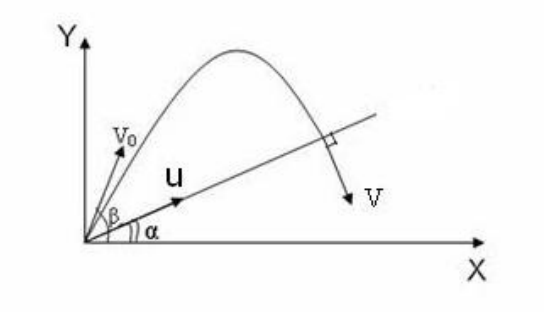
Physique

Sujet proposé par *Sokseiha MUY*

Q1 : A projectile is released with an initial velocity V_0 at inclination β on an inclined plane making an angle α with the horizontal. Calculate the angle β such that projectile strikes the inclined plane with a velocity perpendicular to it.



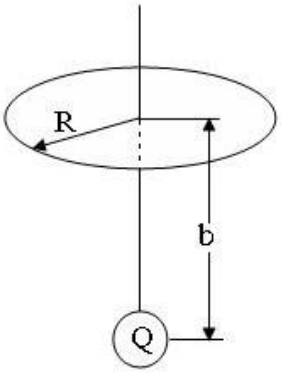
A. $\tan\beta = \dfrac{1+\tan^2\alpha}{\tan\alpha}$

B. $\tan\beta = \dfrac{1+2\tan^2\alpha}{\tan\alpha}$

C. $\tan\beta = \dfrac{1+\tan\alpha}{\tan\alpha}$

D. $\tan\beta = \dfrac{1+\tan^2\alpha}{\tan^2\alpha}$

Q2 : A point charge Q is located on the axis of a disk of radius R of distance b from the plane of the disk. If one fourth of the electric flux from the charge passes through the disk, then the radius of disk is given by:



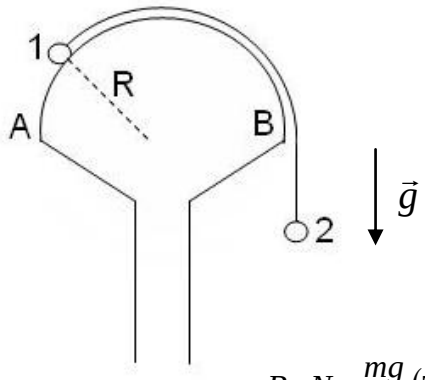
A. $R = \sqrt{3}b$

B. $R = \sqrt{5}b$

C. $R = 2b$

D. $R = \sqrt{6}b$

Q3 : Two small beads each of m are connected by a cord and initially placed in the position of equilibrium on smooth cylindrical surface (the bead 1 one was initially at A and the bead 2 at B). The mass 2 is displaced slightly downward, thus setting the system in motion. At the top of the cylinder the reaction of the cylinder on the mass 1 is given by:



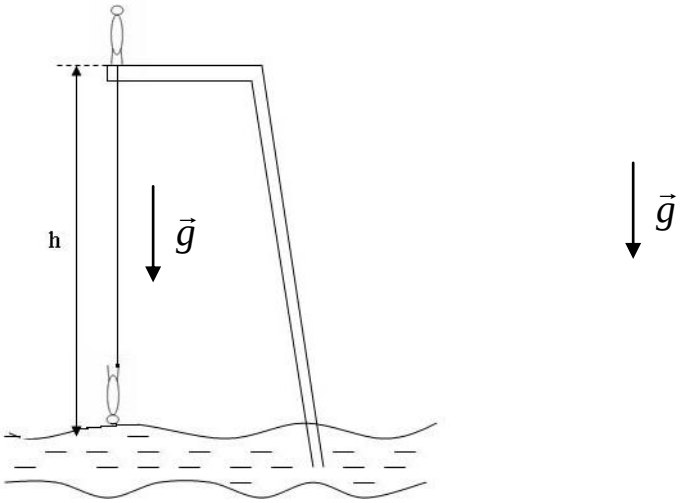
A. $N=\frac{mg}{2}(4-\pi)$

B. $N=\frac{mg}{2}(5-\pi)$

C. $N=\frac{mg}{2}(6-\pi)$

D. $N=\frac{mg}{2}(7-\pi)$

A man of height h_0 = 2m is bungee jumping from a platform situated a height h = 25 m above a lake. One end of an elastic rope is attached to his foot and the other end is fixed to the platform. He starts falling from rest in a vertical position.



