Q.1 Choose the correct option.

(A) For perfect plastic material, there is no restoring force.

(B) Young's molecule for a perfectlyPlastic body is zero.

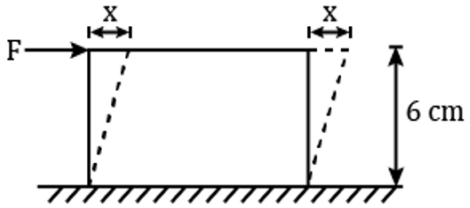
(C) Steel is more elasticthan rubber.

(D) All of the above are correct.

Q.2 The substances having very short plastic region are

(A) Ductile **(B)** Brittle **(C)** Malleable **(D)** All of these

Q.3 A steel plate of upper face area 2 cm^2 and thickness 6 cm is fixed rigidly at the lower surface. A tangential force F = 20 kN is applied on the upper surface as shown in the figure. The lateral displacement x of upper surface w.r.t the lower surface is (Take modulus of rigidity for steel is 8×10^{11} N/m^2).



(A) 7.5×10^{-6}m **(B)** 30×10^{-6}m **(C)** 15×10^{-6}m **(D)** 3.5×10^{-6}m

Q.4 Bulk modulus of an incompressible liquid is

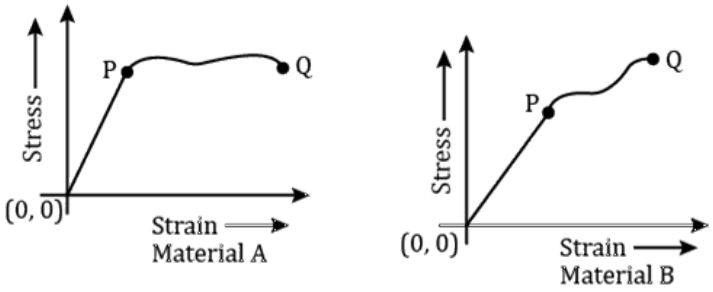
(A) Zero **(B)** Infinity

(C) Unity **(D)** Between Zero & $Unity$

Q.5 A spherical ball contracts in volume by 0.02% when subjected to a normal uniform pressure of 100 atm. The bulk modulus of its material is.

(A) 2.02×10^{10} N/m^2 **(B)** 1.01×10^{11} N/m^2 **(C)** 5.05×10^{10} N/m^2 **(D)** 1.01×10^{10} N/m^2

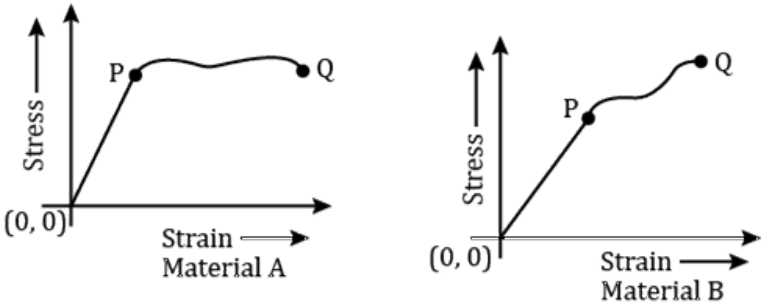
Q.6 The stress strain graphs for two materials A and B are shown in figure. The graph is drawn to the same scale Select the correct statement.



(A) Material A has greater Young's Modulus **(B)** Material A is more ductile

(C) Material B is more ductile **(D)** Both (a) and (b)

Q.7 The stress strain graphs for two materials A and B are shown in figure. The graph is drawn to the same scale Select the correct statement.



