

**A2022**

No. of Printed Pages : 4

Register Number

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**A****PART – III**, awgpayi / **PHYSICS**  
(English Version)

Time Allowed : 3.00 Hours ]

[ Maximum Marks : 70

- Instructions :**
- (1) Check the question paper for fairness of printing. If there is any lack of fairness, inform the Hall Supervisor immediately.
  - (2) Use **Blue** or **Black** ink to write and underline and pencil to draw diagrams.

**PART – I**


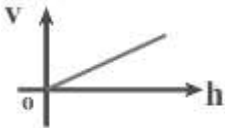
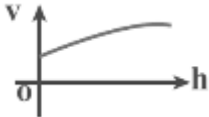

- Note :**
- (i) Answer **all** the questions. **15x1=15**
  - (ii) Choose the most appropriate answer from the given **four** alternatives and write the option code and the corresponding answer.

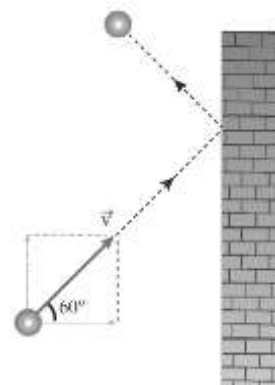
1. A ball of mass 1 kg and another of mass 2 kg are dropped from a tall building whose height is 80 m. After, a fall of 40 m each towards Earth, their respective kinetic energies will be in the ratio of  
 (a)  $\sqrt{2} : 1$  (b)  $1 : \sqrt{2}$  (c)  $2 : 1$  (d)  $1 : 2$
2. If an object is dropped from the top of a building and it reaches the ground at  $t = 4$  s then the height of the building is (ignoring air resistance) ( $g = 9.8 \text{ ms}^{-2}$ )  
 (a) 77.3 m (b) 78.4 m (c) 80.5 m (d) 79.2 m
3. A pendulum is hung in a very high building oscillates to and fro motion freely like a simple harmonic oscillator. If the acceleration of the bob is  $16 \text{ ms}^{-2}$  at a distance of 4 m from the mean position, then the time period is  
 (a) 2 s (b) 1 s (c)  $2\pi \text{ s}$  (d)  $\pi \text{ s}$
4.  $g_e$  and  $g_p$  denote the acceleration due to gravity in the Earth and a planet. The mass and radius of the planet are twice that of the Earth. Then \_\_\_\_\_  
 (a)  $g_p = \frac{g_e}{2}$  (b)  $g_p = 2g_e$  (c)  $g_p = g_e$  (d)  $g_p = \frac{g_e}{\sqrt{2}}$
5. A rope is wound around a hollow cylinder of mass 3 kg and radius 40 cm. What is the angular acceleration of the cylinder if the rope is pulled with a force 30 N?  
 (a)  $0.25 \text{ rad s}^{-2}$  (b)  $25 \text{ rad s}^{-2}$  (c)  $5 \text{ m s s}^{-2}$  (d)  $25 \text{ ms}^{-2}$
6. When a cycle tyre suddenly bursts, the air inside the tyre expands. This process is  
 (a) isothermal (b) adiabatic (c) isobaric (d) isochoric
7. If a particle executes uniform circular motion, choose the correct statement  
 (a) The velocity and speed are constant.  
 (b) The acceleration and speed are constant.  
 (c) The velocity and acceleration are constant.  
 (d) The speed and magnitude of acceleration are constant.

