UTS in physics made by Michael Marchenko in October of 2019.

Edited at 11am 29.10.2019.

s is your student number.

Write your student number: s = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Write your name \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

s is your student number.

k = s mod 10000. T = s mod 100.

m35 = s mod 35. m25 = s mod 25. m20 = s mod 20.

m10 = s mod 10. m9 = s mod 9. m8 = s mod 8. m7 = s mod 7. m6 = s mod 6.

m5 = s mod 5. m4 = s mod 4. m3 = s mod 3. m2 = s mod 2.

Main questions:

1. Describe your project.

Choose topic and write research paper about it.

2.1. Find F = ma, M = Jε, for m = a = J = ε = T.

2. Calculate the Schwarzschild radius for the k grams desk.

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

2.2. Solve oscillation problem y'' + yT2 = 0.

https://www.wolframalpha.com/input/?i=y%27%27+%2B+16y+%3D+0

3. Estimate the distances between the atoms of element number T in the periodic table of elements.

https://physics16.weebly.com/uploads/5/9/8/5/59854633/distance\_between\_particles\_for\_many\_atoms2019oct.txt

http://physics16.weebly.com/uploads/5/9/8/5/59854633/distance\_between\_particles.txt

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

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

5. Find the hangover for the s blocks in the blocks stacking problem.

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

Use statics to find the balance and show that it is half of harmonic series.

6. Solve the elastic collision problem for u1 = k, u2 = k/2, m1 = k, m2 = 2k.

http://physics16.weebly.com/uploads/5/9/8/5/59854633/linear2elastic4collision.txt

Energy and momentum conservation equations are necessary to solve this problem.

7. Find the acceleration of a simple pulley for two masses: L kg and T kg.

http://physics16.weebly.com/uploads/5/9/8/5/59854633/problem4pulleys.txt

Write equation for projection to the cord.

8. Find the center of mass of k equal masses k meters apart located on a straight line.

http://physics16.weebly.com/uploads/5/9/8/5/59854633/center\_of\_mass\_of\_k\_masses.txt

Center of mass is weighted average.

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

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

This is how electric transformer woks.

10. 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

https://en.wikipedia.org/wiki/RLC\_circuit

Solve this circuit by solving the differential equation for dumped oscillation.

Study electronic oscillator.

https://en.wikipedia.org/wiki/Electronic\_oscillator

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

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

Electric oscillator is mathematically similar to mechanical oscillator.

12. Find the energy level and angular momentum for hydrogen according to the Bohr Model.

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

13. Find the energy of the photon with the frequency of s Hz.

E2 = (mc2)2 + (pc)2.

Total energy includes stationary energy and dynamic energy.

14. Calculate the wavelength of k grams desk moving T centimeters per second.

http://physics16.weebly.com/uploads/5/9/8/5/59854633/waves4matter.txt

15. Find the annihilation energy of k grams of matter.

http://physics16.weebly.com/uploads/5/9/8/5/59854633/energy4binding.txt

E = mc2.

-

Additional questions:

33.1. Why do you need physics?

Write why you need physics.

I need physics because it is my job and useful for chemistry, biology, and economics.

33.2. Do what you like in physics.

Try to enjoy physics.

33.3. Will moving or static egg crack? Explain dynamic coefficient and attack vs. defense.

Use answer to this question in finding the best ways to protect your safety.

33.4. Explain efficiency of truck and trolley.

Many trucks and trolleys are in Indonesia and other countries. We must know which one to use and how to save energy, money, time, effort, etc.

33.5. Do big or small wheels give more power.

We can see bikes with big and small wheals. We must know how to use them.

33.6. Why does cat sit on its curved legs?



We often see cats sitting on their curved legs. We must know why.

33.8. What is physics of social media?

Predict physical characteristics of people and robots in social media.

33.9. Study physics of songs.

Try to understand why some songs are popular, using physics (sounds, frequencies, loudness, lyrics, etc.).

33.10. Solve Zimmermann problem:

http://74.72.151.186/Contest/Nearness

http://azspcs.com/Contest/Nearness

Solve for m20 + 6.

Improve these solutions:

https://physics16.weebly.com/uploads/5/9/8/5/59854633/4students\_reversing\_nearness\_sep2019.docx

If you cannot register here then submit your solutions to me.

Zimmermann problem of Nearness is similar to finding correct locations of gas particles.

33.11. What is fractal?

https://en.wikipedia.org/wiki/Fractal

We often use fractals in physics, computer science, computer graphics, computer security, etc.

