**Revision paper in physics:**

1.1. Calculate the Coulomb force between the electron and the proton in a hydrogen atom. Explain Ohm’s, Kirchhoff’s, Ampere’s, Gauss’ and Faraday’s laws. Find the total resistance and capacitance for series and parallel circuits for 1 and 2.

1.2. An average of 120 kW of electric power is sent to a small town from a power plant 10 km away. The transmission lines have the total resistance of 0.4 Ohms. Calculate the power loss if the power is transmitted at: (a) 240 V (b) 24,000 V

2.1. Give the main cases for mirrors and lenses in geometrical optics. Explain reflection and refraction. Prove: R = 2F.

2.2. A man 175 cm 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? Do these depend on his distance from the mirror?

3.1. If the image in the mirror is straight and magnified, what mirror is that? Does the mirror equation hold for the plane mirror?

3.2. An external rearview car mirror is convex with a radius of curvature of 16 m. Determine the location of the image and its magnification for an object 10 m from the mirror.

3.3. Draw the rays for the lenses. Write the equation of a lens. Explain combination of lenses. Give the Lensmaker equation.

4.1. (a) What is the speed of light in a diamond if v = 0.413c? (b) The light passes from medium n = 1.3 to medium n = 1.5, is the light bent toward or away from the perpendicular to the interface?

4.2. A spy satellite camera can recognize 3 cm objects from the altitude of 100 km. If diffraction was the only limitation (the wave length = 500 nm), determine what diameter lens the camera has.

5.1. Compare the resistance of a capacitor and an inductor to direct current and alternating current.

5.2. Write the ground states configurations for Li and Na. List all quantum numbers for each electron. Show that Pauli Exclusion Principle works.

5.3. Explain Black Body Radiation, Photoelectric and Compton’s effects, Schrodinger’s Cat, Wave Function, Uncertainty Principle, Tunneling, atomic clocks, controlled nuclear fusion, Standard Model, Higgs Boson, Large Hadron Collider, General Relativity, Equivalence Principle, Big Bang, Black Hole, Worm Hole, Parallel Universes, models of Universe and pattern recognition. Solve harmonic oscillator’s, Maxwell’s and Schrodinger’s equations. What is the best source of energy?

6.1. Calculate the de Broglie wavelength of a 0.2 kg ball moving with a speed of 15 m/s.

6.2. As a particle travels faster, does its de Broglie wavelength decrease, increase, or remain the same?

7.1. Which of the following electron configurations are possible and which are not

(a) 1s22s22p63s3; (b) 1s22s22p63s23p64s2; (c) 1s22s22p62d1? Explain Hund’s rules.

7.2. The first isotope decays at the rate 10% per year and the second – 5% per half-year. Which of the isotopes has greater half-life? Why?

7.3. How many times is electron microscope more powerful than optical microscope and electromagnetics force weaker than the strong nuclear force? What about proton microscope?

8. Describe your physics project.

9.bio. Nine photons are needed to transform one molecule of CO2 to the carbohydrate and O2. The light wavelength is 700 nm. The inverse chemical reaction releases energy of 5 eV/ molecule of CO2. How efficient is the photosynthesis process?

10.bio. How can change in the magnetic field of the Earth and the space exploration change agribusiness, food science and agro-eco-technology? Explain the radiation hazards. Explain biophysics.

11.IT. Explain quantum entanglement, the possibilities of instantaneous information transfer without the energy transfer, quantum computing, teleportation, quantum logic, quantum cryptography and superposition. How can quantum teleportation change IT and telematics? Explore the physics of computing. Compare the speed of the data processing using different physical phenomena.

12.IT. How is spectroscopy used in the forensic science? Explain total internal reflection and fiber optics. View up from under water: Describe what a person would see who looked up at the world from beneath the perfectly smooth surface of a lake or swimming pool.