If the force acting on a system of particles is central, which of the following will be conserved ?

(a) Angular momentum
(b) Kinetic energy
(c) Linear momentum
(d) All of the above **[Kanpur 2015]**

A body of mass m is moving in a circle of radius r with a uniform velocity v. Its centripetal acceleration is :

(a) $\frac{r}{v}$
(b) $\frac{v}{r}$
(c) zero
(d) $\frac{v^2}{r}$ **[Kanpur 2015]**

If the momentum of a body is increased by 10%, its kinetic energy will increase by :

(a) 121%
(b) 50%
(c) 100%
(d) 21% **[Kanpur 2015]**

The potential energy is :

(a) always negative
(b) always imaginary
(c) always positive
(d) both positive and negative **[Kanpur 2015]**

According to Kepler's third law :

(a) $T^2 \propto R^3$
(b) $T \propto R^{5/2}$
(c) $T \propto R$
(d) $T \propto R^3$ **[Kanpur 2015]**

The acceleration due to gravity at the centre of earth is :

(a) 9.8 m/sec^2
(b) 4.9 m/sec^2
(c) 0
(d) infinity **[Kanpur 2015]**

An artificial satellite is moving with total energy E_0 in a circular orbit around earth. Its potential energy will be :

(a) $-E_0$ (b) $1.5\ E_0$ (c) $2\ E_0$ (d) E_0 **[Kanpur 2015]**

Kepler's second law is based on law of conservation of :

(a) Energy
(b) Linear momentum
(c) Mass
(d) Angular momentum **[Kanpur 2015]**

The acceleration due to gravity (g) above the surface of the earth :

(a) increases
(b) remains unchanged
(c) sometimes decreases and sometimes increases
(d) decreases **[Kanpur 2015]**

The velocity of a communication satellite relative to earth is :

(a) 11.2 km/sec.
(b) zero
(c) 1.66 km/sec.
(d) 8 km/sec. **[Kanpur 2015]**

When we move from equator towards poles, the value of g :

(a) remains unchanged
(b) increases
(c) decreases upto 45° longitude
(d) decreases **[Kanpur 2015]**

The orbit of planets moving around the sun is :

(a) Elliptical
(b) Circular
(c) Hyperbolic
(d) Parabolic **[Kanpur 2015]**

A body at rest breaks into two pieces of equal masses. The parts will move : [Kanpur 2015]

(a) in opposite direction with equal speeds
(b) in opposite direction with unequal speeds
(c) in the same direction
(d) along different lines

A particle of mass m moving with a velocity v makes head on collision with another particle of mass m initially at rest. The velocity of first particle after collision is : [Kanpur 2015]

(a) 0 (b) $-\frac{v}{2}$ (c) v (d) $-v$

A ball moving with velocity v collides elastically with another ball of same mass at rest. After the collision, the two balls have equal speeds. Then the angle between the direction of velocities of the two balls after collision is : [Kanpur 2015]

(a) 180° (b) 90° (c) 0° (d) 45°

Two spheres of mass M and 2M are initially at rest at a distance of d. The move towards each other under their mutual attraction. When the distance between them is $\frac{d}{2}$,the acceleration of their centre of mass is : [Kanpur 2015]

(a) g (b) 3 g (c) 0 (d) 2 g

A bullet strikes a wooden target and gets embedded in it, then the collision is :

(a) inelastic
(b) perfectly elastic
(c) elastic
(d) perfectly inelastic [Kanpur 2015]

When external forces acting on a system have a zero resultant, then the centre of mass has zero :

(a) kinetic energy
(b) momentum
(c) velocity
(d) acceleration [Kanpur 2015]

The centre of mass of a body lies :

(a) on the surfaces of a body
(b) within the material of a body
(c) may lie inside, outside or on the surface of a body
(d) outside the material of a body [Kanpur 2015, 19]

In the HCl molecule, the separation between nuclei of two atoms is about 1.27 Å . Location of the centre of mass (CM) of the molecule is :

(a) 7.23 Å
(b) 1.98 Å
(c) 1.15 Å
(d) 1.24 Å [Kanpur 2016]

Two particles of masses 2.0 kg and 0.5 kg have their positions $(5\hat{i} + 3\hat{j} + 6\hat{k})$ metre and $(-6\hat{i} + 8\hat{j} - \hat{k})$ metre respectively. The centre of mass of joint system will be :

(a) $\frac{-20\hat{i} + 46\hat{j} + 7\hat{k}}{7}$
(b) $\frac{40\hat{i} + 46\hat{j} + 17\hat{k}}{7}$
(c) $\frac{20\hat{i} + 46\hat{j} + 7\hat{k}}{7}$
(d) None of the above [Kanpur 2016]