(A) Material A has greater Young's Modulus **(B)** Material A is more ductile
(C) Material B is more ductile **(D)** Both (a) and (b)

Q.8 The lateral strain produced in the wire is 0.01×10^{-3}. If Poisson's ratio is 0.4, then find the longitudinal strain produced in the wire.
(A) 5×10^{-5} **(B)** 1.25×10^{-5} **(C)** 10×10^{-5} **(D)** 2.5×10^{-5}

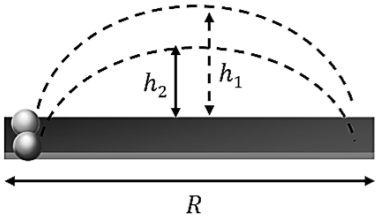
Q.9 The work done per unit volume to stretch the length of a wire having area of cross section 5 mm^2 by 4% will be.(Take Young's modulus $Y = 8 \times 1010\ N/m^2$)
(A) 64 MJ/m^3 **(B)** 32 MJ/m^3 **(C)** 64 J/m^3 **(D)** 32 J/m^3

Q.10 A steel wire of length 5 m is suspended vertically, stretches by 20 mm when mass of 60 kg is attached to the lower end. Find the elastic potential energy gained by the wire. (take g = 10 m/s2)
(A) 0.6J **(B)** 6J **(C)** 60J **(D)** 600J

Q.11 Choose the correct option.
When a uniform metallic wire is stretched the lateral strain produced in it is β. If v and Y are the Poisson's ratio and Young's modulus for the wire, then elastic potential energy density of wire is
(A) $\frac{Y\beta^2}{2}$ **(B)** $\frac{Y\beta^2}{2v^2}$ **(C)** $\frac{Yv\beta^2}{2}$ **(D)** $\frac{Yv^2}{2\beta}$

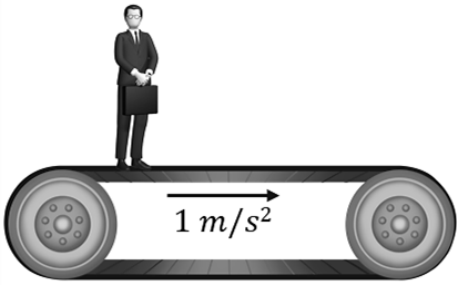
WORK SHEET

Q.1 A projectile can have the same range for two angles of projection. If $h_1$and $h_2$are maximum heights when the range in the two cases is R then the relation between R, $h_1$and h_2 is



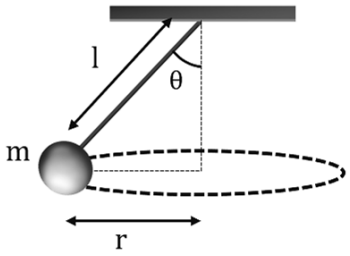
(A) $R = 4\sqrt{h_1 h_2}$ **(B)** $R = 2\sqrt{h_1 h_2}$ **(C)** $R = \sqrt{h_1 h_2}$ **(D)** None of these

Q.2 A man standing stationary with respect to be horizontal conveyer belt which is accelerating with $1\ m/s^2$ as shown in figure. If the coefficient of static friction between man's shoes and the belt is 0.2, up to what acceleration of the belt can the man continue to be stationary relative to the belt? (Mass of the man = 65 kg). Take $g = 10\ m/s^2$



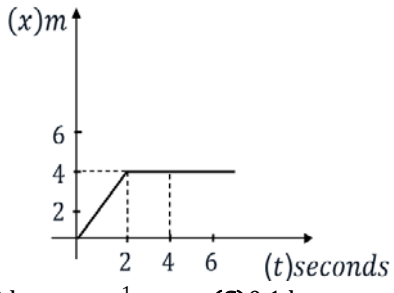
(A) $1\ m/s^2$ **(B)** $2.5\ m/s^2$ **(C)** $3\ m/s^2$ **(D)** $2\ m/s^2$

Q.3 A string of length l = 1 m fixed at one end carries a mass m = 1 kg at the other end. The string is rotating at a rate of $\frac{2}{\pi}$rev/s about the axis through the fixed end as shown in the figure. Then the tension in the string is



(A) 11N **(B)** 12N **(C)** 13N **(D)** 16N

Q.4 In the given figure, the position-time graph of a particle of mass m = 0.1 kg is shown. The impulse at t = 2 sec is



(A) 0.2 kg m sec^{-1} **(B)** −0.2 kg m sec^{-1} **(C)** 0.1 kg m sec^{-1} **(D)** −0.4 kg m sec^{-1}

