Thema 1: astronomy, astrophysics and cosmology

- models of the universe (i.e. contributions by Aristotle, Ptolemy, Copernicus, Kepler, Newton)
- Kepler's laws, universal law of gravitation, gravitational force/field, weight, weightlessness
- first and second cosmic velocity
- basic concepts of circular motion and rotation, centripetal force
- orbits, satellites in orbit, geostationary satellites and geostationary orbits
- evolution of stars, Hertzsprung-Russell diagram

Thema 2: famous experiments

- determination of the speed of light (Roemer, Fizeau)
- experiment of Oersted + magnetic field of a straight wire and a coil
- Faraday's law of induction, Lenz law + experiments
- photoelectric effect (investigations by Lenard, explanation by Einstein)
- electron diffraction, Davisson-Germer Experiment

Thema 3: kinematics and dynamics

- reference frame, model of the mass point, path of motion, speed, velocity, acceleration
- types of linear motion (i.e. uniform and uniformly accelerated motion),motion graphs
- rotation and uniform circular motion, example: carousel
- period, tangential and angular velocity, centripetal force
- Newton's laws
- forces in general, stretching forces (Hooke's law), friction

Thema 4: conserved quantities and conservation laws

- different types of energy: gravitational potential energy, kinetic energy, elastic energy and internal energy
- work and energy, power, efficiency
- law of energy conservation and applications
- friction
- linear momentum and impulse
- safety precautions in cars (airbag, crumple zone, headrest, seat belt)
- linear momentum conservation and applications

Thema 5: natural phenomena

- reflection, refraction, total internal reflection, dispersion
- rainbows and mirages
- lightnings (+ basic concepts of electric fields)
- earth magnetic field and polar lights

Thema 6: paradigm changes in physics / development of world concepts

- Newton's laws
- models of the universe
- wave-particle duality
- double-slit experiment (light, electrons)
- photoelectric effect
- matter waves

Thema 7: physics of the 18th and 19th century

- AC and DC electric motor and generator
- three-phase AC generator, Y-and delta connection
- closed LC-circuit and open LC-circuit/Hertz dipole
- Thomson formula
- electric field, field strength, field-line diagrams
- magnetic field (wire, coil, capacitor), Lorentz force, electromagnetic induction

Thema 8: physics in sports / medical sciences

- different types of ionizing radiation (alpha-, beta-, gamma-radiation, X-rays) and their properties
- effects of radiation on the body
- applications of radioisotopes
- medical imaging (X-ray photography, CT, PET, Scintigraphy)
- velocity, speed, acceleration, linear motion and motion graphs
- energy and energy conservation, impulse and linear momentum

Thema 9: physics and engineering

- transformers (set-up, working principle, transformer equations, step-up and step-down transformers)
- power transmission across the country
- principles of broadcasting: types of waves (ground, sky, and space waves)
- properties of closed and open LC-circuits
- amplitude and frequency modulation, band width
- sending and receiving information
- underlying physical principles (Faraday's law of induction, Lenz law, magnetic flux, electromagnetic wave)

Thema 10: physics in household

- safety precautions in electricity and safety devices (fuses, earthing, socket and plugs, residual current circuit breaker, effects of an electric shock)
- simple electric circuits, resistors in series and in parallel
- electric power and electric energy/work done
- three-phase AC, Y- and delta connection
- microwaves, microwave oven

Thema 11: physics from the end of the 19th century up to now

- emission, absorption, stimulated emission
- properties of laser light, applications of laser light
- creation of laser light (optical pumping, Inversion, metastable state, laser cavity)
- spectroscopy (decomposition of light into spectral colours)
- basic concepts of quantum mechanics, wave function
- double-slit experiment with electrons, matter waves
- Heisenberg's uncertainty principle
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Thema 12: oscillations and waves

- elongation, amplitude, period, frequency, equilibrium position, harmonic oscillation
- damped and forced oscillations, natural frequency, resonance, resonance curve
- mathematical pendulum and spring pendulum
- properties of mechanical waves, harmonic wave, wavelength, speed of a wave
- longitudinal and transverse waves, constructive and destructive interference
- standing waves, tone, sound, noise, beats
- motion of a violin string, standing waves on strings (fundamental mode, overtones)

Thema 13: radiation

- absorption ,emission, photon and light wave, E = hf
- types of spectra (emission/absorption spectra, band/line spectra), spectral series of hydrogen, energy level diagrams
- decomposition of light into spectral colors (prism, diffraction grating), determination of the wavelength
- electromagnetic spectrum, radar, microwaves
- different types of ionizing radiation (alpha, beta, and gamma radiation, X-rays), properties/origin
- detection of ionizing radiation (GM tube)

Thema 14: basic principles of electricity

- electric current, current strength, voltage, resistance, factors influencing the resistance
- measurement of current and voltage
- resistors in series and in parallel, simple electric circuits and applications
- Ohm's law, Kirchhoff's laws, and applications
- electric power and work

Thema 15: electromagnetism - basic principles and applications

- magnetic fields of a straight wire and a coil, electromagnet
- Lorentz force, conducting swing experiment, deflection of electron/ion beams
- DC electric motor, solenoid lock, relais, cathode-ray tube
- Faraday's law of induction, Lenz law, magnetic flux
- magnetic data storage

Thema 16: optics

- diffraction
- double-slit interference, diffraction gratings,
- determination of the wavelength of light
- polarization, polarizing filters,
- polarization by reflection, Brewster angle
- LCD-screens

Thema 17: radioactivity

- atomic nucleus, forces inside the nucleus, mass defect, binding energy
- Heisenberg's uncertainty principle of energy and time
- radioactivity, radioactive decay, Geiger-Mueller tube
- alpha-, beta- and gamma-decay/radiation (origin and properties)
- half -life, decay equation, transformation equation
- effects of radiation on the body

Thema 18: nuclear energy and nuclear reactors

- structure of the atomic nucleus, forces inside the nucleus, mass and energy
- binding energy and mass defect
- nuclear fission and nuclear fusion
- nuclear power station (major parts and working principle)
- fusion power station
- effects of radiation on the human body