33.12. Explain Magnus effect.

https://en.wikipedia.org/wiki/Magnus\_effect

33.13. Apply for American citizenship:

https://www.dvlottery.state.gov/

33.14. Apply for scholarships, grants, fellowships of USA, Europe, Canada, Australia, Japan, etc.

33.15. Study

https://physics15.weebly.com/

https://physics16.weebly.com/

https://physics18.weebly.com/

Try to find something interesting on these web sites.

16.Study math as method of physics.

Calculus is often used in physics.

17. What is least constraint principle?

https://en.wikipedia.org/wiki/Gauss%27s\_principle\_of\_least\_constraint

18. Discuss physics news.

Choose any news, that you are interested in and try to analyze then using physics.

https://en.wikipedia.org/wiki/Physics

https://en.wikipedia.org/wiki/Capital\_of\_Indonesia

https://en.wikipedia.org/wiki/UEFA\_Euro\_2020\_qualifying

https://en.wikipedia.org/wiki/Yemeni\_Civil\_War\_(2015%E2%80%93present)

https://en.wikipedia.org/wiki/Kashmir\_conflict

https://en.wikipedia.org/wiki/2019\_Abqaiq%E2%80%93Khurais\_attack

https://en.wikipedia.org/wiki/Islamic\_State\_of\_Iraq\_and\_the\_Levant

https://en.wikipedia.org/wiki/Al-Qaeda

https://en.wikipedia.org/wiki/Taliban

https://en.wikipedia.org/wiki/Rohingya\_people

https://en.wikipedia.org/wiki/Uyghurs

https://en.wikipedia.org/wiki/Kosovo\_War

https://en.wikipedia.org/wiki/Jamal\_Khashoggi

https://en.wikipedia.org/wiki/Basuki\_Tjahaja\_Purnama

https://en.wikipedia.org/wiki/May\_1998\_riots\_of\_Indonesia

https://en.wikipedia.org/wiki/Indonesian\_mass\_killings\_of\_1965%E2%80%9366

https://en.wikipedia.org/wiki/Brexit

https://en.wikipedia.org/wiki/Julian\_Assange

https://en.wikipedia.org/wiki/Chelsea\_Manning

https://en.wikipedia.org/wiki/Edward\_Snowden

https://en.wikipedia.org/wiki/Noam\_Chomsky

https://en.wikipedia.org/wiki/Annexation\_of\_Crimea\_by\_the\_Russian\_Federation

https://en.wikipedia.org/wiki/War\_in\_Donbass

https://en.wikipedia.org/wiki/Ukrainian\_crisis

19. Study general concepts of mechanics, oscillation, fluid mechanics, thermodynamics, optics, electromagnetism, quantum physics and cosmology.

https://en.wikipedia.org/wiki/Mechanics

https://en.wikipedia.org/wiki/Oscillation

https://en.wikipedia.org/wiki/Fluid\_mechanics

https://en.wikipedia.org/wiki/Thermodynamics

https://en.wikipedia.org/wiki/Optics

https://en.wikipedia.org/wiki/Electromagnetism

https://en.wikipedia.org/wiki/Quantum\_mechanics

https://en.wikipedia.org/wiki/Cosmology

20. How is physics used in computer science?

Cryptography, design of computers, etc.

-

2 section:

21. What is Bernoulli principle?

https://en.wikipedia.org/wiki/Bernoulli%27s\_principle

22. What is econophysics?

https://en.wikipedia.org/wiki/Econophysics

23. What is solid mechanics?

https://en.wikipedia.org/wiki/Solid\_mechanics

24. Explain drone physics.

https://en.wikipedia.org/wiki/Unmanned\_aerial\_vehicle

25. Give mechanics conservation laws.

https://en.wikipedia.org/wiki/Conservation\_law

26. Explain physics of quantum cryptography and public key cryptography.

27. Prepare to Dota2 gaming competition:

http://www.dota2.com/international/overview/

28. What is chaos?

https://en.wikipedia.org/wiki/Chaos\_theory

29. Give Newton laws.

https://en.wikipedia.org/wiki/Newton%27s\_laws\_of\_motion

31. Find x and y for projectile with x0 = y0 = 0, v0 = T m/s, t = T seconds, A = T degrees.

Find maximum distance and maximum height.

https://physics16.weebly.com/uploads/5/9/8/5/59854633/projectile309task2019.txt

32. 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.

