litres at  $100^\circ\text{C}$ . Assuming the gas to be ideal, find the entropy change of the gas.  $R = 8.3\text{ J mol}^{-1}\text{ K}^{-1}$ .
- 27 A Carnot engine working between two temperatures  $T_1$  and  $T_2$  converts 15 % of heat into useful work. When the temperature of the sink is lowered by 100 K the efficiency is doubled. Find  $T_1$  and  $T_2$ .
- 28 Two Carnot engines A and B are in series. First engine absorbs heat at 1000 K and rejects it to the sink at a temperature  $T$  K. Second engine absorbs half of the heat rejected by the first and rejects heat to its sink at 200 K. If the work performed by both engines are equal, calculate  $T$ .

(5 × 2 = 10 weightage)

IV. Answer any *two* questions :

- 29 Define the 3 moduli of elasticity. Derive an equation for couple per unit twist on a uniform cylinder clamped at one end twisted at the other end.
- 30 Derive Stoke's formula. With necessary theory, explain how the coefficient of viscosity of a liquid can be determined by Stoke's method.
- 31 Derive Clausius-Clapeyron latent heat equation. On the basis of it explain the effect of pressure on boiling and melting points.

(2 × 4 = 8 weightage)