

1105-02

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Degree (Part-I) Examination, 2020

(Honours)

PHYSICS

[ Paper : Second ]

[ PPU-D-I(H)-PHY-2 ]

Time : Three Hours]

[Maximum Marks : 75

**Note :** Candidates are required to give their answers in their own words as far as practicable. Attempt five questions in all. Question 1 is **compulsory** and select at least one question from each section. Each question carries equal marks.

1. (i) A metal wire of length  $l$  and area of cross-section  $A$  is fixed between rigid supports at negligible tension. If this is cooled, the tension in the wire will be :
- (a) proportional to  $l$

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- (b) inversely proportional to  $l$   
(c) independent of  $l$   
(d) independent of  $A$

- (ii) A gas expands from 1 litre to 3 litres at atmospheric pressure. The work done by the gas is about :

- (a) 2J  
(b) 200J  
(c) 300J  
(d)  $2 \times 10^5$ J

- (iii) During an adiabatic process, the pressure of a gas is found to be proportional to the cube of its absolute temperature. The ratio  $\frac{c_p}{c_v} = r$  for the gas is :

- (a) 2  
(b)  $3/2$   
(c) 3  
(d)  $2/3$

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( 2 )

(iv) Each molecule of a gas has  $f$  degree of freedom.

The ratio  $\frac{c_p}{c_v} = r$  for the gas is :

(a)  $1 + \frac{2}{f}$

(b)  $1 + \frac{f}{2}$

(c)  $1 + f$

(d)  $\frac{f}{2}$

(v) A mixture of  $n_1$  moles of monoatomic gas and  $n_2$  moles of diatomic gas has  $\frac{c_p}{c_v} = r = 1.5$  :

(a)  $n_1 = n_2$

(b)  $2n_1 = n_2$

(c)  $n_1 = 2n_2$

(d)  $n_1 = n_2/2$

(vi) The first law of thermodynamics incorporates the concepts of :

(a) conservation of energy

(b) conservation of heat

(c) conservation of work

(d) both conservation of energy and equivalence of heat and work.

(vii) The internal energy of a system remains constant when it undergoes :

(a) a cyclic process

(b) an isothermal process

(c) an adiabatic process

(d) a cyclic, isothermal and any process in which the heat given out by the system is equal to the work done on the system.

(viii) RMS speed of an ideal gas is inversely proportional to the square root of its :

(a) Temperature

(b) Mass

(c) Volume

(d) None of these

(ix) Two equal drops of water are falling through air with a steady velocity of 5 cm/sec. If the drops coalesce, what will be the new terminal velocity?

- (a) 2.5 cm/sec
- (b) 7.94 cm/sec
- (c) 6.5 cm/sec
- (d) 3.14 cm/sec

(x) The internal energy change in a system that has absorbed 2Kcal of heat and done 500 J of work is :

- (a) 6400 J
- (b) 5400 J
- (c) 7900 J
- (d) 8900 J

**Section - A**

2. Derive Maxwell-Boltzmann distribution law for velocities of particles of a gas. Describe briefly any one method to verify the above law experimentally.

3. What are transport phenomena? Derive an expression for coefficient of thermal conductivity of a gas on the basis of Kinetic theory.

4. Describe Langerin and Einstein theories.

5. What do you mean by entropy? Show that for any thermodynamic process, the entropy either remains constant or increases.

**Section - B**

6. Using first and second laws of thermodynamics, derive Maxwell's four thermodynamic relations.

7. State and prove Carnot theorem.

8. Describe the principle and experiment related to production of low temperature by adiabatic demagnetization.

9. State and describe Debye theory of specific heat.

10. Establish the relation for efficiency of a Carnot's engine using T-S diagram as :

$$\eta = \frac{T_1 - T_2}{T_1}$$

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