Projectile, energy, black hole, fracture

Projectile

Rotation

Energy

Static equilibrium

Black hole

Elasticity

Plasticity

Fracture

Fluid

Heat

Scholarship

Exchange students

American citizenship

Accessing all information you need

Collisions

Big foot vs small foot

Small foot is more likely to be more accurate and more precise, give less random error and systematic error because small foot can kick more accurately and precisely with respect to centre of mass of soccer ball.

Because of that, Messi is smaller and better than Ronaldo, who is bigger but, in real life, Ronaldo can kick the ball very accurately and precisely. In this case, physics fails but just a little bit.

Question:

Is big or small foot better for more accurate and precise kick of soccer ball?

Is Ronaldo or Messi better for that?

Projectile

Question:

Find minimum velocity and corresponding angle of release of projectile to hit the point (s, T).

$$x=tvcosA$$

$$y=tvsinA-\frac{gt^{2}}{2}$$

$$y=xTanA-\frac{gx^{2}}{2v^{2}}\left(1+\left(TanA\right)^{2}\right)$$

$$v^{2}=\frac{\left(1+\left(TanA\right)^{2}\right)gx^{2}}{2\left(y-xTanA\right)}$$

$$TanA=T$$

$$v^{2}=\frac{\left(1+T^{2}\right)gx^{2}}{2\left(y-xT\right)}$$

$$0=\frac{∂\left(v^{2}\right)}{∂T}=\frac{gx^{2}}{2}\left[\frac{\left(1+2T\right)\left(y-xT\right)+\left(1+T^{2}\right)x}{\left(y-xT\right)^{2}}\right]=0$$

$$xT^{2}+\left(x-2y\right)T-\left(x+y\right)=0$$

$$T\_{1,2}=\frac{2y-x\mp \sqrt{\left(x-2y\right)^{2}+4x\left(x+y\right)}}{2x}$$

https://calculus12s.weebly.com/uploads/2/5/3/9/25393482/projectile16.docx

' minimum velocity for projectile

x = 11

y = 2.5

'

g = 10

'

T1 = (2 \* y - x + Sqr((x - 2 \* y) ^ 2 + 4 \* x \* (x + y))) / (2 \* x)

T2 = (2 \* y - x - Sqr((x - 2 \* y) ^ 2 + 4 \* x \* (x + y))) / (2 \* x)

'MsgBox T1

'MsgBox T2

'

v1 = Sqr(g \* x ^ 2 \* (1 + T1 ^ 2) / (2 \* (x \* T1 - y)))

MsgBox v1

'v2 = Sqr(g \* x ^ 2 \* (1 + T2 ^ 2) / (2 \* (x \* T2 - y)))

'MsgBox v2

MsgBox Atn(T1) \* 180 / (4 \* Atn(1))

'MsgBox Atn(T2) \* 180 / (4 \* Atn(1))

calculus12s.weebly.com/uploads/2/5/3/9/25393482/velocity4minimum4projectile.txt

Question:

Check correctness of minimum velocity calculation by using x = 0.000000001 and y = 20.

Question:

Calculate minimum velocity for tanA = y/x +1/s

s = 20000000

x = 1

y = 1

g = 10

T1 = 1 / s + y / x

v1 = Sqr(g \* x ^ 2 \* (1 + T1 ^ 2) / (2 \* (x \* T1 - y)))

MsgBox v1

Question:

Find all projectile solutions for V0 = V0mimimum + 1/T.

$$x=tvCosA$$

$$y=tvSinA-\frac{gt^{2}}{2}$$

$$y=xTanA-\frac{gx^{2}}{2v^{2}}\left(1+\left(TanA\right)^{2}\right)$$

$$TanA=T$$

Quadratic equation for T:

$$\frac{gx^{2}}{2V^{2}}T^{2}-xT+y+\frac{gx^{2}}{2V^{2}}=0$$

$$T\_{1}=\frac{x+\sqrt{x^{2}-4\frac{gx^{2}}{2V^{2}}\left(y+\frac{gx^{2}}{2V^{2}}\right)}}{gx^{2}}V^{2}$$

$$T\_{2}=\frac{x-\sqrt{x^{2}-4\frac{gx^{2}}{2V^{2}}\left(y+\frac{gx^{2}}{2V^{2}}\right)}}{gx^{2}}V^{2}$$

Here V = V0.

s = 22000005

T = s Mod 100

x = 1

y = 1

g = 10

T1 = (2 \* y - x + Sqr((x - 2 \* y) ^ 2 + 4 \* x \* (x + y))) / (2 \* x)

T2 = (2 \* y - x - Sqr((x - 2 \* y) ^ 2 + 4 \* x \* (x + y))) / (2 \* x)

v1 = Sqr(g \* x ^ 2 \* (1 + T1 ^ 2) / (2 \* (x \* T1 - y)))

