D 22286 (Pages : 3) Name.....

Reg. No.....

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.*

1. 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 (σ) ?

(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 weightage)

II. *Answer* **all** *nine questions.*

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 weightage)

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

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 $\frac{3S}{c\rho}\left(\frac{1}{r}-\frac{1}{R}\right)$ where S is the surface tension *c* is the specific heat capacity and ρ is the density.

25 Calculate the work done in blowing a soap bubble of radius 7 cm and surface tension 0.04 $N\,m^{-1}$.

26 Two equal drops of water are falling through air with a steady velocity of 2 cm/second. If the drops coalesce find the new terminal velocity.

27 An ideal gas at S.T.P. is first compressed to ¼ th of its volume adiabatically and then expanded to its initial volume isothermally. Calculate the net amount of work done ($\gamma = 1.4$).

28 State and prove Carnot's Theorem.

(5 × 2 = 10 weightage)

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)

D 32496 (Pages : 2) Name.....Risna.....

Reg. No.....UTASCS023

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 × ¼ = 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 Poiseuillie'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 δV is the corresponding change in volume of the contained air and δA 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 η under a pressure P.

26 One mole of Nitrogen expands isothermally from 10 to 20 litres at 100° C. Assuming the gas to be ideal, find the entropy change of the gas. R = 8.3 J $mol.^{-1}$ 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 rejets 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 modulii 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 necessry 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)

D 74382 (Pages : 2) Name.....

Reg. No.....

FIRST SEMESTER B.Sc. DEGREE EXAMINATION, NOVEMBER 2014

(CUCBCSS–UG)

Complementary Course—Physics

PH 1C 01—PROPERTIES OF MATTER AND THERMODYNAMICS

Time : Three Hours Maximum : 64 Marks

Section A

Answer **all** *questions.*
Each question carries 1 *mark.*

1. If the work done in stretching a wire by 1 mm is 2 J, the work necessary for stretching another wire of the same material but double the radius and half the length by 1 mm is ———.
2. A wire can support a load W without breaking. It is cut into two equal parts. The maximum load that each part can support is ———.
3. The viscous drag on a small spherical body moving with a speed v is proportional to ———.
4. When the body attain terminal velocity its acceleration is ———.
5. In a capillary tube, water rises to a height of 4 cm. If the cross-sectional area of the tube were one-fourth, water would have risen to a height of ———.
6. A Carnot engine works first between 200° C and 0° C and then between 0°C and –200°C . The ratio of its efficiency in these two cases is ———.
7. Mean free path of the molecule of a gas depends on the molecular diameter d as ———.
8. 3.2 kg of ice at –10° C just melts with a mass m of steam is ———.
9. First law of thermodynamics is the law of conservation of ———.
10. In the given process of an ideal gas if dW = 0 and dQ < 0 then the temperature will ———.

(10 × 1 = 10 marks)

Section B

Answer all **seven** *questions.*
Each question carries 2 *marks.*

11. Name a material whose elastic limit is zero.
12. Out of the stress and strain, which is the cause and effect ? Why ?
13. What is Poise ?
14. Define surface tension. Give its dimension.
15. State and explain zerot'h law of thermodynamics.

Turn over

16. Explain why $C_p > C_v$.
17. Write down Clausius Clapyron equation.

(7 × 2 = 14 marks)

Section C

Answer any **three** *questions.*
Each question carries 4 *marks.*

18. Obtain the relation between various elastic constant.
19. Derive an expression for the work done in blowing a bubble.
20. Discuss the various factors which control surface tension of liquid.
21. Write down the relations for Helmholtz free energy, Enthalpy and Gibb's function. Explain its importance.
22. Use Maxwell's relations to obtain $C_p - C_v = R$.

(3 × 4 = 12 marks)

Section D

Answer any **three** *problems.*
Each problem carries 4 *marks.*

23. A solid sphere of mass 3 kg and diameter 0.2 m is suspended from a wire. The torque required to twist the wire is 5×10^{-2} Nm/radian. Calculate the period of oscillation.
24. A metal plate 5 cm × 5 cm rests on layer of castor oil 1 mm thick whose coefficient of viscosity is 1.55 NS m^{-2}. Find the horizontal force required to move the plate with a speed of 2 cm/s.
25. Calculate the amount of energy evolved when 8 droplets of water of surface tension 0.072 N/m and radius 0.5 mm each combine into one.
26. Calculate the change in entropy of a system contains 1 kg ice at 0° C, which melts at the same temperature. Latent heat of ice 79.6 k cal/kg.
27. Calculate the change in boiling point of water when the pressure is increased by 1 atmosphere. B.P of water is 373 K. Specific volume of steam = 1.671 m^3 and Latent heat of steam 2.268×10^6 J kg^{-1}.