Q.5 Which one of the following statements is true regarding collision of bodies in absence of external forces? (Considering all surfaces to be smooth)

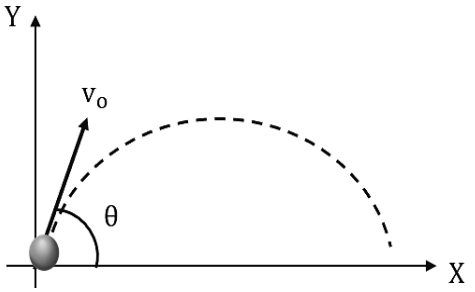
(A) Momentum is conserved in collision but Kinetic energy is conserved only in case of elastic collision.

(B) Momentum is conserved in collision but not kinetic energy.

(C) Both Momentum and kinetic energy are conserved in all case of collision.

(D) Neither momentum nor kinetic energy is conserved in elastic collision.

Q.6 A particle of mass m is projected at an angle θ with the X -axis with an initial velocity $v0$ in the $X-Y$ plane as shown in the figure. At a time $t < \frac{v0 \sin \theta}{g}$,the angular momentum of the particle about originis

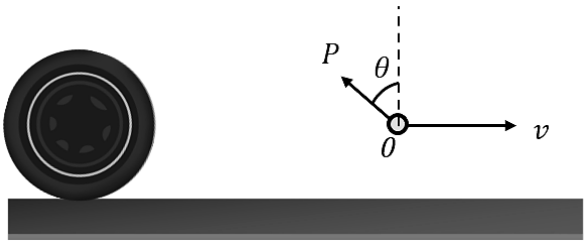


(A) $-mgv0t^2 \cos\theta\,\hat{j}$ **(B)**$mgv0t \cos\theta\,\hat{k}$ **(C)** $-\frac{1}{2}mgv0t^2 \cos\theta\ \hat{k}$ **(D)** $\frac{1}{2}mgv0t^2 \cos\theta\,\hat{i}$

Q.7 The angular speed of a body changes from $\omega 1$to $\omega 2$ due to changes in its moment of inertia without applying torque. The ratio of radius of gyration in the two cases is

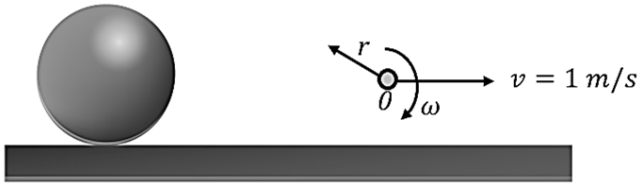
(A) $\omega_1 : \omega_2$ **(B)** $\sqrt{\omega_2}\ :\ \sqrt{\omega_1}$ **(C)** $\sqrt{\omega_2^2} : \sqrt{\omega_1^2}$ **(D)** $\sqrt{\omega_2^3} : \sqrt{\omega_1^3}$

Q.8 A wheel is rolling without slipping on ground along a straight line. If the axis of the wheel has a linear speed v, the instantaneous velocity of point P at an angle θ from vertical on the rim, relative to the ground will be



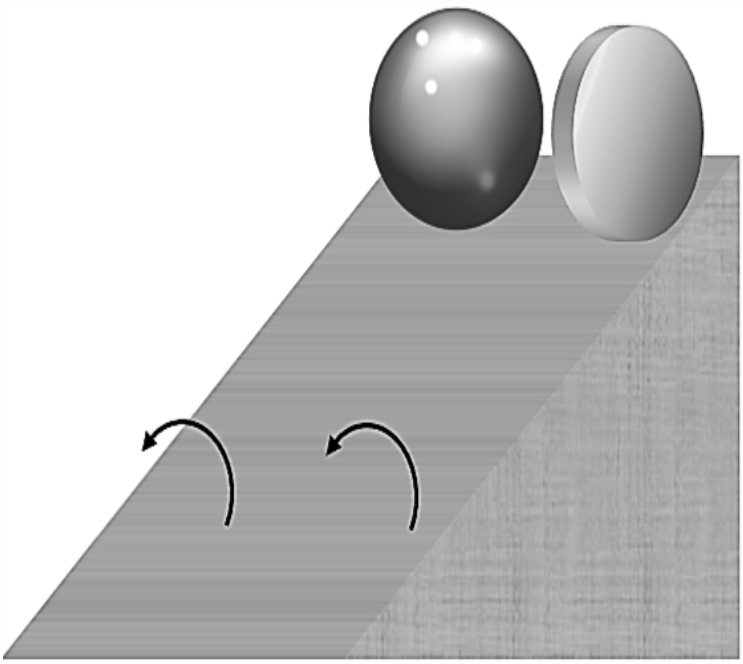
(A)$v \cos\left(\frac{\theta}{2}\right)$ **(B)** $2v \cos\left(\frac{\theta}{2}\right)$ **(C)**$v\ (1 + \sin\theta)$ **(D)** $v(1 + \cos\theta)$

