EBGIS EAST BAY GERMAN INTERNATIONAL SCHOOL

Physics

Grade Span 9/10

Electromagnetic Interactions

Subject Matter and Methodological Competencies

- characterize magnets by the presence of two inseparably connected poles and the force effect
- on ferromagnetic materials, current carrying conductors and other magnets
- model magnetic fields using field lines
- describe magnetic fields in terms of their non-contact force effect in space and compare with electric fields
- describe the magnetic field of the Earth
- describe the structure and operation of electromagnets
- quantitatively describe the dependence of the strength of a magnetic field on current, number of turns and coil length
- describe and explain the influence of the iron core on the strength of the magnetic field of a coil
- describe the force effect on a current-carrying conductor in a magnetic field
- describe applications of magnetism (e.g. electric motor, loudspeaker, relay, door opener)
- state the conditions of induction and qualitatively formulate the law of induction
- describe the construction of a generator and a transformer and describe how they work
- compare DC and AC voltage on the basis of a time course
- describe the following parameters using the example of an alternating current: frequency, period and amplitude
- describe and explain energy transfer in the power grid
- student experiment on the force effects of magnets
- student experiment on induction

Social and Emotional Competencies

- prepare, conduct and evaluate experiments as part of a team in a concentrated and responsible manner

- learn cooperatively in a group and take responsibility for the communal work process
- on the basis of physics competencies draw conclusions regarding the handling of electrical energy
- appreciate the role of electromagnetism as a significant factor in a high societal standard of living

Project Recommendations

- development of electrical lighting technology
- photovoltaics as a technical use of solar energy
- alternative drive concepts
- applications of electromagnets in technology
- electrical measuring instruments over the course of history
- applications of induction in technology

Movement, Forces and Laws of Conservation

Movement

Subject Matter and Methodological Competencies

- define the concept of motion
- characterize, measure and calculate distance, time, speed and acceleration as physical quantities
- describe linear motion at a constant speed using equations and diagrams
- describe linear motion at a constant acceleration using equations and diagrams
- apply the laws of motion to free fall and other examples, and interpret diagrams
- describe a horizontal throw as superimposed movement (superposition) and apply to examples
- differentiate the types and forms of movement
- describe uniform circular motion in terms of linear speed, period of revolution and rotational speed
- characterize angular velocity as a physical quantity to describe circular movements
- describe vibrations as periodic movements using their characteristics and graphical representations
- qualitatively describe periodic energy conversions in oscillations
- describe a wave as the propagation of an oscillation in space by means of its characteristics and give examples
- define a wave as a special form of energy transfer

- describe examples of wave propagation and its applications
- student experiment investigating a movement event
- student experiment on period of oscillation

Forces

Subject Matter and Methodological Competencies

- determine component forces and resulting forces (e.g. on an inclined plane)
- explain everyday processes with the help of Newton's laws
- apply Newton's Second Law to calculate accelerations and forces during motion
- apply Newton's Second Law in complex calculations
- explain and quantitatively describe the dynamics of uniform circular motion using radial force and radial acceleration
- describe gravity as a natural phenomenon
- interpret and quantitatively apply the law of gravity
- describe examples of the effects of gravity (e.g. weight force, tides, planetary motion)

Conservation Laws

Subject Matter and Methodological Competencies

- name different forms of energy and categorize given examples
- define energy as a state variable
- illustrate the connection between work and energy and explain it using examples
- describe energy conversion, transmission and storage using the example of the supply of
- of electrical energy
- apply the equation for calculating kinetic energy
- describe and calculate the efficiency of energy conversions using selected examples
- apply the law of conservation of energy to various processes
- quantitatively apply the law of conservation of mechanical energy
- characterize and apply to various scenarios force of impact and momentum as physical quantities
- describe the relationship between force of impact and momentum
- apply the law of momentum conservation to different processes
- quantitatively apply the conservation laws to central elastic and inelastic impact processes

Social and Emotional Competencies

- set goals for one's own work and when working in groups; in group work, agree upon an approach and realistically assess its implementation
- deduce the outcomes of behavior (e.g. in road traffic) based on one's knowledge of kinematics and dynamics
- plan, carry out and evaluate measurements in a concentrated, independent and responsible manner
- generalize from the effects of causal relationship and include them in one's personal decision-making based on one's knowledge of the Newtonian laws
- within a team, prepare and lead a discussion session on the efficiency of using various forms of energy

Project Recommendations

- movement in everyday life and sports
- noise and noise protection
- construction of musical instruments
- air currents and flight
- applications of regenerative energy sources
- determination of astronomical quantities
- determination of the efficiency of technical devices
- possibilities for sensible energy conservation in homes

Radioactivity

Subject Matter and Methodological Competencies

- distinguish the components of an atomic nucleus
- identify the composition of atomic nuclei using scientific symbols
- differentiate among isotopes
- differentiate among α, β and γ radiation with reference to their characteristics
- state means of detecting radiation
- name protective measures against radiation
- describe the nuclear transformation during radioactive decay using an example
- describe the origin of α, β and γ radiation and state the associated decay equations
- define the term half-life
- interpret a graphical representation of the time course of radioactive decay and determine half-life
- describe an example of the application of radionuclides

Social and Emotional Competencies

- form a personal point of view regarding the application of radiation technology based on one's scientific knowledge and taking into account economic and social factors as well as ecological considerations
- engage the opinions of others on the subject of radioactivity in an objective and understanding manner
- deduce the consequences of their own actions with regard to radiation protection

Project Recommendations

- possibilities and problems associated with the use of nuclear energy (nuclear fission and fusion)
- use of radioactive nuclides in medicine and technology
- biological effects of radiation