(3 × 4 = 12 marks)

Section E

Answer any **two** *problems.*
Each problem carries 8 *marks.*

28. Derive an expression for the depression produced at the midpoint of a uniform rectangular bar loaded at its middle. How is Y determined by this method ?
29. Derive an expression for the rate of flow of liquid through capillary tube.
30. What is Carnot's engine ? Derive an expression for its efficiency in terms of temperature of source and sink.
31. Using Maxwell's relation, prove that ratio of adiabatic to isothermal bulk modulus is equal to the ratio of specific heats.

(2 × 8 = 16 marks)

D 73715 (Pages : 3) Name.....

Reg. No.....

FIRST SEMESTER B.Sc. DEGREE (SUPPLEMENTARY/IMPROVEMENT) EXAMINATION, NOVEMBER 2014

(U.G.—CCSS)

Complementary Course—Physics

PH 1C 01—PROPERTIES OF MATTER AND THERMODYNAMICS

(2013 Admissions)

Time : Three Hours Maximum : 30 Weightage

Part A

Answer **all** *questions.*
Each question carries ¼ Weightage.

1. There is no change in volume of a wire due to change in its length on stretching. The Poison ratio of the wire is :

   (a) – 0.5. (b) 0.5.

   (c) 0. (d) 1.

2. Rubber is ———— elastic than glass.

3. A horizontal beam fixed at one end and loaded at the free end is called a ————.

4. With rise of temperature the surface tension of a liquid :

   (a) does not change (b) Increases.

   (c) decreases. (d) becomes zero.

5. The velocity of a falling raindrop attains limited value due to :

   (a) air current (b) up thrust of air.

   (c) surface tension (d) viscous force exerted by air.

6. The viscous drag on a spherical body moving with a speed V is proportional to :

   (a) u. (b) u.

   (c) u^2. (d) $2u$.

7. A reversible heat engine can have 100% efficiency if the temperature of sink is :

   (a) Less than that of source. (b) Equal to that of source.

   (c) 0°C. (d) OK.

Turn over

8. The ratio of two specific heats of a diatonic gas is :

(a) 1.66. (b) 1.4.

(c) 1.33 (d) 1.21.

9. Change in entropy depends :

(a) on the transfer of heat. (b) on change of temperature.

(c) on the transfer of mass. (d) on the thermodynamic state.

10. Absolute zero is the temperature at which isothermal and adiabatic processes are identical :

(a) True. (b) False.

(c) cannot be defined. (d) None of these.

11. In a complete Carnot cycle, the change in Entropy of the universe is :

(a) Positive. (b) Negative.

(c) Infinite. (d) Zero.

12. The quantity remaining constant in the isothermal expansion of an ideal gas is :

(a) Internal energy. (b) Heat.

(c) Pressure. (d) Temperature and Pressure.

(12 × ¼ = 3 weightage)

Part B

Answer **all** *questions.*
Each question carries 1 *weightage.*

13. What is meant by elastic hysteresis ?

14. Springs are usually made of steel and not of copper. Why ?

15. Explain the phenomenon of surface tension.

16. Distinguish between streamline flow and Turbulent flow of liquids.

17. Why do gases have two specific heats ?

18. Explain the terms : (a) Thermodynamic state ; (b) Thermodynamic equilibrium

19. What are the limitations of the first law of thermodynamics ?

20. Give Kelvin's statement of the second law of thermodynamics.

21. How does pressure effect the melting point of a substance ?

(9 × 1 = 9 weightage)

Part C

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

22. What is Stress energy ? A wire 4m long and 3×10^{-4}m in diameter is stretched by a force of 8kgwt. If the extension in the length amounts to 1.5mm. Calculate the energy stored in the wire.

23. What is Cantilever ? A Cantilever of length 0.5m is depressed by 0.015m at a distance 0.3m from the fixed end.

24. Define angle of contact. By how much will the surface of mercury be depressed in a glass tube of radius 0.01cm if the angle of contact of mercury is 135° and its surface tension is 0.488N/m.

