Inertia, solids, elasticity, sound, thermodynamics, electromagnetism

Inertia:

Inertial reference frame moves without acceleration (it includes rotation (centripetal acceleration) and linear acceleration)

Reference frame is coordinate system with clock.

Inertial force is fictitious, it is result of reference frame not being inertial.

Some scientists think that inertia forces are the result of attraction of distant stars.

During circular rotation with the same speed, we compensate centripetal force with fictitious centrifugal force of inertia.

Question:

Explain inertial force.

Solids:

Movement of solid is described as movement of its centre of mass and rotation around the centre of mass.

Moment of inertia

The simplest moment of inertia around axis I = mR2.

m is mass.

R is distance from mass m to axis of rotation.

For solids moments of inertia are calculated as integrals.

Torque t through moments of inertia I and angular acceleration a:

m = 1, 2, 3.

We use Cramer Rule

en.wikipedia.org/wiki/Cramer%27s\_rule

= I(1, 1) \* (I(2, 2) \* I(3, 3) - I(2, 3) \* I(3, 2)) –

I(1, 2) \* (I(2, 1) \* I(3, 3) - I(3, 1) \* I(2, 3)) +

I(1, 3) \* (I(2, 1) \* I(3, 2) - I(3, 1) \* I(2, 2))

D must not be zero.

Question:

Find torque for given tensor of inertia and angular acceleration.

a1 = s mod 10

a2 = s mod 20

a3 = s mod 30

I11 = s mod 11

I12 = s mod 12

I13 = s mod 13

I21 = s mod 21

I22 = s mod 22

I23 = s mod 23

I31 = s mod 31

I32 = s mod 32

I33 = s mod 33

Dim a(3), I(3, 3), torque(3)

s = 99107088

a(1) = s Mod 10

a(2) = s Mod 20

a(3) = s Mod 30

I(1, 1) = s Mod 11

I(1, 2) = s Mod 12

I(1, 3) = s Mod 13

I(2, 1) = s Mod 21

I(2, 2) = s Mod 22

I(2, 3) = s Mod 23

I(3, 1) = s Mod 31

I(3, 2) = s Mod 32

I(3, 3) = s Mod 33

For c = 1 To 3

torque(c) = 0

For cc = 1 To 3

torque(c) = torque(c) + I(c, cc) \* a(cc)

Next cc

MsgBox torque(c)

Next c

Question:

Calculate angular acceleration for given tensor of inertia and torque.

torque(1) = s Mod 10

torque(2) = s Mod 20

torque(3) = s Mod 30

Dim a(3), I(3, 3), torque(3)

s = 99107088

torque(1) = s Mod 10

torque(2) = s Mod 20

torque(3) = s Mod 30

I(1, 1) = s Mod 11

I(1, 2) = s Mod 12

I(1, 3) = s Mod 13

I(2, 1) = s Mod 21

I(2, 2) = s Mod 22

I(2, 3) = s Mod 23

I(3, 1) = s Mod 31

I(3, 2) = s Mod 32

I(3, 3) = s Mod 33

determinant = I(1, 1) \* (I(2, 2) \* I(3, 3) - I(2, 3) \* I(3, 2)) - I(1, 2) \* (I(2, 1) \* I(3, 3) - I(3, 1) \* I(2, 3)) + I(1, 3) \* (I(2, 1) \* I(3, 2) - I(3, 1) \* I(2, 2))

If determinant = 0 Then GoTo 1

'MsgBox determinant

I(1, 1) = torque(1)

I(2, 1) = torque(2)

I(3, 1) = torque(3)

determinant1 = I(1, 1) \* (I(2, 2) \* I(3, 3) - I(2, 3) \* I(3, 2)) - I(1, 2) \* (I(2, 1) \* I(3, 3) - I(3, 1) \* I(2, 3)) + I(1, 3) \* (I(2, 1) \* I(3, 2) - I(3, 1) \* I(2, 2))

a(1) = determinant1 / determinant

MsgBox a(1)

I(1, 1) = s Mod 11

I(2, 1) = s Mod 21

I(3, 1) = s Mod 31

I(1, 2) = torque(1)

I(2, 2) = torque(2)