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

33. Find gravity acceleration g, orbital velocity Vo and escape velocity Ve for planet with mass s billion tons and radius s millimeters.

https://physics18.weebly.com/uploads/5/9/8/5/59854633/g1orbital1velocity1escape1velocity13oct2017.txt

36. Find the displacement of a harmonic oscillator after s seconds with amplitude k, frequency k and initial phase k/2.

http://physics16.weebly.com/uploads/5/9/8/5/59854633/harmonic4oscillator.txt

37. Solve the string oscillatory equation for v = T, frequency = L = m10, Amplitude = T.

Find the displacement after s seconds at m meters.

https://physics18.weebly.com/uploads/5/9/8/5/59854633/string1wave1oscillation22oct2017.txt

38. 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.

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

39. 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

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

40. Enjoy physics.

-

3 section:

We answered questions 41 - 60 on 2 October 2019.

41. Is black or white clothes warmer? Why?

42. How does guitar string move?

43. Explain power pyramid: USA, UK, EU, Australia, New Zealand, Japan, Korea, Singapore, Malaysia, Indonesia, China, India, Russia, etc.

44. Why are some civilizations more successful than the others?

45. Why are some people very massive?

46. What are Brownian motion, random walk and how are they linked to Zimmermann problem?

47. Predict results of 2019 rugby world cup:

https://en.wikipedia.org/wiki/2019\_Rugby\_World\_Cup

48. Explain good country index.

https://en.wikipedia.org/wiki/Good\_Country\_Index

50. Solve number puzzle for 3 + m8 digits.

https://discrete4math.weebly.com/uploads/2/5/3/9/25393482/codesums0-9.txt

https://discrete4math.weebly.com/uploads/2/5/3/9/25393482/code1-9sums.txt

https://discrete4math.weebly.com/uploads/2/5/3/9/25393482/1-8code1-8sums.txt

https://discrete4math.weebly.com/uploads/2/5/3/9/25393482/0-6codesums.txt

https://discrete4math.weebly.com/uploads/2/5/3/9/25393482/1dx4de5dnumberpuzzle.txt

https://discrete4math.weebly.com/uploads/2/5/3/9/25393482/2dx3de5dnumberpuzzle.txt

https://discrete4math.weebly.com/uploads/2/5/3/9/25393482/code1-9numberpuzzles.txt

https://discrete4math.weebly.com/uploads/2/5/3/9/25393482/code0-8numberpuzzles.txt

https://discrete4math.weebly.com/uploads/2/5/3/9/25393482/code1-8numberpuzzles.txt

https://discrete4math.weebly.com/uploads/2/5/3/9/25393482/code0-6numberpuzzles.txt

https://discrete4math.weebly.com/uploads/2/5/3/9/25393482/code1-6numberpuzzles.txt

https://discrete4math.weebly.com/uploads/2/5/3/9/25393482/code1-5numberpuzzles.txt

https://discrete4math.weebly.com/uploads/2/5/3/9/25393482/code1-4numberpuzzles.txt

51. Hack password.

https://calculus1only.weebly.com/

https://calculus1only.weebly.com/uploads/5/9/8/5/59854633/password-hacking-game-rules.docx

https://calculus1only.weebly.com/uploads/5/9/8/5/59854633/guessinput.txt

52. Why can crazy people be good for physics?

53. Who is internet troll?

54. Analyze these topics:

https://en.wikipedia.org/wiki/Greta\_Thunberg

https://en.wikipedia.org/wiki/2019\_Papua\_protests

https://en.wikipedia.org/wiki/2019\_Trump-Ukraine\_controversy

55. Why is there less freedom in the world?

56. Will Trump be impeached? Why?

57. How do we help Indonesia?

58. Scattering:

m3 = 0: What color is the Sun?

m3 = 1: Why are clouds white?

m3 = 2: Why is the sky blue?

60. 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.

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

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4 section:

61. Why is there terror? Why is monopoly bad?

Freedom solves many problems. Balance of powers in necessary for freedom.

62. Explain physics Nobel Prize 2019.

Search information about physics Nobel Prize 2019.

63. Do Bernoulli experiment.

Blow bellow the paper, placed on top of the books and explain the result.

65. Use 3T mod n to pass secret.

Calculate 3T mod 19 and exchange secret information with your friend.

https://www.dcode.fr/modular-exponentiation

mod function produces almost perfect chaos, which allows people to protect their passwords well.

66. Calculate the largest prime number.

https://discrete4math.weebly.com/uploads/2/5/3/9/25393482/primes2find.txt

The largest prime number is necessary to improve safety of password.

67. Do prime factorization of s.

https://discrete4math.weebly.com/uploads/2/5/3/9/25393482/prime4factorization4of4numbers.txt

Prime factorization is used for password.

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

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

That is how we know color of Sun and other stars.

69. Calculate the final speed after absolutely inelastic collision of two balls of masses L kg and T kg, moving with velocities s m/s and k m/s respectively.

http://physics16.weebly.com/uploads/5/9/8/5/59854633/inelastic4collision.txt

One equation of momentum conservation is enough to solve this problem.