25. Calculate the mass of water flowing in 10 minutes through a tube 0.001m in diameter, 0.4m long under a constant pressure head of 20cm of water. Coefficient of viscosity of water = 0.000089 SI units.

26. A tyre is pumped to a pressure of 2 atmospheres at 15°C when it suddenly bursts. Calculate the drop in temperature.

27. Explain Brownian motion. How is it explained ?

28. Prove that for a Perfect gas, Cp-Cu = R.

(5 × 2 = 10 weightage)

Part D

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

29 Describe with the theory the Torsion pendulum method of determining the rigidity modulus of a material in the form of a wire.

30. Describe a Carnot's engine. Draw the P-V indicator diagram for a cycle of its operations between two given temperatures and deduce from it the thermal efficiency of the engine.

31. Starting from Maxwell's relations derive Clapeyron's equations.

(2 × 4 = 8 weightage)

D 53527 (3) (Pages : 3) Name.....

Reg. No.....

FIRST SEMESTER B.Sc. DEGREE EXAMINATION
JANUARY 2014

(UG–CCSS)

Complementary Course – Physics

PH 1C 01 – PROPERTIES OF MATTER AND THERMODYNAMICS

(2012 and earlier Admissions)

Time : Three Hours Maximum : 30 Weightage

Section A

Answer **all** *questions.*

12 *Objective type questions, in bunches of four questions.*

Each bunch carries a weightage of 1.

1. When the radius of a metal wire is doubled its Young's modulus will be :
   (a) Doubled. (b) Halved.
   (c) Remains the same. (d) None of these.
2. The unit of coefficient of viscosity is :
   (a) Poise. (b) Weber.
   (c) Joules/second. (d) None of the above.
3. The expression for excess pressure inside a soap bubble of radius R and surface tension T is given by :
   (a) 2 T/R. (b) 4 T/R.
   (c) T/R. (d) None of these.
4. The Helmholtz function is given by :
   (a) F = U – TS. (b) F = T – US.
   (c) F = S – UT. (d) None of these.
5. The expression for work done/unit volume in twisting a wire is given by _____.
6. The radius of an air bubble in deep water _____ with the depth of water.
7. The Stoke's equation for the viscous drag acting on a sphere falling through a high viscous medium is given by _____.
8. The energy of the gas molecule at absolute zero temperature is called _____.

Turn over

9. What is the dimension formula for the modulus of elasticity?
10. Write down the relation between surface tension and surface energy.
11. What is angle of contact? The angle b/w the tangent to the liquid surface at the point of contact and the solid surface inside the liquid
12. What is a 'reservoir' in thermodynamics?

(12 × ¼ = 3 weightage)

Section B

Answer **all** *questions.*

Each question carries a weightage of 1.

13. State Hooke's law in elasticity.
14. What is a torsion pendulum?
15. Write down an expression for the geometrical moment of inertia of a cylindrical wire. Explain the symbols used. $I_g = \frac{\pi r^4}{4}$
16. How does detergent remove dirt from cloths? The mole
17. Define the term 'terminal velocity' of a body falling through a highly viscous medium.
18. Give one application of Stoke's formula for viscous drag.
19. State second law of thermodynamics.
20. Why does a gas has two specific heat capacities?
21. "Entropy of the universe is increasing". Comment → the entropy change of the universe is zero for a reversible process. Hence no natural process is reversible and only ideal processes are reversible

(9 × 1 = 9 weightage)

Section C

Answer any **five** *questions.*

Each question carries a weightage of 2.

22. Derive the relation, w = ½ × strain × strain; where w is the work done/unit volume in twisting a wire.
23. Derive a relation for the geometrical moment of inertia of a rectangular bar of thickness d and breadth b. $I = \int_{-d/2}^{d/2} b\,dz \cdot z^2 = 2\int_0^{d/2} b\,dz \cdot z^2 = 2b\left[\frac{z^3}{3}\right]_0^{d/2} = \frac{bd^3}{12}$
24. Determine the elastic energy stored up in a wire, originally 5 meter long and 1 mm in diameter, which has been stretched 3/10 mm due to a load of 10 Kg. Take $g = 300\pi$ m/s^2.
25. Water is conveyed through a horizontal tube 6 cm, in diameter and 4 kilometer in length, at the rate at 20 liters per second. Assuming only viscous resistance, calculate the pressure required to maintain the flow. Coefficient of viscosity of water is 0.001 S.I units.