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8. An object of mass 10 kg is hanging on a spring scale which is attached to the roof of a lift. If the lift is in free fall, the reading in the spring scale is  
 (a) 98 N (b) zero (c) 49 N (d) 9.8 N
9. A uniform rope having mass  $m$  hangs vertically from a rigid support. A transverse wave pulse is produced at the lower end. Which of the following plots shows the correct variation of speed  $v$  with height  $h$  from the lower end?
- (a)  (b) 
- (c)  (d) 
10. If an object is at rest and no external force is applied on the object, the static friction acting on the object is:  
 (a) zero (b)  $\mu_s mg$  (c)  $\mu_s mg \sin \theta$  (d)  $\mu_s mg \cos \theta$
11. In a horizontal pipe of non-uniform cross section, water flows with a velocity of  $1 \text{ ms}^{-1}$  at a point where the diameter of the pipe is 20 cm. The velocity of water ( $1.5 \text{ m s}^{-1}$ ) at a point where the diameter of the pipe is (in cm)  
 (a) 8 (b) 16 (c) 24 (d) 32
12. A particle of mass  $m$  is moving with speed  $u$  in a direction which makes  $60^\circ$  with respect to  $x$  axis. It undergoes elastic collision with the wall. What is the change in momentum in  $x$  and  $y$  direction?
- (a)  $\Delta p_x = -mu, \Delta p_y = 0$   
 (b)  $\Delta p_x = -2mu, \Delta p_y = 0$   
 (c)  $\Delta p_x = 0, \Delta p_y = mu$   
 (d)  $\Delta p_x = mu, \Delta p_y = 0$
13. Which of the following pairs of physical quantities have same dimension?  
 (a) force and power (b) torque and energy  
 (c) torque and power (d) force and torque
14. A book is at rest on the table which exerts a normal force on the book. If this force is considered as reaction force, what is the action force according to Newton's third law?  
 (a) Gravitational force exerted by Earth on the book.  
 (b) Gravitational force exerted by the book on Earth  
 (c) Normal force exerted by the book on the table.  
 (d) Normal force exerted by the table on the book.
15. In stationary waves, the distance between a node and its neighbouring anti-node is:  
 (a)  $\frac{\lambda}{4}$  (b)  $\frac{\lambda}{2}$  (c)  $\frac{3\lambda}{4}$  (d)  $\lambda$



**PART – II****Note :** Answer **any six** questions. Question No. **24** is **compulsory**.**6x2=12**

16. Write any two limitations of dimensional analysis?
17. What is meant by Escape speed in the case of the Earth?
18. A mobile phone tower transmits a wave signal of frequency 900 MHz. Calculate the length of the waves transmitted from the mobile phone tower.
19. State Stefan – Boltzmann Law.
20. Define Centre of mass.
21. What is meant by periodic and non-periodic motion?
22. State Hooke's Law of Elasticity.
23. Define Inertia.
24. Consider two trains A and B moving along parallel tracks with same velocity in the same direction. Let the velocity of each train be 50 km / hr due east. Calculate the relative velocities of the trains.

**PART – III****Note :** Answer **any six** questions. Question No. **33** is **compulsory**.**6x3=18**

25. State Newton's three laws of motion.
26. An electron of mass  $9.1 \times 10^{-31}$  kg revolves around a nucleus in a circular orbit of radius  $0.53 \text{ \AA}$ . What is the angular momentum of the electron?  
(Velocity of electron  $v = 2.2 \times 10^6 \text{ ms}^{-1}$ )
27. Distinguish between streamlined flow and turbulent flow.
28. What is meant by Gross Error? How shall we minimize it?
29. Derive an expression for Energy of Satellite.
30. Show that path of a projectile is a parabola in horizontal projection.
31. Derive the relation between momentum and kinetic energy.
32. State the laws of Simple Pendulum.
33. During a cyclic process, a heat engine absorbs 500 J of heat from a hot reservoir, does work and ejects an amount of heat 300 J into the surroundings (cold reservoir). Calculate the efficiency of the heat engine

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**A2022****4****PART – IV****Note :** Answer **all** the questions.**5x5=25**

34. (a) Derive an expression for moment of Inertia of a rod about its centre and perpendicular to the axis of the rod.

**(OR)**

- (b) What is a Sonometer? Give its construction and working. Explain how to determine the frequency of tuning fork using Sonometer.

35. (a) What is Inelastic collision? Derive an expression for loss of kinetic energy in perfect inelastic collision.

**(OR)**

- (b) Explain in detail the kinetic interpretation of temperature.

36. (a) Explain in detail about the Newton's Law of cooling.

**(OR)**

- (b) Describe the method of measuring angle of repose.

37. (a) Explain in detail the Triangle Law of Vector Addition.

**(OR)**

- (b) Derive Poiseuille's formula for the volume of a liquid flowing per second through a pipe under streamlined flow.

38. (a) Write a note on Triangulation method and radar method to measure larger distances.

**(OR)**

- (b) Explain the variation of 'g' with depth from the Earth's surface.

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