'v2 = Sqr(g \* x ^ 2 \* (1 + T2 ^ 2) / (2 \* (x \* T2 - y)))

v = v1 + 1 / T

T1 = v \* v \* (x + Sqr(x \* x - 4 \* g \* x \* x \* (y + g \* x \* x / (2 \* v \* v)) / (2 \* v \* v))) / (g \* x \* x)

T2 = v \* v \* (x - Sqr(x \* x - 4 \* g \* x \* x \* (y + g \* x \* x / (2 \* v \* v)) / (2 \* v \* v))) / (g \* x \* x)

MsgBox Atn(T1) \* 180 / (4 \* Atn(1))

MsgBox Atn(T2) \* 180 / (4 \* Atn(1))

https://physics15.weebly.com/uploads/3/0/2/7/30272185/2anglesof1initialvelocity1projectile23sept.txt

To hit the target as quickly as possible, we need to calculate minimum velocity, provide maximum initial velocity, which must be bigger than minimum velocity, chose the smallest angle of release for the maximum initial velocity.

Question:

How can I hit a target as quickly as possible, using projectile?

Question:

Prove that for the projectile

$$D\_{MAX}=x\_{MAX}=\frac{V\_{0}^{2}\sin(\left(2A\right))}{g}$$

$$H\_{MAX}=y\_{MAX}=\frac{V\_{0}^{2}\left(\sin(A)\right)^{2}}{2g}$$

$$V\_{y}=V\_{0}\sin(A)-gt$$

$$V\_{y}=0$$

$$t\_{H}=\frac{V\_{0}\sin(A)}{g}$$

$$t\_{D}=2t\_{H}$$

$$x\_{MAX}=D\_{MAX}=t\_{D}V\_{0}\cos(A)$$

$$y\_{MAX}=H\_{MAX}=t\_{D}V\_{0}\sin(A)-\frac{gt\_{D}^{2}}{2}$$

Angular velocity and linear acceleration

Question:

Find angular velocity and linear acceleration for v = T m/s and R = k meters.

s = 19107012

L = s Mod 10

T = s Mod 100

k = s Mod 10000

v = T

R = k

omega = v / R

a = R \* omega ^ 2

MsgBox omega

MsgBox a

https://physics16.weebly.com/uploads/5/9/8/5/59854633/angular\_velocity\_linear\_acceleration2019nov.txt

Question:

Find velocity and acceleration at T degrees latitude. Earth Radius = 6371.009km.

s = 19107016

T = s Mod 100

RE = 6371.009

Pi = 4 \* Atn(1)

omegaE = 2 \* Pi / 24

Angle = T \* Pi / 180

R = RE \* Cos(Angle)

v = R \* omegaE

a = R \* omegaE ^ 2

MsgBox v

MsgBox a

https://physics16.weebly.com/uploads/5/9/8/5/59854633/latitude4velocity4acceleration2019nov.txt

Question:

Find the angular speed and total acceleration for the rotational motion of the material point around the circumference with radius of T meters and constant linear speed of s meters per second.

s = 19107016

T = s Mod 100

R = T

v = s

omega = v / R

MsgBox omega

a = R \* omega ^ 2

MsgBox a

https://physics16.weebly.com/uploads/5/9/8/5/59854633/omega\_acceleration309task2019.txt

Potential energy

Question:

Find potential energy E = mgh. h = T.

https://en.wikipedia.org/wiki/Potential\_energy

s = 19107012

m = s Mod 35

T = s Mod 100

g = 10

h = T

E = m \* g \* h

MsgBox E

Kinetic energy

Question:

Give kinetic energy $E= \frac{mv^{2}}{2}$. v = T.

https://en.wikipedia.org/wiki/Kinetic\_energy

s = 19107012

m = s Mod 35

T = s Mod 100

v = T

E = m \* v ^ 2 / 2

MsgBox E

Definitions:

Distance is the total movement of object without regard to direction.

Displacement is distance moved in a particular direction.

Mass is the measure of resistance to change in motion (inertial mass).

Gravitational mass is measure of strength of gravitational force.

Speed is a scalar quantity that is equal to how far the object has moved divided by time taken.

Velocity is a quantity that designates how fast and in what direction a point is moving.

Momentum is product of mass of particle and its velocity.

Angular velocity is rotation rate, showing how fast object rotates.

Angular acceleration is the time rate of change of angular velocity.

Moment of inertia is resistance to angular acceleration. J = I = mR2

Angular momentum is moment of inertial times angular velocity.

Acceleration is the rate of change of the velocity of an object with respect to time.

Time is continued sequence of existence and events that occurs in irreversible succession from the part, through the present, into the future.