26. Briefly explain molecular theory of surface tension.

27. Write a brief note on Carnot's refrigerator.

28. Discuss the effects of pressure on boiling and melting points of liquids.

(5 × 2 = 10 weightage)

Section D

Answer any **two** *questions.*

Each question carries a weightage of 4.

29. What is a cantilever? Derive the expression for the depression at the loaded end of a cantilever.

30. Derive an expression for the excess pressure on a curved liquid surface. Obtain the excess pressure inside a spherical soap bubble.

31. What is an adiabatic process? Derive the gas equations for an adiabatic process.

(2 × 4 = 8 weightage)

D 92867 (Pages : 2) Name.....

Reg. No.....

FIRST SEMESTER B.Sc. DEGREE EXAMINATION, NOVEMBER 2015

(CUCBCSS–UG)

Complementary Course

PHY 1C 01—PROPERTIES OF MATTER AND THERMODYNAMICS

Time : Three Hours Maximum : 64 Marks

Section A (One Word)

Answer **all** *questions.*
Each question carries 1 *mark.*

1. As the temperature increases the Young's Modulus of a steel wire ————.
2. The dimensions of surface tension are ————.
3. The angle of contact for pure water and clear glass is ————.
4. The viscosity of gases ———— with increase in temperature.
5. The type of modulus of elasticity of gases is ————.
6. When the pressure increases, the boiling point of water ————.
7. When work is done by an isolated system its internal energy ————.
8. The change in Helmoltz free energy function during an isothermal isochoric process is ————.
9. During an adiabatic process the enthalpy of the system ————.
10. The efficiency of a Carnot's engine working between temperatures 500 K and 300 K is ————.

(10 × 1 = 10 marks)

Section B

Answer **all** *questions.*
Each question carries 2 *marks.*

11. Define the terms angle of twist and angle of shear.
12. What is a cantilever ?
13. What is meant by Brownian motion ? How does temperature affect this movement ?
14. Assuming the expression for excess of pressure on a curved liquid surface, deduce the excess of pressure inside a liquid spherical drop and bubble.
15. State Carnot's theorem.
16. How does the pressure affect the boiling point of a liquid and melting point of ice ?
17. State and explain second law of thermodynamics.

(7 × 2 = 14 marks)

Turn over

Section C

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

18. What is an I-section girder ? Why are I-section girders preferred ?
19. Define the term surface tension. Derive an expression for finding the work done in blowing a liquid bubble.
20. Derive Stoke's formula for the velocity of a small sphere falling through a viscous liquid.
21. Derive Clasius-Cleyperon equation.
22. Derive an expression for work done during an adiabatic expansion process.

(2 × 4 = 8 marks)

Section D

Answer any **three** *questions.*
Each question carries 4 marks.

23. Calculate the work done in twisting a steel wire of radius 10^{-3} m. and length 0.25 m. through an angle of 45°. Given the rigidity modulus of wire is 8×10^{10} Nm^{-2}.
24. Calculate the radius of the drop of water falling through air, if the terminal velocity of the drop is 0.012 ms^{-1} ; viscosity of air is 1.81×10^{-5} SI units and density of air is 1.21×10^{-3} $kg.m.^{-3}$?
25. A Carnot's engine works between two temperatures whose difference is 100° C. If it absorbs 746 J of heat from source and gives 546 J to sink, calculate the temperature of source and sink.
26. Calculate the work done if one mole of an ideal gas is compressed very slowly at 27° C. to one fourth of the original volume. R = 8.314 J $mol.^{-1}$ K^{-1}.
27. Calculate the change in entropy when 10 g of ice at 0° C. is converted into steam at 100° C. Latent heat of fusion of ice is 3.35×10^5 J $kg.^{-1}$; Latent heat of steam is 2.268×10^6 J $kg.^{-1}$ and Specific heat capacity of water is 4.2×10^3 $Jkg.^{-1}$ K^{-1}.

(3 × 4 = 12 marks)

Section E

Answer any **two** *questions.*
Each question carries 10 *marks.*

28. A rectangular bar of iron is supported at its two ends of knife edges and a load is applied at the middle point. Derive an expression for the depression at the middle. Describe an experiment to determine Young's modulus of a bar using this arrangement.
29. Derive Poiseulli's formula for the flow of a liquid through a capillary tube. Describe an experiment to measure the viscosity of a liquid using the formula.
30. Describe the working of a Carnot's engine. Define efficiency of a heat engine. Derive an expression for efficiency of a Carnot's engine.