A solid cylinder of mass M and radius R rolls down an inclined plane from height h without slipping. The speed of the centre of mass when it reaches the bottom is :

(a) $\sqrt{\frac{6}{3}gh}$ (b) $\sqrt{\frac{4}{3}gh}$ (c) $\sqrt{\frac{10}{3}gh}$ (d) $\sqrt{\frac{2}{5}gh}$

The acceleration of a body rolling down an inclined plane does not depend on :

(a) angle of inclination (b) acceleration due to gravity
(c) mass of body (d) radius of body **[Kanpur 2015]**

Which of the following formula is not correct ?

(a) $\vec{J} = \vec{r} \times \vec{F}$ (b) $\vec{F} = m\vec{a}$
(c) $\vec{J} = \vec{r} \times \vec{p}$ (d) $\vec{p} = m\vec{v}$ **[Kanpur 2015]**

Moment of inertia is :

(a) a vector quantity (b) tensor quantity
(c) both scalar and vector quantity (d) a scalar quantity **[Kanpur 2015]**

The correct relationship among rotational kinetic energy (K), moment of inertia (I) and angular momentum (J) is :

(a) $K = \frac{J}{I}$ (b) $K = \frac{1}{2}IJ^2$
(c) $K = \frac{1}{2}JI^2$ (d) $K = \frac{J^2}{2I}$ **[Kanpur 2015]**

The moment of inertia of rod of mass M and length l about an axis passing through its centre of mass and perpendicular to its length is $\frac{1}{12}Ml^2$. The moment of inertia of the rod about an axis passing through one end of the rod perpendicular to its length will be :

(a) $\frac{1}{5}Ml^2$ (b) $\frac{1}{4}Ml^2$
(c) $\frac{1}{2}Ml^2$ (d) $\frac{1}{3}Ml^2$ **[Kanpur 2015]**

The radius of gyration of an object depends on :

(a) its axis of rotation (b) its size only
(c) its shape only (d) All of the above **[Kanpur 2015]**

The moment of inertia of a disc of mass M and radius R about an axis perpendicular to its plane and passing through its centre is :

(a) $\frac{1}{4}MR^2$ (b) MR^2
(c) $\frac{1}{2}MR^2$ (d) $\frac{2}{5}MR^2$ **[Kanpur 2015]**

The depression at the midpoint of the girder is reduced by :

(a) decreasing breadth (b) increasing breadth

(c) increasing length (d) decreasing thickness

[Kanpur 2018]

A metallic beam is fixed at its ends and loaded in the middle. The depression δ of the beam is :

(a) $\delta \propto Y$ (b) $\delta \propto \frac{1}{Y}$ (c) $\delta \propto \frac{1}{Y^2}$ (d) $\delta \propto Y^2$

[Kanpur 2018]

Young's modulus of a perfectly plastic body is :

(a) 1 (b) ∞ (c) 0 (Zero) (d) None of these

[Kanpur 2018, 19]

The correct relation is :

(a) $\vec{F} = \frac{d\vec{J}}{dt}$ (b) $\vec{J} = \frac{d\vec{F}}{dt}$ (c) $\vec{J} = \frac{d\vec{\tau}}{dt}$ (d) $\vec{\tau} = \frac{d\vec{J}}{dt}$

[Kanpur 2018]

The correct relation is :

(a) $Y > \eta$ (b) $\sigma < -1$ (c) $\sigma = \frac{Y}{2\eta} - 1$ (d) $\sigma = \frac{3k}{Y}$

[Kanpur 2019]

The limiting values of Poisson's ratio is :

(a) $\sigma > 0.5$ (b) $1 < \sigma < 0.5$ (c) $-1 < \sigma < 0.5$ (d) $\sigma < 0.5$

[Kanpur 2019]

Cross-section area of a wire is $0.5\,\text{cm}^2$. Young's modulus is $2\times10^{11}\ \text{N/m}^2$. What will be magnitude of force required to double the length of the wire ?

(a) 10^7 Newton (b) 10^8 Newton

(c) 10^{10} Newton (d) Zero

[Kanpur 2019]

A steel wire of 1 mm radius is bent in the form of a circular arc of radius 50 cm. Given Young's modulus for steel is 2×10^{12} dynes $/\text{cm}^2$, the bending moment will be :

(a) $2\pi\times10^6$ dyne-cm (b) $\pi\times10^6$ dyne-cm

(c) $\frac{\pi}{2}\times10^6$ dyne-cm (d) $4\pi\times10^6$ dyne-cm [Kanpur 2019]

Which one is more elastic in the following ?