I(3, 2) = torque(3)

determinant2 = I(1, 1) \* (I(2, 2) \* I(3, 3) - I(2, 3) \* I(3, 2)) - I(1, 2) \* (I(2, 1) \* I(3, 3) - I(3, 1) \* I(2, 3)) + I(1, 3) \* (I(2, 1) \* I(3, 2) - I(3, 1) \* I(2, 2))

a(2) = determinant2 / determinant

MsgBox a(2)

I(1, 2) = s Mod 12

I(2, 2) = s Mod 22

I(3, 2) = s Mod 32

I(1, 3) = torque(1)

I(2, 3) = torque(2)

I(3, 3) = torque(3)

determinant3 = I(1, 1) \* (I(2, 2) \* I(3, 3) - I(2, 3) \* I(3, 2)) - I(1, 2) \* (I(2, 1) \* I(3, 3) - I(3, 1) \* I(2, 3)) + I(1, 3) \* (I(2, 1) \* I(3, 2) - I(3, 1) \* I(2, 2))

a(3) = determinant3 / determinant

MsgBox a(3)

I(1, 3) = s Mod 13

I(2, 3) = s Mod 23

I(3, 3) = s Mod 33

' Checking correctness of the solution:

For c = 1 To 3

'MsgBox torque(c)

Next c

For c = 1 To 3

torque(c) = 0

For cc = 1 To 3

torque(c) = torque(c) + I(c, cc) \* a(cc)

Next cc

'MsgBox torque(c)

Next c

GoTo 2

1 determiniantIsZero = 0

MsgBox "Determinant = 0, no solutions"

2 ThereAreSolusions = 2

Checking for 2

Dim a(2), I(2, 2), torque(2)

s = 99107088

torque(1) = s Mod 10

torque(2) = s Mod 20

I(1, 1) = s Mod 11

I(1, 2) = s Mod 12

I(2, 1) = s Mod 21

I(2, 2) = s Mod 22

determinant = I(1, 1) \* I(2, 2) - I(1, 2) \* I(2, 1)

If determinant = 0 Then GoTo 1

'MsgBox determinant

I(1, 1) = torque(1)

I(2, 1) = torque(2)

determinant1 = I(1, 1) \* I(2, 2) - I(1, 2) \* I(2, 1)

a(1) = determinant1 / determinant

'MsgBox a(1)

I(1, 1) = s Mod 11

I(2, 1) = s Mod 21

I(1, 2) = torque(1)

I(2, 2) = torque(2)

determinant2 = I(1, 1) \* I(2, 2) - I(1, 2) \* I(2, 1)

a(2) = determinant2 / determinant

'MsgBox a(2)

I(1, 2) = s Mod 12

I(2, 2) = s Mod 22

' Checking correctness of the solution:

For c = 1 To 2

MsgBox torque(c)

Next c

For c = 1 To 2

torque(c) = 0

For cc = 1 To 2

torque(c) = torque(c) + I(c, cc) \* a(cc)

Next cc

MsgBox torque(c)

Next c

GoTo 2

1 determiniantIsZero = 0

MsgBox "Determinant = 0, no solutions"

2 ThereAreSolusions = 2

Elasticity

The most general case of elastic body deformation and stress:

i,j,m,n = 1, 2, 3.

is tensor of stress, stress is pressure.

is tensor of deformation, deformation is relative extension.

is tensor of elastic constants.

Sound

Sound is a mechanical wave.

Sound is a longitudinal wave, which means that the propagation of the wave is in the same direction as oscillation.

Soundwave needs environment to propagate.

The denser the environment, the faster the sound in this environment.

Dopler effect:

Dopler effect is change in frequency of the wave due to motion of the source of the wave.

Because the speed of the wave is constant, frequency of the wave changes: if motion of the source towards the observer, then frequency increases, if the motion of the source away from the observer, then the frequency decreases.

c = λf

c is the speed of sound, which is 343 meters per second in this case.

λ is the wavelength of the sound wave.

f is the frequency of the sound wave.

Question:

Calculate Doppler effect for sound.

Frequency changed; wavelength changed from 17 meters to 16 meters because of the speed of the source of sound.

Which direction does the source of sound move?