(2 × 10 = 20 marks)

D 18819 (Pages : 3) Name.....

Reg. No.....

FIRST SEMESTER B.Sc. DEGREE EXAMINATION, NOVEMBER 2016

(CUCBCSS—UG)

Complementary Course

PHY 1C 01—PROPERTIES OF MATTER AND THERMODYNAMICS

Time : Three Hours Maximum : 64 Marks

Section A

Answer **all** *questions.*
Each question carries 1 *mark.*

1. The type of modulus of elasticity of gases is ————.
2. Angle of contact for purewater and clear glass is ————.
3. The limiting values of Poisson's ratio are ———— and ————.
4. The viscosity of liquids ———— with increase of pressure.
5. When Sodium chloride is added to water, the surface tension of water ————.
6. The SI unit of entropy is ————.
7. The change in enthalpy during a reversible isobaric adiabatic process is ————.
8. The thermodynamic process during which the entropy remains constant is called ————.
9. The efficiency of a Carnot's engine working between temperatures 100°C and 0°C is ————.
10. When the pressure increases, the melting point of wax ————.

(10 × 1 = 10 marks)

Section B

Answer **all** *questions.*
Each question carries 2 *marks.*

11. What is torsional rigidity of a wire ? couple per unit twist
12. How does the temperature and pressure affect the viscosity of a liquid ?
13. Explain why liquids possess surface tension ?
14. Define the term modulus of rigidity ? Write down the relation Connecting the three modulii of elasticity.
15. State and explain the principle of increase of entropy ?
16. What do you mean by quasi-static process ?
17. Distinguish between isothermal process and adiabatic process ?

(7 × 2 = 14 marks)

Turn over

Section C

Answer any two questions.
Each question carries 4 marks.

18. Derive an expression for the excess of pressure inside a liquid bubble ?

19. Show that a hollow shaft of the same length, mass and material is Comparatively Stronger than a solid shaft ?

20. Derive stoke's law for the motion of a body in a viscous medium from dimensional considerations ?

21. What do you mean by entropy ? Show that the entropy remains constant in reversible process but increase in irreversible process ?

22. Derive an expression for work done during an adiabatic process ?

(2 × 4 = 8 marks)

Section D

Answer any **three** *questions.*
Each question carries 4 *marks.*

23. A rectangular bar 2 cm breadth and 1 cm depth and 100 cm in length is supported at its ends and a load of 2 kg is applied at its middle point. Calculate the depression at the middle point, if Young's modulus of the bar is 200 GPa ?

24. Water flows through a horizontal capillary tube of 1 mm internal diameter and length 70 cm under a pressure of a column of water 30 cm in height. If the visosity of water is 1×10^{-3} Ns m^{-2}, find the rate of flow of water through the Capillary tube ?

25. Find the efficiency of a Carnot's engine working between 127°C and 27°C. If it absorbs 840 J of heat from the source, Calculate the amount of heat rejected to the Sink ?

26. Calculate the change in temperature of boiling water when the pressure is increased by 27.12 mm of Hg. The normal boiling point of water at atmospheric pressure is 100°C. Given latent heat of steam = 2.268×10^6 JK^{-1} ; Specific volume of steam = 1.674 m^3 Kg^{-1} and specific volume of water at 100°C = 1×10^{-3} m^3 Kg^{-1}.

27. Calculate the change in entropy when 0.1 kg of water at 15°C is mixed with 0.15 kg of water at 50°C. Specific heat of water = 4.2×10^3 J kg^{-1} K^{-1}.

(3 × 4 = 12 marks)

Section E

Answer any **two** *questions.*
Each question carries 10 *marks.*

28. What is a torsion pendulum ? Derive an expression for its time period. Using the pendulum how will you determine the rigidity modulus of a wire.

29. Derive Poiseuille's formula for the flow of a liquid through a Capillary tub. Mention its limitations.

30. Deduce Maxwell's four thermodynamical relations. What are the importance of these relations ?

(2 × 10 = 20 marks)

D 52764 (Pages : 3) Name.....

Reg. No.....

