Checklist - physics

- methods of natural science
- SI-system, base units/quantities and derived units/quantities

- reference frame, model of the mass point, path of motion, speed, velocity, acceleration
- types of linear motion, motion graphs
- Newton's laws
- forces (in general), gravitational force, weight and weightlessness, stretching forces (Hooke's law), friction
- work and energy, different types of energy (kinetic energy, potential energy, elastic energy, internal energy), law of energy conservation, power, efficiency
- linear momentum and impulse, safety precautions in cars (airbag, headrest, crumple zone, safety belt), linear momentum conservation
- uniform circular motion, period, angular velocity, tangential velocity, centripetal force

- models of the universe
- Kepler's laws**,** Newton's law of gravitation
- first and second cosmic velocity**,** orbits, satellites in orbit, geostationary satellites

- oscillations: definition of period, frequency, amplitude, elongation, phase, harmonic oscillations
- spring pendulum, mathematical pendulum
- damped oscillations
- forced oscillations, resonance

- properties of mechanical waves, harmonic wave, wavelength, $c = \lambda \cdot f$
- longitudinal/transverse waves
- constructive and destructive interference, beats, standing waves
- tone, sound, noise
- motion of a violin string, standing waves on strings (fundamental mode and overtones)

- determination of c (Fizeau, Roemer)
- reflection, refraction, determination of the refractive index, total internal reflection
- optical fibres, rainbows and mirages (presentation)
- spectroscopy, decomposition of light into spectral colours
- emission, absorption
- types of spectra (emission/absorption spectra, band/line spectr
- spectrum of hydrogen, spectral series
- laser: properties and creation of laser light, laser cavity, applications of laser light
- diffraction (light and sound)
- double-slit interference, diffraction gratings, determination of the wavelength of light
- polarization, polarizing filters, polarization by reflection, Brewster angle
- LCD screens (presentation)

- electric field, field strength, field-line diagrams
- Coulomb's law
- lightnings (presentation)
- electric current, current strength, voltage, resistance
- measurement of current and voltage
- resistors in series, resistors in parallel, electric circuits
- Ohm's law
- Kirchhoff's laws
- electric power and work

- experiment of Oersted
- magnetic field of a straight wire and a coil
- electromagnet, solenoid lock, relais
- Lorentz force, deflection of electron or ion beams
- AC and DC electric motor
- cathode-ray tube
- earth magnetic field, polar lights (presentations)
- Faraday's law of induction + experiments, Lenz's law
- residual current circuit breaker
- magnetic data storage
- AC and DC generator, three-phase AC generator, Y- and delta connection
- transformer, power transmission
- safety precautions in electricity and devices

- closed LC – circuit, Hertz dipole (=open LC-circuit), Thomson formula
- broadcasting: types of waves, sending and receiving and information, AM, FM
- electromagnetic spectrum
- presentations on radar, microwaves, infrared and X-rays

- basic concepts of quantum mechanics, wave function
- double-slit experiment with electrons, electron diffraction
- matter waves (de Broglie), Davisson-Germer experiment
- Heisenberg's uncertainty principle
- photoelectric effect

- radioactivity, properties of the different types of ionizing radiation
- detection of ionizing radiation (GM tube)
- radioactive decay: alpha-, beta- and gamma decay, half life, decay equation, transformation equation
- effects of radiation on the body
- applications of radioisotopes
- mass defect, binding energy, forces inside the nucleus
- fission, fusion
- nuclear power station
- fusion power station

- Michelson-Morley experiment
- basic concepts of the special and general theory of relativity
- time dilation, length contraction
- mass and energy
- clocks in gravitational fields

- basic concepts of elementary particle physics
- leptons, hadrons and quarks
- evolution of stars
- Hertzsprung-Russell diagram
- basic principles of cosmology
- Hubble's law