Q.9 If a solid sphere of mass 1 kg and radius 0.1 m rolls without slipping at a uniform velocity of 1 m/s along a straight line on a horizontal floor, then its kinetic energy is



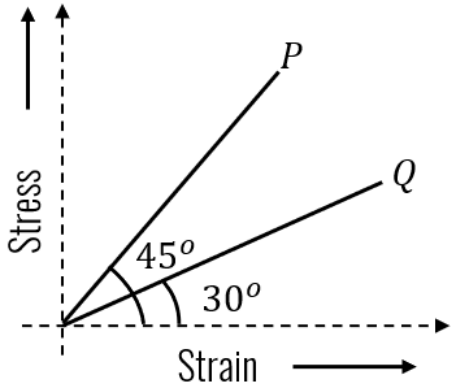
(A)$\frac{7}{5}$J **(B)**$\frac{2}{5}$ J **(C)**$\frac{7}{10}$J **(D)**1J

Q.10 When a uniform solid sphere and a disc of the same mass and of the same radius rolls down without slipping on a smooth inclined plane from rest to the same distance along the inclined plane, then the ratio of the time taken by solid sphere and the disc to cover the distance is



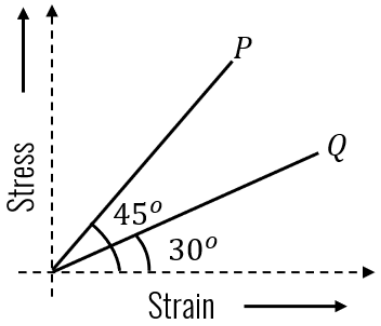
(A) 15 :14 **(B)** $15^2 : 14^2$ **(C)** $\sqrt{14} : \sqrt{15}$ **(D)** $15^2 : 14^2$

Q.11 The stress versus strain graph for the wire of two materials P and Q are shown in the figure. If the Y_p and Y_Q are the Young's modulus of the materials, then



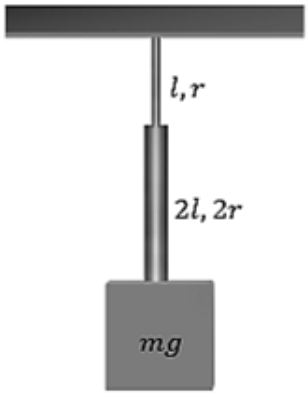
(A) $Y_P = 3YQ$ **(B)** $Y_P = \sqrt{3}Y_Q$ **(C)** $Y_P = YQ$ **(D)** $Y_Q = \sqrt{3}\,Y_P$

Q.12 The load versus elongation graph for four wires of same length and the same material is shown in figure. The thinnest wire is represented by line



(A) OC **(B)** OD **(C)** OA **(D)** OB

Q.13 Two wires of length l, radius r and length 2l, radius 2r respectively having same Young's modulus are hung with a weight mg as shown in figure. The net elongation is