FIRST SEMESTER B.Sc. DEGREE EXAMINATION, NOVEMBER 2018

(CUCBCSS—UG)

Complementary Course (Physics)

PHY 1C 01—PROPERTIES OF MATTER AND THERMODYNAMICS

Time : Three Hours Maximum : 64 Marks

Section A

Answer **all** *questions.*
Each question carries 1 *mark.*

1. A and B are two wires. The radius of A is twice that of B. If same force is acting on them, the stress on A is ———— that on B.
2. The energy stored per unit volume of a stretched wire is ————.
3. YI/R of a beam is called ————.
4. In an oil lamps, the oil rises up in the wicks due to ————.
5. The excess pressure inside a soap bubble is 40 N/m^2 .The excess pressure inside another soap bubble having radius twice the first one is ————.
6. A steel ball falls through castor oil more slowly than through water because castor oil has greater ————.
7. An adiabatic process occurs at constant ————.
8. The equation dQ=dU represents ———— process.
9. Equilibrium state is a state of ———— Entropy.
10. Water expands on solidification. The melting point of ice will ———— with pressure.

(10 × 1 = 10 marks)

Section B

Answer **all** *questions.*
Each question carries 2 *marks.*

11. Steel is more elastic than rubber. Explain the statement.
12. Explain, why the iron girders have the cross-section in the shape of I ?
13. Explain the effect of temperature on surface tension.
14. Distinguish between stream line flow and turbulent flow. Define critical velocity.

Turn over

15. What are isothermal, adiabatic, isobaric and isochoric process ? Represent them on the same PV diagram.

16. Show that Gibb's function remains a constant during reversible isothermal isobaric process.

17. Distinguish between entropy and enthalpy of a system.

(7 × 2 = 14 marks)

Section C

Answer any **three** *questions.*
Each question carries 4 *marks.*

18. Show that theoretical limiting values of Poisson's are –1 and 0.5.

19. Derive Stokes formulae for the velocity of a small sphere falling through a viscous fluid.

20. Define surface tension and surface energy. Show that surface tension is numerically equal to surface energy.

21. What is meant by quasistatic process ? Derive an expression for work done during an adiabatic process.

22. Derive Clausius Clapeyron equation from Maxwell's equations.

(3 × 4 = 12 marks)

Section D

Answer any **three** *questions.*
Each question carries 4 *marks.*

23. A gold wire 0.32 mm in diameter elongates by 1 mm when stretched by a force 3.23 Newton and twists through 1 radian, when equal and opposite torque of 1.45×10^{-7} N-m are applied at its ends. Find the value of Poisson's ratio for gold.

24. Calculate the loss of energy if 1000 drops of water of diameter 2 mm coalesce To form one large drop. Surface tension of water = 0.07 N/m.

25. A metal plate of area 1.25×10^{-2} m^2 is separated from a large plate by a layer of Glycerin of thickness 1×10^{-3} m. If the viscosity of glycerin is 1.6 Nsm^{-2}. Calculate the force required to keep the plate moving with a velocity of 2.5×10^{-2} ms^{-1}.

26. One mole of a gas at 27°C expands adiabatically until its volume is doubled. Calculate the work done $\gamma = 1.4$.

27. Calculate the change in entropy when 5 kg of ice is completely converted into Water at its melting point 273 K. Latent heat of ice = 335×10^3 J/kg.

(3 × 4 = 12 marks)

Section E

Answer any **two** *questions.*
Each question carries 8 *marks.*

28. Describe an experiment to determine the Youngs modulus of the material of the bar using the bar as a cantilever.

29. Obtain an expression for Volume of liquid flowing per second through a narrow tube of circular cross-section.

30. Explain Carnot engine. Derive an expression for efficiency of Carnot engine.

31. Explain, what do you mean by the entropy of a substance. Show that for any Reversible cyclic change of a system the total change in entropy is zero. Explain, why this statement is not true for irreversible changes.

(2 × 8 = 16 marks)

D 73173 (Pages : 3) Name.....

Reg. No.....