Frequencies:

f = c/BIG\_Wave\_Length

F = c/small\_wave\_length

f = Fc/(c+v)

v = -c + Fc/f

BIG\_Wave\_Length = 17

small\_wave\_length = 16

' c is speed of sound

c = 343

f\_small = c / BIG\_Wave\_Length

F\_BIG = c / small\_wave\_length

wavelengthchange = BIG\_Wave\_Length - small\_wave\_length

MsgBox wavelengthchange

v = -c + c \* F\_BIG / f\_small

MsgBox v

https://physics16.weebly.com/uploads/5/9/8/5/59854633/doppler4effect2019nov.txt

Fluid

Buoyant force

F = ρgV

F is force.

ρ is density of the fluid.

V is volume of the body, which is submerged to the fluid.

Question:

Find buoyant force for water ρ = 1000 kg/m3, g = 10 m/s2, V = s m3.

en.wikipedia.org/wiki/Archimedes%27\_principle

s = 99107088

ro = 1000

g = 10

V = s

F = ro \* g \* V

MsgBox F

Thermodynamics

Increase in temperature of body means increase of average velocity of particles of body.

Black clothes vs white clothes

White clothes keep the temperature the same. Black clothes cause heat exchange.

Question:

Are black or white clothes warmer? Why?

If bodies are heated, then they expand because of bigger velocities of the particles.

There is linear extension of the length due to heat.

Volume change is not cubed but times 3 because linear extensions are small compared to 1.

Question:

The thermal expansion rate α is 1/k. The temperature change is T degrees.

a. Find the extension of m meters rod due to the temperature change.

b. Find the approximate volume change of m meters cubed cube due to the temperature change.

n = 15108097

k = n Mod 10000

t = 10

L = 1

a = 1 / k

d = t \* L \* a

MsgBox d

V = 3\*t \* L \* a

MsgBox V

http://physics16.weebly.com/uploads/5/9/8/5/59854633/thermal4expansion.txt

Heat flows from hot to cold.

Specific heat capacity C is heat necessary to increase the temperature of the body by 1 degree.

Question:

There are two bodies in a thermodynamically isolated system: C1 m1 T1 and C2 m2 T2. Find the resulting temperature T. m1 = k, m2 = 2k. C1 = k/11, C2 = k/222, T1 = k/111, T2 = k/22

n = 15108097

k = n Mod 10000

'

m1 = k

c1 = k / 11

t1 = k / 111

'

m2 = 2 \* k

c2 = k / 222

t2 = k / 22

'

t = (t1 \* c1 \* m1 + t2 \* c2 \* m2) / (m1 \* c1 + m2 \* c2)

MsgBox t

http://physics16.weebly.com/uploads/5/9/8/5/59854633/result4temperature.txt

P is directly proportional to V2.

T is proportional to P.

T is temperature.

P is pressure.

V is velocity.

Energy of particles

E = 1.5kT

T is temperature.

k = 1.380649×10-23 JK-1

en.wikipedia.org/wiki/Boltzmann\_constant

In ideal gas there is no interaction between the infinitely small particles.

Ideal gas is good enough model for many applications.

PV = nRT

P is pressure.

V is volume.

n is number of moles of substance.

R = 8.31446261815324 joules per kelvin per mole

T is temperature.

One mole contains NA = 6.02214076×1023 elementary entities, which can be atoms, molecules, ions, or other particles. The number of particles in a mole is the Avogadro number NA expressed in mol-1.

For gas at room temperature, one mole is approximately 22.4 litres.

Question:

Give P from PV = nRT. R = 2 + m25. V = 3 + m35. n = s.

https://en.wikipedia.org/wiki/Ideal\_gas\_law

s = 19107012

L = s Mod 10

m = s Mod 35

T = s Mod 100

k = s Mod 10000

E = s Mod 8

q = s Mod 17

R = s Mod 25

d = 2 + (T - L) / 10

Pi = 4 \* Atn(1)

R = R + 2

V = 3 + m

n = s

P = n \* R \* T / V

MsgBox P

Real gas

In real gas particles interact and are finite in size.

Vm is molar volume.

a and b are parameters, that are determined experimentally for each gas.

Question:

Find real gas pressure.

https://en.wikipedia.org/wiki/Real\_gas

a = m25

b = m9

Vm = s

R = m8

T = m100

s = 19107012

m25 = s Mod 25

m9 = s Mod 9

m8 = s Mod 8

m100 = s Mod 100

a = m25

b = m9

Vm = s

R = m8

T = m100

p = R \* T / (Vm - b) - a / Vm ^ 2

MsgBox p

Electromagnetism

Electric charge is physical property of matter that causes it to experience force when placed into electric field.