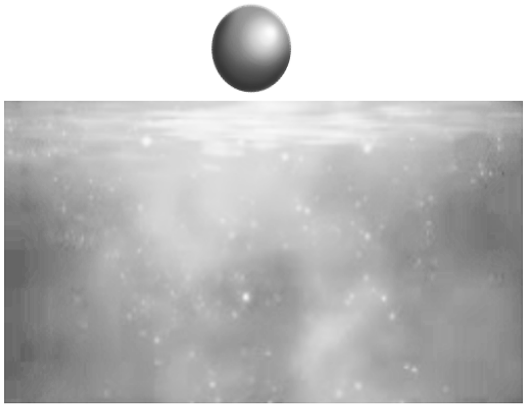


(A) $\frac{3mgl}{\pi r^2 Y}$ **(B)** $\frac{3mgl}{2\pi r^2 Y}$ **(C)** $\frac{2mgl}{3\pi r^2 Y}$ **(D)** $\frac{3mgl}{4\pi r^2 Y}$

Q.14 The approximate depth of an ocean is 3500 m. The compressibility of water is $50 \times 10^{-11} Pa^{-1}$ and density of water is $10^3 kg/m^3$. Find the fractional compression of water that will be obtained at the bottom of the ocean. (Take $g = 10\ m/s^2$)

(A) 5.25×10^{-2} **(B)** 10.5×10^{-2} **(C)** 1.75×10^{-2} **(D)** 2.625×10^{-2}

Q.15 When a rubber ball is taken to the bottom of a sea of depth 2000 m, the volume of the rubber ball decreases by 1.5 %. Find the bulk modulus of the rubber ball. Take the density of water $\rho = 1000\ kg/m^2$ and $g = 10\ m/s^2$.



(A) $2.66\times10^9 N/M^2$ **(B)** $3.3\times10^9 N/M^2$ **(C)** $6.6\times10^9 N/M^2$ **(D)** $1.33\times10^9 N/M^2$

Q.16 There is no change in the volume of a wire due to change in its length on stretching. The Poisson's ratio of the material of the wire is

(A) $-\frac{1}{2}$ **(B)** $\frac{1}{2}$ **(C)** $-\frac{1}{4}$ **(D)** $\frac{1}{4}$

Q.17 Choose the correct relationship between Young's modulus (Y), shear modulus (G) and Poisson's ratio (μ).

(A) $Y = 2G(1 - 2\mu)$ **(B)** $Y = 2G(1 - \mu)$ **(C)** $Y = 2G(1 + 2\mu)$ **(D)** $Y = 2G(1 + \mu)$

Q.18 Find the value of Poisson's ratio (μ) of a material whose bulk modulus (K) value is half of its Young's modulus (Y) value.

(A) $\frac{1}{3}$ **(B)** $\frac{1}{6}$ **(C)** $\frac{1}{4}$ **(D)** $\frac{1}{2}$

Q.19 If in a wire of Young's modulus Y, longitudinal strain X is produced, then the elastic potential energy stored in its unit volume will be.

(A) $0.5\ YX^2$ **(B)** $0.5\ Y^2X$ **(C)** $2YX^2$ **(D)** YX^2

Q.20 Choose the correct relationship between Young's modulus (Y), shear modulus (G) and Poisson's ratio (μ).

(A) $\frac{\phi^2V}{2G}$ **(B)** $\frac{G\phi V2}{2}$ **(C)** $\frac{\phi V}{2G}$ **(D)** $\frac{1}{2}G\phi 2V$

Q.21 A metal wire having Poisson ratio $1/4$ and Young's modulus $4 \times 10^{10}\ N/m^2$ is stretched by a force, which produces a lateral strain of 0.01 % in it. The elastic potential energy stored per unit volume in wire is (in J/m^3)

(A) 2500 **(B)** 3200 **(C)** 6400 **(D)** 1250

ANSWER KEY

Q.	1	2	3	4	5	6	7	8	9	10
Sol.	(D)	(B)	(A)	(B)	(C)	(D)	(A)	(D)	(A)	(B)
Q.	11									
Sol.	(B)									
WORK SHEET										
Q.	1	2	3	4	5	6	7	8	9	10
Sol.	(A)	(D)	(D)	(B)	(A)	(C)	(B)	(B)	(C)	(C)
Q.	11	12	13	14	15	16	17	18	19	20
Sol.	(B)	(C)	(C)	(C)	(D)	(B)	(D)	(B)	(A)	(B)
Q.	21	22	23	24	25	26	27	28	29	30
Sol.	(B)									