FIRST SEMESTER B.A./B.Sc. DEGREE EXAMINATION
NOVEMBER 2019

(CUCBCSS—UG)

Physics

PHY 1C 01—PROPERTIES OF MATTER AND THERMO DYNAMICS

Time : Three Hours Maximum : 64 Marks

Section A

Answer **all** *questions.*
Each question carries 1 *marks.*

1. The relation between the three elastic constants are ———.
2. For a given material the Young's modulus is 2.4 times the modulus of rigidity. Its Poisson's ratio is ———.
3. If temperature rises the coefficient of viscosity of a liquid ———.
4. A steel ball of mass m falls in a viscous liquid with a terminal velocity v. Another steel ball of mass 64 m. will fall through the same liquid with a terminal velocity ———.
5. At critical temperature the surface tension of a liquid is ———.
6. The efficiency of Carnot engine depends on ——— and ——— temperature.
7. Entropy is a measure of ——— of a system
8. The first law of thermodynamics is the conservation of ———.
9. The plot of isotherms will not be a straight line when a plot is drawn between ——— and ———.
10. A cooking pot should be ——— specific heat and ——— conductivity

(10 × 1 = 10 marks)

Section B

Answer **all** *seven questions.*
Each question carries 2 *marks.*

11. Distinguish between elasticity and plasticity.
12. Most of the beam which we use are of square cross section and not of circular cross section, Why ?
13. Even though lava is highly viscous it flows rapidly why ?
14. Define velocity gradient.
15. State and explain second law of thermodynamics.

Turn over

16. What are isobaric processes ?

17. Give the significance of Helmholtz function.

(7 × 2 = 14 marks)

Section C

Answer any **three** *questions.*

Each question carries 4 *marks.*

18. Derive an expression for couple per unit twist of the wire.

19. Explain the method of determination of coefficient of viscosity of a liquid by Stoke's method.

20. Discuss the effect of electrostatic pressure on a bubble. Give its application.

21. Discuss the principle and working of Carnot's refrigerator.

22. What is Carnot's cycle ? Show that change in entropy in a Carnot's cycle is zero.

(3 × 4 = 12 marks)

Section D

Answer any **three** *problems.*

Each problems carries 4 *marks.*

23. Calculate the work done in twisting a steel wire of radius 10^{-3} m. and length of 0.25 m. through an angle of 45°. The modulus of rigidity of the material is 8×10^{10} N m^{-2}.

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 2 cm/s. Co-efficient of viscosity of oil is 1.56 poise.

25. Calculate the loss of energy when 27 drops of water of S.T. 72×10^{-3} N/m , each of radius 0.6 mm. coalesce to form a single drop ?

26. Calculate the change in entropy when 0.25 kg. of water at 9°C is mixed with 0.5 kg of water at 30°C. Specific heat of water between 0°C and 30° C is 1 kilo cal/ Kg – K.

27. Calculate the depression of melting point of ice produced by one atmosphere increase of pressure. Given that latent heart of ice = 80 cals/gm. and specific volume of ice and water at 0°C are 1.091 cm^3 and 1.0 cm^3 respectively.

(3 × 4 = 12 marks)

Section E

Answer any **two** *problems.*

Each problems carries 8 marks.

28. Describe an experiment to determine the young's modulus of the given material using a cantilever with necessary theory.

29. Derive Poiseuille's formula and give its limitations.

30. State and prove Carnot's theorem for a reversible heat engine. Show that efficiency of any reversible heat engine is greater than that of any irreversible heat engine working between the same two temperatures. What is the importance of this theorem in Physics and Engineering?

31. Using Carnot's cycle derive Clausius Clapeyron's equation give its application.

(2 × 8 = 16 marks)

D 73294 (Pages : 2) Name.....

Reg. No.....

FIRST SEMESTER B.A./B.Sc. DEGREE EXAMINATION NOVEMBER 2019

(CBCSS—UG)

Physics/Applied Physics

PHY 1C 01—PROPERTIES OF MATTER AND THERMO DYNAMICS

(2019 Admissions)

Time : Two Hours Maximum : 60 Marks

The symbols used in this question paper have their usual meanings.

Section A (Short Answer Type)

(*Answer* **all** *questions in two* **or** *three sentences. Each correct answer carries a maximum of* 2 *marks*).

1. What do you mean by the term modulus of elasticity ? What are the different types ?
2. Distinguish between uniform and non-uniform bending of beams.
3. Why hollow cylinders are used in shafts ?
4. What do you mean by surface tension ? What is its unit ?
5. Distinguish between streamline and turbulent flows of liquids.
6. Write down the Stokes's formula. What are the terms involved?
7. Distinguish between isochoric and isobaric processes.
8. Explain Carnot's theorem.
9. Give Kelvin's statement of the second law of thermodynamics.
10. Obtain the change of entropy of working substance in a Carnot cycle.
11. What is the effect of pressure on the melting point of a system ? Give an example.
12. Explain the principle of increase of entropy.