Electric field is space where electric force acts.

Electric current is flux of electric charges.

Electrostatics

Coulombs law in electrostatics is similar to Newton law of gravity, the difference is that gravity can only attract and gravity is much weaker than electrostatic force, which can repel and attract.

Question:

Find the force between two charges of L and T Coulombs, m meters apart.

s = 16108088

T = s Mod 100

m = s Mod 35

L = s Mod 10

charge1 = L

charge2 = T

Coulomb\_constant = 10 ^ 10

Coulomb\_force = Coulomb\_constant \* L \* T / m ^ 2

MsgBox Coulomb\_force

http://physics16.weebly.com/uploads/5/9/8/5/59854633/coulomb\_force.txt

Question:

Ed = V (uniform field strength (electric field)). E = m8. d = d2.

s = 19107012

L = s Mod 10

T = s Mod 100

k = s Mod 10000

E = s Mod 8

d = (T - L) / 10

V = E \* d

MsgBox V

https://physics16.weebly.com/uploads/5/9/8/5/59854633/uniform4electromagnetic4field2019nov.txt

Question:

F = Eq (field and force (electricity)). E = m8. q = m17.

s = 19107012

L = s Mod 10

T = s Mod 100

k = s Mod 10000

E = s Mod 8

q = s Mod 17

F = E \* q

MsgBox F

https://physics16.weebly.com/uploads/5/9/8/5/59854633/force4electromagnetic4field2019nov.txt

Electric circuits

There are many electronic elements in electric circuits.

Resistor causes drop of voltage.

Capacitor accumulates electric charge and then releases it.

Inductor induces electromagnetic field.

Diode allows electric current only in one direction.

Transistor is a switch.

Ohm law: V = IR

en.wikipedia.org/wiki/Ohm%27s\_law

Question:

Calculate voltage V for I = T Amperes and R = L Ohms.

s = 99107088

T = s Mod 100

L = s Mod 10

I = T

R = L

V = I \* R

MsgBox V

Resistivity for specific material is resistance of a wire of 1 meter long and 1 meter squared in cross-section.

Question:

Find A = m25. ρ = m17. L = m10.

s = 19107012

L = s Mod 10

ro = s Mod 17

A = s Mod 25

R = L \* ro / A

MsgBox R

https://physics16.weebly.com/uploads/5/9/8/5/59854633/resistivity2019nov.txt

Question:

Calculate the series and the parallel circuits with e.m.f. of T Volts and the resistors L+1, 2 and 3 ohms respectively.

s = 16108088

T = s Mod 100

L = s Mod 10

emf = T

V = emf

R1 = L + 1

R2 = L + 2

R3 = L + 3

' For series circuit:

R = R1 + R2 + R3

current\_I = V / R

MsgBox current\_I

V1 = current\_I \* R1

V2 = current\_I \* R2

V3 = current\_I \* R3

MsgBox V1

MsgBox V2

MsgBox V3

' For parallel circuit:

‘ R = R1 \* R2 \* R3 / (R1 \* R2 + R1 \* R3 + R2 \* R3)

current\_I = V / R

MsgBox current\_I

current\_I1 = V / R1

current\_I2 = V / R2

current\_I3 = V / R3

MsgBox current\_I1

MsgBox current\_I2

MsgBox current\_I3

http://physics18.weebly.com/uploads/5/9/8/5/59854633/series\_parallel\_circuits.txt

Question:

Show that Maximum loss in circuit with internal resistance r and external resistance R is when R = r.

E = I(R+r)

waste = RI2.

Take derivative, equate it to zero and find the Maximum.