72. Find acceleration of a mass at the inclined plane with

A = T degrees and the friction coefficient μ = 1/T.

https://physics16.weebly.com/uploads/5/9/8/5/59854633/ramp4inclined4plane2019oct.txt

http://physics16.weebly.com/uploads/5/9/8/5/59854633/inclined4plane.txt

We use ramp often.

74. Explain tensor of inertia for drone, etc.

This is solid mechanics of 3D rigid body.

75.

m4 = 0: What visible light is the fastest? Why?

m4 = 1: What visible light is the most noticeable? Why?

m4 = 2: What visible light has the most energy? Why?

m4 = 3: What visible light is the most absorbed? Why?

Think of frequency and wavelength.

L = 6: 76. What is quantum money?

https://en.wikipedia.org/wiki/Quantum\_money

L = 7: 77. Are massless or mass-full particles used in quantum information? Why?

79. 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

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

See why electrical energy is transferred at high voltage.

80. 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.

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

That is how electric motor works.

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5 section:

Study electronics and electric circuits.

https://simple.wikipedia.org/wiki/Electrical\_circuit

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

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

L = m10.

V = IR

Use Ohm law and Kirchhoff law.

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

https://en.wikipedia.org/wiki/Kirchhoff%27s\_circuit\_laws

Node sum of all I in and out = 0.

Sum of all V = E = Electromotive force (Work per unit charge) of the power source.

Parallel and series resistors are similar to parallel and series capacitors.

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Study optics.

https://en.wikipedia.org/wiki/Optics

83. 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?

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

Angle of incidence is equal to angle of reflection.

84. 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.

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

Angle of incidence is equal to angle of reflection.

85. 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 = s.

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

Intelligence is the most important.

-

Study quantum physics.

en.wikipedia.org/wiki/Quantum\_mechanics#targetText=Quantum%20mechanics%20(QM%3B%20also%20known,of%20atoms%20and%20subatomic%20particles.

87. Find energy and momentum of photon of s Hz frequency.

https://en.wikipedia.org/wiki/Photon

v = fλ

88. Calculate the energy and momentum of a photon for Lambda = 0.05k nanometers.

http://physics16.weebly.com/uploads/5/9/8/5/59854633/energy4photon.txt

v = fλ

89. Determine the wavelength of an electron that has been accelerated through the potential difference of T Volts.

http://physics16.weebly.com/uploads/5/9/8/5/59854633/wavelength4electron.txt

91. What is the matter wave length of T gram book?

https://en.wikipedia.org/wiki/Matter\_wave

-

Study binding energy E = mc2.

https://en.wikipedia.org/wiki/Binding\_energy#targetText=In%20physics%2C%20binding%20energy%20(also,of%20particles%20into%20separate%20parts.

-

Study Relativity Theory.

https://en.wikipedia.org/wiki/Special\_relativity

94. If your velocity would be then how would your height, mass, and time change?

e = m8.

Assess how velocity affects height and mass.

-

Study nuclear decay and exponential decay.

https://en.wikipedia.org/wiki/Radioactive\_decay

95. Calculate the remaining mass (it is NOT 0) of the decaying substance after k seconds if the decay ratio is T and initial mass is s. Calculate the half-life.

http://physics16.weebly.com/uploads/5/9/8/5/59854633/code4nuclear4decay4half4life.txt

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Explore correlation between different physical quantities in periodic table of elements.

96. Perform correlation and regression analyses of the periodic table for T+2 elements and for m7 + 3 elementary particles.

http://physics16.weebly.com/uploads/5/9/8/5/59854633/correlations4periodic4table.xlsx

http://physics16.weebly.com/uploads/5/9/8/5/59854633/regression4periodic4table.txt

http://physics16.weebly.com/uploads/5/9/8/5/59854633/evergy4lifetime.xlsx

http://physics16.weebly.com/uploads/5/9/8/5/59854633/regression4elementary4particles4energies4life4times.txt

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Study particle physics.

https://en.wikipedia.org/wiki/Particle\_physics#targetText=Particle%20physics%20(also%20known%20as,that%20constitute%20matter%20and%20radiation.

m3 = 0: 97. What particles mediate electromagnetic interaction?

A. electrons

B. protons

C. positrons

D. photons

m3 = 1: 98. What particles mediate strong interaction?

A. neutrons

B. gluons

C. photons

D. protons

m3 = 2: 99. How many times is Electromagnetic Force weaker than the Strong Force?

A. 137

B. 758

C. 3592

D. 126434