

Test Time: 3:00 Hours

MRD-11<sup>TH</sup> 08052025(A-I)

# Physics (Part-1)

Total Marks: 85

There are three sections in this paper i.e A, B & C.

VERSION: A

Instructions:

- Please attempt Section-A on the MCQs Answer Sheet only.
- Only black ball point or marker may be used for shading the relevant circle.
- Please make sure that there is no cutting, over writing, erasing, or multiple circles shading.

Time Allowed: 20 Minutes

## "Section – A"

Marks: 18

Q1 Choose the correct option i.e A, B, C or D.

- The SI unit of pressure is pascal (Pa), which is equivalent to  
 (A)  $\text{Kg. ms}^{-1}$  (B)  $\text{Kg. ms}^{-2}$  (C)  $\text{Kg.m}^{-1}\text{s}^{-2}$  (D)  $\text{Kg m}^{-2}\text{s}^{-2}$
- A vector  $\vec{F} = -3\hat{i} + 3\hat{j}$  makes an angle  $\theta$  with X – axis, the value of  $\theta$  is  
 (A)  $30^\circ$  (B)  $60^\circ$  (C)  $90^\circ$  (D)  $135^\circ$
- The vector product of two vectors is non – zero then the vectors are:  
 (A) Perpendicular (B) Parallel (C) Antiparallel (D) Collinear
- When the length of the spanner decreases, the force required to loosen a nut.  
 (A) Increases (B) Decreases (C) Remains same (D) Becomes zero
- A car accelerates uniformly from 0 to 25 m/s in 5 seconds. The average velocity of the car during this time is.  
 (A) 2.5 m/s (B) 5 m/s (C) 12.5 m/s (D) 20 m/s
- A book of mass 1 kg is placed on a table. The force exerted by the table on the book is:  
 (A) 0 N (B) 1 N (C) 10 N (D) 100 N Qrc-3039
- In displacement –time graph a horizontal line parallel to x- axis represents  
 (A) Constant velocity (B) Constant speed (C) State of rest (D) Motion towards east
- If a 50 N force applied to an object does work of 2500J, then the displacement in the direction of the force is  
 (A) 0 m (B) 50 m (C) 100 m (D) 125 m
- A 1000 W motor lifts an object vertically, if the time taken to lift the object is doubled, the power would be.  
 (A) 500 W (B) 1000 W (C) 2000 W (D) 4000 W
- The efficiency of a car engine is reduced by energy losses in the form of  
 (A) Mechanical work (B) Friction and heat (C) Electrical energy (D) Gravitational potential
- If an object's angular acceleration is negative, it is  
 (A) Slowing down (B) Speeding up (C) At rest (D) Moving with constant speed
- A particle is moving in a circle of radius 2m and completes 2 revolutions, its angular displacement in radians is  
 (A)  $2\pi$  radians (B)  $4\pi$  radians (C)  $10\pi$  radians (D)  $20\pi$  radians
- The moment of inertia of a ring of mass 2kg and radius 2m is:  
 (A)  $2 \text{ kgm}^2$  (B)  $4 \text{ kgm}^2$  (C)  $8 \text{ kgm}^2$  (D)  $16 \text{ kgm}^2$
- Streamline flow tends to occur at  
 (A) Low velocity, high viscosity (B) High velocity, high viscosity (C) High velocity, low viscosity (D) Low velocity, low viscosity
- The time period (T) of a wave of angular frequency of 12rad/s is  
 (A)  $\frac{2\pi}{12} \text{ s}$  (B)  $\frac{1}{12} \text{ s}$  (C)  $\frac{12}{2\pi} \text{ s}$  (D)  $\frac{\pi}{12} \text{ s}$
- Two sound waves of same frequency arriving at same place at the same time having path difference  $\frac{7\lambda}{2}$  produces  
 (A) Beats (B) Silence (C) Loudness (D) Echo
- In young's double slit experiment the bright fringes were observed when the path difference is.  
 (A)  $d \sin \theta = m\lambda$  (B)  $d \sin \theta = (m + \frac{1}{2})\lambda$  (C)  $d \sin \theta = m^2\lambda$  (D)  $d \sin \theta = \frac{m}{3} \lambda$
- If a gas is compressed adiabatically, its internal energy  
 (A) Increases (B) Decreases (C) Remains constant (D) Becomes zero

"Section – B"

Marks: 40

**Q-2. Write short answers to any ten (10) of the following parts. All parts carry equal marks:-**

- (i) How do precision and accuracy differ? Provide two examples.
- (ii) Show the  $P.E. = mgh$  is dimensionally correct.
- (iii) Find the magnitude and direction of the resultant vector for  $A = 3i + 4j$  and  $B = -2i + 5j$ .
- (iv) Explain the second condition of equilibrium in terms of the sum of torques about any point.
- (v) Prove that the work done by gravity depends only on initial and final position of the body, not on path followed?
- (vi) Explain escape velocity in terms of the gravitational constant  $G$ , mass of the planet  $M$  and its radius  $R$ .
- (vii) Explain how Bernoulli's principle helps generate lift over an aero foil.
- (viii) Derive the expression for terminal velocity using Stokes law
- (ix) Define the terms time period, frequency, wavelength and velocity of a air.
- (x) Explain why pressure does not significantly affect the speed of sound in air.
- (xi) Explain why an ambulance siren sounds higher- pitched as it approaches and lower-pitched as it moves away.
- (xii) Explain the relationship between the source of light and the type of wave front produced.
- (xiii) Discuss why diffraction can not be explained using the particle theory of light.
- (xiv) What is the difference between the resultant and equilibrant of vectors?

"Section – C"

Marks: 27

**Note: Answer any three (3) questions. All questions carry equal marks:-**

- Q 3** (a) Define orbital speed. Derive an expression for orbital speed of a satellite. Qrc-3039  
(b) What should be the orbital speed to launch a satellite in a circular orbit 960 km above the surface of the earth?
- Q 4** (a) What is projectile motion? Derive mathematical expressions for its range and find the angle for maximum range.  
(b) A cricket ball is hit with an initial velocity of 25 m/s at an angle of  $30^\circ$  above the horizontal ground. Calculate the maximum height it reaches.
- Q 5** (a) Derive an expression for kinetic energy of a body executing SHM and explain what happens to KE when displacement is maximum.  
(b) A body of mass 700g executes SHM and completes one vibration in 1.2s. Find its potential energy when the displacement is 12cm.
- Q 6** (a) Describe the concept of Carnot engine and provide the detailed explanation of the processes in the Carnot cycle.  
(b) A Carnot engine having efficiency 55% takes certain amount of heat from a source having temperature 500K, converts a part of it into work and rejects the remaining towards the sink, Find the temperature of the heat sink.