(Ceiling 20)

Section B (Paragraph/Problem Type)

(*Answer* **all** *questions in a paragraph of about* **half a page** *to* **one page.** *Each correct answer carries a maximum of* 5 *marks*).

13. Determine the work done in stretching a wire of length 2 m. and cross-section 1 mm^2 through 1 mm. Given, the Young's modulus of the material of the wire is 210 GPa.

Turn over

14. Determine the energy released when 8 droplets of water of radius 0. 5 mm. coalesce to form a single drop. Give, the surface tension of water is 0.072 Nm^{-1}.

15. Estimate the pressure inside a drop of a liquid of radius 2 mm. at room temperature. Given, the surface tension of the liquid at room temperature is 4.65×10^{-1} Nm^{-1}.

16. In a Poiseuille's capillary flow method of determining the co-efficient of water, 50 ml of water is collected in 6 minutes. If the constant pressure used is 0.4 m., length of the capillary tube is 0.8 m. and the diameter of the capillary tube is 1 mm, what will be the viscosity value obtained in the experiment ?

17. Using a suitable figure, explain the working principle of a Carnot's refrigerator.

18. Calculate the change of entropy when 100 g of water is heated from 0°C to 100°C. Given, the specific heat capacity of water is 4200 $JKg^{-1}K^{-1}$.

19. A Carnot engine whose cold reservoir is 300 K has an efficiency of 0.25. How much the temperature of the source be increased to increase the efficiency to 0.75 ?

(Ceiling 30)

Section C (Essay Type)

(*Answer in about* **two pages**, *any* **one** *question. Answer carries* 10 *marks*).

20. Determine the work done per unit volume when a body undergoes (i) Volume strain ; and (ii) shearing strain.

21. Distinguish between isothermal and adiabatic processes. Obtain expressions for the work done in the two processes.

(1 × 10 = 10 marks)

9— It is impossible by means of an inanimate material agency to derive an mechanical effect from any portion of matter by cooling it below the temperature of its coldest surroundings.

suitable figure

@ membrane

D 32383 (Pages : 2) Name.....

Reg. No.....

FIRST SEMESTER (CBCSS—UG) DEGREE EXAMINATION
NOVEMBER 2022

Physics/Applied Physics

PHY 1C 01—PROPERTIES OF MATTER AND THERMODYNAMICS

(2019—2022 Admissions)

Time : Two Hours Maximum : 60 Marks

The symbols used in this question paper have their usual meanings.

Section A (Short Answer Type)

Answer **all** *questions in two* **or** *three sentences.*
Each correct answer carries a maximum of 2 marks.

1. Explain elasticity.
2. State Hooks Law.
3. What is Poisson's ratio ?
4. What is a Cantilever ?
5. What are thermodynamic co-ordinates ?
6. Explain I section girders.
7. What is angle of contact ?
8. What is Viscosity ?
9. Why small drops are spherical in shape ?
10. What is meant by efficiency of a heat engine ?
11. State Clausius statement of second law of thermodynamics.
12. State Clausius-Clapyron equation.

(Ceiling 20)

Turn over

Section B (Paragraph/Problem Type)

Answer **all** *questions in* **a paragraph** *of about* **half a page to full page.**
Each correct answer carries a maximum of 5 marks.

13. Write notes on 1) Brownian motion ? 2) Viscosity of gases.

14. Derive the relation connecting moduli of elasticity and Poisson's ratio.

15. Derive the expression for the couple required to twist a cylinder through an angle θ.

16. A rod of rectangular cross section having breadth 2 cm and thickness 1 cm is bent in the form of an are of radius 10 m. If Young's modulus is $10^{10} N/m^2$, find (a) Stress and strain on convex surface, (b) Bending moment.

17. Describe Stoke's method of determination of co-efficient of viscosity.

18. Find the change in internal energy of a gas if its volum increases from 3.5 to 4.2 litre at a constant pressure of atmosphere on giving 320 J of heat.

19. Entropy is a point (state) function and not a path function. Explain. How is entropy change calculated ?

(Ceiling 30)

Section C (Essays)

Answer in about **two pages,** *any* **one** *question.*
Answer carries 10 *marks.*

20. What is bending moment ? Derive an expression for bending moment.

21. Calculate the work done by a hydrostatic system in isothermal, adiabatic, isochoric and isobaric processes.

(1 × 10 = 10 marks)