Question:

Find the frequency and the period of the harmonic oscillator. L = k μH and C = T μF.

n = 15108097

k = n Mod 10000

T = n Mod 100

L = k \* 10 ^ (-6)

C = T \* 10 ^ (-6)

omega0 = 1 / Sqr(L \* C)

MsgBox omega0

pi = 4 \* Atn(1)

period = 2 \* pi / omega0

MsgBox period

http://physics16.weebly.com/uploads/5/9/8/5/59854633/rlc4circuit4natural4frequency4period.txt

Question:

Find the electrical current i in the circuit for R = T, L = 1/k, C = 1/s, ω = k, and εm = T.

http://physics16.weebly.com/uploads/5/9/8/5/59854633/2054\_ch21a.pdf

Question:

Explain NOT, AND, OR gates circuits using transistor.

m3 = 0: NOT

m3 = 1: AND

m3 = 2: OR

Question:

Find V1 for the transformer if V2 = T volts, N1 = k and N2 = s.

n = 15107096

k = n Mod 10000

T = n Mod 100

V2 = T

N1 = k

N2 = n

V1 = -V2 \* N1 / N2

MsgBox V1

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

Question:

T kilowatts of electric power is sent to a town from a power plant. The transmission lines have the total resistance of 0.1T Ohms. Calculate the power loss if the power is transmitted at:

(a) 0.03k Volts (b) s Volts

n = 15108097

k = n Mod 10000

T = n Mod 100

power = T \* 10 ^ 3

resistance = 0.1 \* T

voltage = 0.03 \* k

voltage = n

current = power / voltage

Losses = resistance \* current ^ 2

MsgBox Losses

http://physics16.weebly.com/uploads/5/9/8/5/59854633/losses4transmitting4power.txt

Question:

A circular coil of wire has a diameter of 0.002k cm and contains 10 loops. The current in each loop is 3A, and the coil is placed into 2TESLA external magnetic field. Determine the maximum and minimum torque exerted on the coil by the field.

n = 15107086

k = n Mod 10000

T = n Mod 100

diameter = 0.002 \* k \* 0.01

area = 4 \* Atn(1) \* diameter ^ 2 / 4

number4loops = 10

current = 3

magneticflied = 2

torque = area \* number4loops \* current \* magneticflied

MsgBox "maximum torque is equal to"

MsgBox torque

MsgBox "minimum torque is equal to zero"

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

Question:

T Watts lamp emits electromagnetic radiation in all directions. Assuming a lamp to be a point source, calculate the intensity of the radiation:

a. at distance of 1 m from the lamp.

b. at distance of 2 m from the lamp.

S = 4πR2.

I = T/S.

s = 19107012

L = s Mod 10

T = s Mod 100

k = s Mod 10000

Pi = 4 \* Atn(1)

S1 = 4 \* Pi \* 1 ^ 2

S2 = 4 \* Pi \* 2 ^ 2

I1 = T / S1

I2 = T / S2

MsgBox I1

MsgBox I2

https://physics16.weebly.com/uploads/5/9/8/5/59854633/intensity4radius2019nov.txt

Question:

Waves from a source have an amplitude of 5 cm and an intensity of T Wm-2.

a. The amplitude of the waves is increased to 10 cm. What is their intensity now?

b. The intensity of the waves is increased to 100 Wm-2. What is their amplitude?

I = CA2.

C = I/A2.

I = Intensity

A = Amplitude

C = Constant

s = 19107012

L = s Mod 10

T = s Mod 100

k = s Mod 10000

I = T

A = 5 \* 10 ^ (-2)

C = I / A ^ 2

A = 10 \* 10 ^ (-2)

I = C \* A ^ 2

MsgBox I

I = 100

A = Sqr(I / C)

MsgBox A

https://physics16.weebly.com/uploads/5/9/8/5/59854633/amplitude4intensity2019nov.txt

Question:

Light of wavelength T nm in a vacuum travels into glass, where its speed decreases to 2×108ms-1. Determine:

a. the frequency of the light in vacuum

b. its frequency and wavelength in glass.

c = 3\*108 m/s in vacuum.

s = 19107012

L = s Mod 10

T = s Mod 100

k = s Mod 10000

c = 3 \* 10 ^ 8

lambdainvacuum = T \* 10 ^ (-9)

frequencyinvacuum = c / lambdainvacuum

MsgBox frequencyinvacuum

velocityinglass = 2 \* 10 ^ 8

lambdainglass = velocityinglass / frequencyinvacuum

MsgBox lambdainglass

https://physics16.weebly.com/uploads/5/9/8/5/59854633/wavelength4frequency4refraction2019nov.txt

Question:

An astronomer observes light from a distant star. A particular line in its spectrum has a wavelength of T nm. When measures in the laboratory, the same spectral line has a wavelength of L nm. Determine:

a. the change in the wavelength of the spectral line

b. the speed of the star

c. the direction of the movement of the star (towards or away from the observer).

