

SECTION "A" (MULTIPLE CHOICE QUESTION)

1. Choose the correct answer for each from the given options:
 - (i) The dimensions of G are:
 - * $M^{-1}L^3T^{-2}$ * $M^2L^2T^{-2}$ * $M^{-1}L^2T^{-2}$ * MLT^{-2}
 - (ii) Of velocity of a body is decreasing, the direction of acceleration is:
 - * in the direction of velocity
 - * opposite to the direction of velocity
 - * perpendicular to the direction of velocity
 - * 60° to the direction of velocity
 - (iii) The rate of change of angular momentum is also known as:
 - * Linear momentum
 - * Torque
 - * Force
 - * Energy
 - (iv) At a distance, equal to twice of the radius of the earth, above the surface of the earth, the value of gravitational acceleration will be:
 - * one half
 - * One fourth
 - * Four times
 - * One ninth
 - (v) The range of audible sound is:
 - * 1 Hz – 10 Jz
 - * 20Hz – 20000 Hz
 - * 21000 Hz – 24000 Hz
 - * 25000 Hz – 50000 Hz
 - (vi) The conditions of interference in thin film are reversed due to:
 - * Diffraction
 - * Phase coherence
 - * Refraction
 - * Phase reversal
 - (vii) The magnifying power of a lens of focal length $1/2m$ is:
 - * 1 dioptre
 - * 2 dioptres
 - * 50 dioptres
 - * 100 dioptres
 - (viii) This equation represents Bragg's Law:
 - * $m\lambda = 2d \sin \theta$
 - * $m\lambda = d \sin \theta$
 - * $2m\lambda = d \sin \theta$
 - * $2m\lambda = 3d \sin \theta$
 - (ix) The distance between the principal focus and the optical centre is called:
 - * Radius of curvature
 - * Aperture
 - * Focal length
 - * Principal axis
 - (x) If \hat{i} , \hat{j} and \hat{k} are unit vectors then $\hat{k} \cdot (\hat{i} \times \hat{j})$ is equal to:
 - * zero
 - * one
 - * \hat{j}
 - * \hat{k}
 - (xi) The angle between centripetal acceleration and tangential acceleration in circular motion is:
 - * 180°
 - * 0°
 - * 90°
 - * 45°
 - (xii) Kitabul Manazir was written by:
 - * Ibn-Al Haitham
 - * Al Razi
 - * Abu-Rehan Al Beruni
 - * Jabir bin Hayyan
 - (xiii) One radian is equal to:
 - * 1°
 - * 75.3°
 - * 57.3°
 - * 0.017°
 - (xiv) One kilo watt hour is equal to:
 - * $3.6 \times 10^6 J$
 - * $3.3 \times 10^9 J$
 - * $3.9 \times 10^6 J$
 - * $3.6 \times 10^9 J$
 - (xv) Two vibrating bodies, having slightly different frequencies, produce:
 - * Echo
 - * Beats
 - * Resonance
 - * Polarization
 - (xvi) If $\vec{A} \cdot \vec{B} = 0$, $\vec{A} \times \vec{B} = 0$ and $\vec{A} \neq 0$, then vector \vec{B} is:
 - * Equal to \vec{A}
 - * Parallel to \vec{A}
 - * Perpendicular to \vec{A}
 - * zero
 - (xvii) Kinetic friction is always:
 - * greater than static friction
 - * equal to static friction
 - * less than static friction
 - * zero

PHYSICS

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SECTION 'B' (SHORT-ANSWER QUESTIONS)(40)

NOTE: Answer any 10 questions from this section.

- 2.(i) Deduce the expression for the variation of acceleration due to gravity 'g' with altitude.
- (ii) Show that the following formulae are dimensionally correct:

(a) $V = f\lambda$

(b) $T = 2\pi \sqrt{\frac{m}{k}}$
- (iii) Tarzan swings on a vine, of length 5m, in a vertical circle, under the influence of gravity. When the vine makes an angle of 30° with the Vertical, Tarzan has a speed of 4 m/s. Find:
 - (a) Centripetal acceleration at this instant
 - (b) His tangential acceleration
- (iv) A uniform ladder, of length 'L' and weight 50 N, tests against a smooth vertical wall. If the coefficient of friction between the ladder and the ground is 0.4, find the minimum angle θ such that the ladder may not slip.
- (v) The radius of the moon is 27% of the earth's radius and its mass is 1.2% of the earth's mass. Find the acceleration due to gravity on the surface of the moon. How much will a 424 N body weigh there?
- (vi) A water pump is needed to lift water through a height of 2.5 m at the rate of 500 gm/minute. What will be the minimum horsepower of the pump?
- (vii) A moving car has a siren sounding a 2 KHz tone. What frequency will be detected by a stationary observer as the car approaches him at 80 km/h? (Speed of sound = 1200 km/h).
- (viii) It is observed that all bodies, sliding down a frictionless inclined plane, have the same acceleration. How does it happen? Explain.
- (ix) Prove that the gravitational field is a conservative field.
- (x) A converging lens of 4 dioptres is placed in contact with a diverging lens of -2 dioptres. Find the power and the focal length of combination.
- (xi) Determine the unit vector perpendicular to the plane of $\vec{A} = 3\hat{i} + 4\hat{j} - \hat{k}$ and $\vec{B} = 4\hat{i} + 3\hat{j} - 2\hat{k}$ vectors.
- (xii) A car starts from rest and moves with a constant acceleration. During the 5th second of its motion, it covers a distance of 36 m. Calculate:
 - (a) Acceleration of the car
 - (b) Distance covered by the car during this time.
- (xiii) A string 2 m long, of mass 0.004 kg, is stretched horizontally by passing one end over a frictionless pulley and a mass of 1 kg is suspended, Find the speed of transverse waves on the string.
- (xiv) Derive an expression for the centripetal acceleration produced by the body of mass 's', moving along circular path of radius 'r'.
- (xv) In a double slit experiment, the separation of the slit is 1.9 mm and the fringe spacing is 0.31 mm, at a distance of 1 m from the slits. Find the wavelength of light.

SECTION 'C' (DETAILED- ANSWER QUESTIONS)

NOTE: Answer 2 questions from this section. (28)

- 3.(a) Define scalar and vector product. Show that:
 - $\vec{A} \cdot \vec{B} = \vec{B} \cdot \vec{A}$
 - $\vec{B} \cdot (\vec{A} + \vec{C}) = \vec{B} \cdot \vec{A} + \vec{B} \cdot \vec{C}$
- (b) What are Newton's rings? Derive the expression for the radius of nth bright ring.
- 4.(a) Define elastic and inelastic collisions. Two non-rotating spheres of masses m_1 and m_2 , initially moving with the velocities U_1 and U_2 respectively in one dimension, collide elastically. Derive the expression for their final velocities V_1 and V_2 .
- (b) Describe the construction and working of compound microscope. Derive the formula for its magnification.
- 5.a) A particle is in a state of uniform circular motion. Show that its projection along one of its diameters executes simple harmonic motion.
- (b) Define projectile motion. A projectile is thrown in the air at an angle ' θ ' with the horizontal with the velocity V_0 . Derive the equation for the total time of flight and the range of projectile.