Torque is measure of force that can cause an object to rotate about an axis.

Question:

Define distance, displacement, time, speed, velocity, liner acceleration, linear momentum, angular velocity, angular acceleration, angular momentum, moment of inertia, force, torque.

Force

Force changes motion of body.

If physics, by nature, forces can be gravitational, electromagnetic, nuclear weak, nuclear strong.

By way of application, forces can be surface forces (friction) and volume forces (gravity, electromagnetism).

Surface force acts across surface element of body.

Volume force acts on all particles of given body.

Static equilibrium

Static equilibrium for material point is when all forces are 0.

Static equilibrium for mechanical system is when all forces are 0 and all torques are 0.

Question

Solve the pulley problem for the case of static equilibrium.

Moment of inertia

Moment of inertia is measure of resistance to change of angular velocity.

Black hole

Black hole is cosmic body with extremely intense gravity, from which even light cannot escape.

Question

Calculate the Schwarzschild radius for the k grams desk.

n = 15108097

k = n Mod 10000

T = n Mod 100

c = 2.99792458 \* 10 ^ 8

G = 6.67408 \* 10 ^ (-11)

M = k \* 10 ^ (-3)

Rs = 2 \* G \* M / c ^ 2

MsgBox Rs

http://physics16.weebly.com/uploads/5/9/8/5/59854633/radius4schwarzschild.txt

Question

Prove Schwarzschild radius formula from escape velocity expression

$$c=V\_{e}=\sqrt{2gR}=\sqrt{\frac{2GMR}{R^{2}}}=\sqrt{\frac{2GM}{R}}$$

$$R=\frac{2GM}{c^{2}}$$

R is radius of black hole of Schwarzschild

G is gravity constant

g is gravity acceleration

M is mass of the object, which is compressed to the size of black hole

Ve is escape velocity

c is the speed of light

Special relativity

Question:

Assess the time, size, mass when you move with c/1000000, c/1000, c/100, c/10, c/2, 0.8c, 0.9c.

$$\sqrt{1-\frac{v^{2}}{c^{2}}}$$

c = 300000000

v = c / 1000000

v = c / 1000

v = c / 100

v = c / 10

v = c / 2

v = 0.8 \* c

v = 0.9 \* c

MsgBox Sqr(1 - v \* v / (c \* c))

Chaos in classical mechanics

Double pendulum is chaotic.

en.wikipedia.org/wiki/Double\_pendulum

Spring

Some students do not know what spring is. Spring can oscillate. Oscillation is one of the most important phenomena in physics.

Elasticity

Hooks Law

F = kx

Elastic energy: E = 0.5kx2.

$$F=\frac{dE}{dx}$$

Electromagnetic nature of friction, elasticity, plasticity, fracture

Elasticity, friction, plasticity, fracture of solids in classical mechanic have electromagnetic causes.

Plasticity

Plastic deformation is irreversible deformation.

Fracture

Question:

What must the masses in the simple pulley problem to break the rope if the breaking point of the rope is T Newtons?

Fluid

Pressure = Force/Area

Pressure of fluid at depth h is $ρgh$

h is height or depth

ρ is density

g is gravity acceleration

A is area

V is volume

Proof: Pressure is F/A, pressure = mg/A, m = ρV, V = Ah, ρAhg/A = ρgh

Question:

Prove that pressure of fluid at depth h is $ρgh$

Question:

Calculate fluid pressure p = ρgh. ρ = a; h = T.

https://en.wikipedia.org/wiki/Pressure#Fluid\_pressure

s = 19107012

a = s Mod 25

T = s Mod 100

ro = a

g = 10

h = T

p = ro \* g \* h

MsgBox p

Question:

How will water level change if all floating icebergs will melt?

Bernoulli principle

$$ρgh+0.5ρV^{2}=constant$$

Magnus effect is when, for example, ball curves its trajectory because of rotation of the ball, fluid sticking to the ball because of viscosity, then Bernoulli principle explains why the ball curves its trajectory in soccer, tennis, etc.

Question:

Explain Magnus effect.

Thermodynamics

Similarly to mechanics, in thermodynamics system tries to reduce its potential energy.

Question:

Prove the solution to the heat transfer equation.

Heat H transfers in time in one dimension x.

$\frac{∂H}{∂t}=D\frac{∂^{2}H}{∂x^{2}}$ (equation)

$H\left(\infty ,t\right)=0$ (boundary condition)

$H\left(x,t\right)=\frac{e^{-\frac{x^{2}}{4Dt}}}{\sqrt{4πDt}}$ (solution)

D is transferring constant

π = 3.14…..

Electromagnetism

Transistors for logic gates

Question:

Explain using transistors for logic gates.