f = c/T

F = c/L

f = Fc/(c+v)

v = -c + Fc/f

s = 19107012

L = s Mod 10

T = s Mod 100

k = s Mod 10000

c = 3 \* 10 ^ 8

f\_small = c / (T \* 10 ^ (-9))

F\_BIG = c / (L \* 10 ^ (-9))

wavelebgthchange = T \* 10 ^ (-9) - L \* 10 ^ (-9)

MsgBox wavelebgthchange

v = -c + c \* F\_BIG / f\_small

MsgBox v

https://physics16.weebly.com/uploads/5/9/8/5/59854633/doppler4effect2019nov.txt

Question:

Find x. λD = ax Young double-slit experiment (waves). D = d2. a = m25. λ = L = m10.

s = 19107012

L = s Mod 10

T = s Mod 100

k = s Mod 10000

E = s Mod 8

q = s Mod 17

a = s Mod 25

d = (T - L) / 10

Lambda = L

x = Lambda \* d / a

MsgBox x

https://physics16.weebly.com/uploads/5/9/8/5/59854633/young4double4slit4experiment2019nov.txt

Question:

Give n. d sinA = nλ diffraction grating (waves). d = d2. A = m25. λ = L = m10.

s = 19107012

L = s Mod 10

T = s Mod 100

k = s Mod 10000

E = s Mod 8

q = s Mod 17

A = s Mod 25

d = (T - L) / 10

Pi = 4 \* Atn(1)

A = A \* Pi / 180

Lambda = L

n = d \* Sin(A) / Lambda

n = Round(n)

MsgBox n

https://physics16.weebly.com/uploads/5/9/8/5/59854633/diffraction4grating2019nov.txt

Question:

Solve the simplified Maxwell Equations for c = 300000000-s, red light. Take amplitude 1 V/m. Find the intensity of electric field after s seconds at m meters.

s = 16108088

Ttt = s Mod 100

m = s Mod 35

L = s Mod 10

t = s

x = m

c = 3 \* 10 ^ 8 - s

E = Sin(x - c \* t)

MsgBox E

http://physics16.weebly.com/uploads/5/9/8/5/59854633/maxwell\_equations\_solution.txt

Question:

Suppose a star has a surface temperature of 4k degrees. What are the wavelength and the color this star appears?

n = 15108097

k = n Mod 10000

b = 3 \* 10 ^ (-3)

t = 4 \* k

Lambda\_max = b / t

MsgBox Lambda\_max

http://physics16.weebly.com/uploads/5/9/8/5/59854633/color4black4body.txt

Question:

A man 0.25k mm tall stands in front of a vertical plane mirror. His eyes are 10 cm bellow the top of his head. What are the sizes and the best location of the smallest possible mirror so that he can see his entire body?

n = 15107096

k = n Mod 10000

T = n Mod 100

Height\_of\_man = 0.25 \* k \* 10 ^ (-3)

d = 10 \* 10 ^ (-2)

Top\_of\_mirror = Height\_of\_man - d / 2

Mirror\_Length = Height\_of\_man / 2

MsgBox Top\_of\_mirror

MsgBox Mirror\_Length

http://physics16.weebly.com/uploads/5/9/8/5/59854633/height4mirror.txt

Question:

For convex mirror with a radius of curvature of 0.002k meters, determine the location of the image and its magnification for an object 0.0012k meters from the mirror.

n = 15108097

k = n Mod 10000

r = 16

doo = 10

r = 0.002 \* k

doo = 0.0012 \* k

f = -r / 2

di = 1 / (1 / f - 1 / doo)

MsgBox di

m = -di / doo

MsgBox m

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

Question:

A spy satellite camera can recognize T cm objects from the altitude of n meters. If diffraction was the only limitation (the wave length Lambda = 0.1k nanometers), determine what diameter lens the camera has.

n = 15108097

k = n Mod 10000

T = n Mod 100

Lambda = 550 \* 10 ^ (-9)

A = 0.03 / 100000

Lambda = k \* 10 ^ (-10)

A = T \* 0.01 / n

D = 1.22 \* Lambda / A

MsgBox D

http://physics16.weebly.com/uploads/5/9/8/5/59854633/satellite4spying.txt