The length and elastic properties of the rope are chosen so that his speed will have been reduced to zero at the instant when his head reaches the surface of the water. Ultimately the jumper is hanging from the rope, with his head 8m above the water.

g = 10m s^{-2}

Q4 : The unstretched length of the rope is:

A. $l_0=10m$

B. $l_0=11m$

C. $l_0=12m$

D. $l_0=13m$

Q5 : The maximum speed achieved during the jump is:

A. $V_{max}=17ms^{-1}$

B. $V_{max}=18ms^{-1}$

C. $V_{max}=19ms^{-1}$

D. $V_{max}=20ms^{-1}$

Q6 : The maximum acceleration achieved during the jump is:

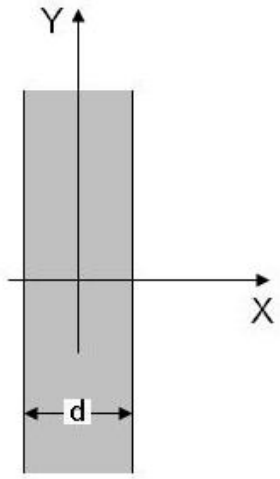
A. $a_{max} = 2g$

B. $a_{max} = 3g$

C. $a_{max} = 4g$

D. $a_{max} = 5g$

Q7 : A slab of insulating material (infinite in two of its three dimensions) has a uniform positive charge ρ and thickness d. If an electron of charge –e and mass m_e is released from rest at a distance x from the center, then it will oscillates with a frequency f given by:



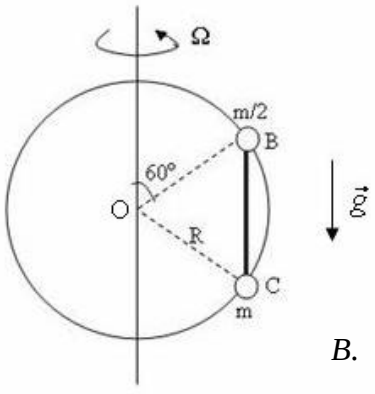
A. $f = \frac{1}{2\pi}\sqrt{\frac{\rho e}{m_e \varepsilon_0}}$

B. $f = \frac{1}{2\pi}\sqrt{\frac{\rho m_e}{e \varepsilon_0}}$

C. $f = \frac{1}{2\pi}\sqrt{\frac{m_e \varepsilon_0}{\rho e}}$

D $f = \frac{1}{2\pi}\sqrt{\frac{e \varepsilon_0}{\rho m_e}}$

Q8 : Two beads of mass m and m/2 are threaded on a smooth wire in a form of circle of radius r and with center O. The wire is free to rotate about its fixed vertical diameter. The 2 beads are connected by means of a massless rod of length r. When the wire is made to rotate with fixed angular velocity Ω, the rod BC remains vertical. The radius OB makes an angle of 60° with the downward vertical. The rod exerts equal and opposite vertical forces on the two beads. The angular velocity Ω is given by:



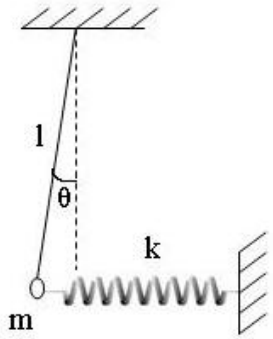
A. $\Omega = \sqrt{\frac{5g}{R}}$

B. $\Omega = \sqrt{\frac{6g}{R}}$

C. $\Omega = \sqrt{\frac{8g}{R}}$

D. $\Omega = \sqrt{\frac{10g}{R}}$

Q9 : A bead of mass m is attached to one end of a massless rod of length. The other end of the rod is attached to a fixed point around which it can freely rotate. The bead is also attached to a one end of a spring with spring constant k while the other end is attached to a wall. The bead is slightly displaced from its equilibrium position and then released without initial velocity. Subsequently, the bead oscillates around its equilibrium position. Determine the period of this oscillation.



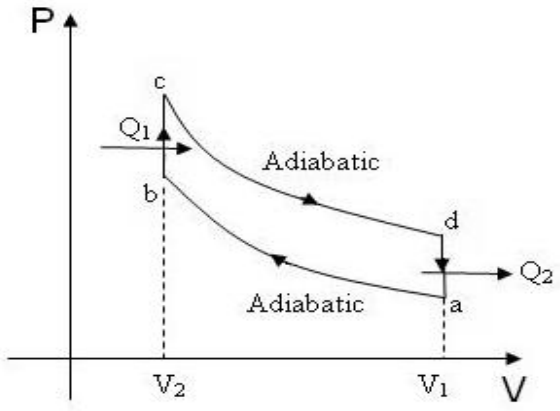
A. $T=2\pi\sqrt{\dfrac{ml}{mg+kl}}$

B. $T=2\pi\sqrt{\dfrac{2ml}{mg+kl}}$

C. $T=2\pi\sqrt{\dfrac{3ml}{mg+kl}}$

D. $T=2\pi\sqrt{\dfrac{5ml}{mg+kl}}$

Q10 : For a gasoline engine undergoing the cycle shown in the figure below, determine its thermal efficiency. Denote γ the adiabatic coefficient.



A. $\eta=1-\left(\dfrac{V_2}{V_1}\right)^{\gamma-2}$

B. $\eta=1-\left(\dfrac{V_2}{V_1}\right)^{\gamma-1}$

C. $\eta=1-\left(\dfrac{V_2}{V_1}\right)^{\frac{\gamma-1}{2}}$

D. $\eta=1-\left(\dfrac{V_2}{V_1}\right)^{\frac{\gamma-2}{2}}$