(a) Air (b) Water (c) Mercury (d) Both (a) and (b)

[Kanpur 2019]

The value of Poisson's ratio for which the volume of the rod remains unchanged by application of external force is :

(a) 0.1 (b) −1 (c) 0.00 (d) 0.5 [Kanpur 2019]

Which of the following remains constant in SHM ?
(a) Potential energy (b) Restoring force
(c) Time period (d) Kinetic energy **[Kanpur 2015]**

The acceleration and displacement of a particle executing SHM have a phase difference of :
(a) 90° (b) 180° (c) 360° (d) 0° **[Kanpur 2015]**

The total energy of a simple pendulum is E. When its displacement is half of its amplitude, its kinetic energy will be :
(a) E (b) $\frac{E}{2}$ (c) $\frac{3E}{4}$ (d) $\frac{E}{4}$
[Kanpur 2015, 18, 19]

The total energy of an oscillator is :
(a) $E = \frac{1}{2} m\omega^2 a^2$ (b) $E = \frac{1}{2} ca^2$
(c) $E = 2m\pi^2 a^2 n^2$ (d) All of the above **[Kanpur 2016]**

If force on a body is given by $F = -kx$, where k is constant, then shape of kinetic energy curve will be : **[Kanpur 2016]**
(a) sinusoidal (b) exponential
(c) parabolic with downward head (d) parabolic with upward head

Which of the following statements is true for the energy of the oscillator ?
(a) It is wholly potential at points $x = \pm a$.
(b) It is partially kinetic and partly potential at points $-a < x < a$.
(c) It is wholly kinetic at point $x = 0$.
(d) All of the above **[Kanpur 2016]**

A particle of mass 10 gram lies in a potential field $V = 5x^2 + 10$ joule/kg. The frequency of oscillation will be : **[Kanpur 2016]**
(a) $\frac{\sqrt{10}}{2\pi}$ Hz (b) $\frac{10}{2\pi}$ Hz (c) $\frac{\sqrt{5}}{2\pi}$ Hz (d) None of these

Which of the following statements is true for vertical oscillation of spiral spring ?
(a) gravity has no effect on its frequency.
(b) gravity has no effect on its force constant.
(c) Both (a) and (b) are correct (d) None of the above **[Kanpur 2016]**

Two springs of force constant K are joined in series. What will be equivalent force constant ?
(a) $\frac{K}{2}$ (b) K
(c) $2K$ (d) None of the above **[Kanpur 2016]**

For lesser velocity of an oscillator, the damping force is proportional to :

(a) $\log v$ (b) v^2

(c) v (d) $v^{1/2}$ **[Kanpur 2015]**

If a straight hole is drilled through the centre of the earth and a ball is dropped into the hole, then the frequency of oscillation of the ball will be (Given, radius of earth = R) :

(a) $\frac{1}{2\pi}\sqrt{\frac{g}{R}}$ (b) $\frac{1}{2\pi}\sqrt{\frac{R}{g}}$

(c) $\frac{1}{\pi}\sqrt{\frac{2g}{R}}$ (d) None of these **[Kanpur 2016]**

Vibrations of the screen of a microphone are :

(a) damped oscillations (b) forced oscillations

(c) free oscillations (d) resonant oscillations

[Kanpur 2016]

$\frac{d^2x}{dt^2} + 2b\frac{dx}{dt} + \omega_0^2 x = 0$ is the equation of a damped harmonic oscillator. The oscillation will be overdamped, if :

(a) $b > \omega_0$ (b) $b = \omega_0$

(c) $b < \omega_0$ (d) $b >> \omega_0$ **[Kanpur 2016]**

The meaning of high quality factor of an oscillator :

(a) damping is more (b) damping is small

(c) damping is zero (d) damping is infinite **[Kanpur 2016]**

A tuning fork has frequency 600 Hz and its quality factor is 5×10^4. In what time after its energy becomes $\frac{1}{10}$ th of its initial value ? **[Kanpur 2016]**

(a) 60 sec (b) 50 sec (c) 30 sec (d) 15 sec

The quality factor of a L-C-R damped oscillator of low resistance is : :

(a) LWR (b) R/LW

(c) W/RL (d) LW/R **[Kanpur 2016]**

Resonance frequency of a forced oscillator is :

(a) $\omega_r = h$ (b) $\omega_r = \sqrt{h^2 - 2b^2}$

(c) $\omega_r = \frac{h^2}{b^2}$ (d) None of the above **[Kanpur 2016]**

The rate of fall in amplitude with the change of forcing frequency on each side of the resonant frequency is known as :

