E group physics task:

Edited at 7am 17.4.2017.

Solid Mechanics:

1. Give the expressions for work, energy and power. Explain.

2. Explain the gravity law of Newton.

3. Find the orbital velocity and the escape velocity.

4. Explain the free-body diagram.

5. Explain the Laws of Kepler.

6. Define and explain conservative forces and conservation of energy.

7. Can you pull yourself out of the mud, why? Can internal forces move the center of mass of a mechanical system and why?

8. What in the main rule of mechanics (related to the lever’s length)?

9. Calculate change of weight of the same mass on the equator, compared to the pole.

10. Find the altitude and velocity at the geostationary orbit.

11. Is it better to launch satellites to the East or to the West? Why?

12. If a body is rotated and the thread fails, how would the body move?

13. Why is perpetual motion impossible?

14. Define a vector.

15. Write the equations of the free massive thread and uniformly loaded massless thread.

16. Write the equations of Hook’s Law and oscillations.

17. Draw the typical curve of displacement versus force in elasticity, plasticity and fracture.

Waves:

18. Explain waves, diffraction, refraction, reflection, interference, longitudinal waves, transversal waves.

Compare mechanical waves, sound waves and electromagnetic waves.

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

Fluids:

19. Give the fluid pressure at the depth of h.

Thermodynamics:

20. Which clothes are warmer, black or white? Why?

21. Define temperature, thermal capacity, pressure, thermodynamics, irreversibility, entropy, enthalpy, internal energy, ideal gas, real gas, Brownian motion and random walk.

22. Explain uniform and normal distributions.

23. Explain the thermodynamics of computing.

24. There are two bodies in a thermodynamically isolated system: C1 m1 T1 and C2 m2 T2. Find the resulting temperature T.

25. The thermal expansion rate α is 0.001. The temperature change is 10 degrees.

Find the extension of a 1 meter rod due to the temperature change.

Prove that ∆V ≈ ∆T3αV if ∆L ≈ ∆TαL and α << 1.

26. Write and explain the Ideal Gas Equation. Link temperature, pressure and internal energy with kinetic energy of particles.

27. Calculate E = 1.5KT, P from PV = nRT; N from PV = NKT for n = 2; T = 34; P = 99; V = 56.

28. Assess the efficiency of the heat engines, heat pumps, fridges and air conditioners.

29. Explain latent heat and laws of thermodynamics.

30. Solve the heat equation.

31. The density of copper is 9 × 103 kg/m3, and each copper atom has mass of 64u.

Estimate the average distance between the neighboring copper atoms. NA= 6.02214129(27)×1023 mol−1.

Deadline: 22.4.2017 Saturday.