(a) quality factor (b) amplitude resonance

(c) sharpness of resonance (d) None of the above **[Kanpur 2016]**

The differential equation of a particle given by $\frac{d^2x}{dt^2} + a\,x = 0$ represents :

(a) non-oscillatory and S.H.M.
(b) oscillatory and S.H.M.
(c) uniform circular motion
(d) straight line motion

[Kanpur 2018]

The temperature at which the speed of sound in air becomes double of its value at 27°C is :

(a) 108°C (b) 927°C (c) 54°C (d) 1200°C

[Kanpur 2018]

The speed of longitudinal wave travelling in a gas of pressure P and density d is :

(a) $\nu = \sqrt{\frac{\gamma P}{d}}$ (b) $\nu = \sqrt{\frac{P}{d}}$ (c) $\nu = \sqrt{\frac{P}{\gamma d}}$ (d) $\nu = \gamma\sqrt{\frac{P}{d}}$

[Kanpur 2018]

If E is mean energy and τ is relaxation time, the power dissipation of a damped harmonic oscillator is :

(a) $E\tau$ (b) $E\tau^2$ (c) E/τ^2 (d) E/τ

[Kanpur 2018]

The quality factor of an oscillatory system is :

(a) $Q = 2\pi \frac{\text{Energy stored}}{\text{Energy loss per period}}$

(b) $Q = 2\pi \frac{\text{Energy loss per period}}{\text{Energy stored}}$

(c) $Q = \frac{1}{2\pi} \frac{\text{Energy stored}}{\text{Energy loss per period}}$

(d) $Q = \frac{1}{2\pi} \frac{\text{Energy loss per period}}{\text{Energy stored}}$

[Kanpur 2018]

The expression for intensity of a wave is :

(a) $2\pi^2 n^2 A^2 e$
(b) $2\pi^2 n^2 A^2 e^2$
(c) $2\pi^2 n^2 A^2 e^2 v$
(d) $2\pi^2 n^2 A^2 ev$

[Kanpur 2018]

At resonance the phase of displacement and velocity with respect to driving force :

(a) lags behind, zero
(b) leads ahead, zero
(c) lags behind, leads ahead
(d) zero, lags behind

[Kanpur 2018]

The number of beats produced by oscillations $y_1 = a\sin 320\pi t$ and $y_2 = a\sin 326\pi t$ is :

(a) 3 (b) 6 (c) 2 (d) 4 **[Kanpur 2015]**

When a sound wave moves from one medium to another medium, which of the following remains unchanged ?

(a) wavelength (b) frequency of sound

(c) velocity (d) All of the above **[Kanpur 2015]**

The sound level at a place is increased by 40 dB. The intensity increases by a factor of :

(a) 10^2 (b) 40

(c) 10^4 (d) 10 **[Kanpur 2015]**

The intensity of sound wave depends on :

(a) number of overtones (b) amplitude only

(c) frequency as well as amplitude (d) frequency only **[Kanpur 2015]**

An organ pipe open at both ends produces :

(a) no harmonic (b) only odd harmonics

(c) only even harmonics (d) both even and old harmonics **[Kanpur 2015]**

In a stationary wave $y = 4\sin\left(\frac{\pi x}{15}\right)\cos(96\pi t)$, the distance between a node and antinode is :

(a) 22.5 (b) 7.5

(c) 15 (d) 30 **[Kanpur 2015]**

The energy is transferred :

(a) Only by progressive wave (b) Only by stationary wave

(c) By both progressive and stationary waves

(d) None of the above **[Kanpur 2016]**

The amplitude of stationary wave is zero at :

(a) an antinode (b) node

(c) a point midway between node and antinode

(d) None of the above **[Kanpur 2016]**

For production of beats, the waves must be :

(a) Coherent and of nearly same frequency

(b) Coherent and of same frequency

(c) Incoherent and of nearly same frequency

(d) Incoherent and of same frequency **[Kanpur 2018]**

Which of the following physical quantity of a wave changes when the wave is reflected from a rigid boundary ?

(a) wavelength (b) amplitude (c) frequency (d) velocity **[Kanpur 201, 19]**

Ultrosonic, infrasonic and audio waves travel through a medium with speeds v_u, v_i and v_a respectively, then : **[Kanpur 2019]**

(a) $v_u = v_i = v_a$ (b) $v_u > v_a > v_i$

(c) $v_u < v_a < v_i$ (d) $v_a \le v_u$ and $v_u < v_i$