

Natural Science subject curriculum

Dette er en oversettelse av den fastsatte læreplanteksten. Læreplanen er fastsatt på Bokmål

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Purpose

Natural science is the result of human curiosity and our need to find answers to questions about our existence, life and life forms, and our place in nature and the universe, and in this way it becomes part of our culture.

The laws and theories of natural science are models of a complex reality, and these models are changed or developed through new observations, experiments and ideas. An important part of general knowledge is to realise that the natural science are in constant development, and that research and new knowledge in natural science and technology have great importance for societal development and the environment in which we live.

Even though natural science is divided into disciplines such as biology, physics, chemistry and geo-science subjects, the aim is that natural science shall appear as a holistic school subject, both theoretically and practically.

Knowledge on, understanding of and experiences in nature can strengthen the will to protect natural resources, preserve biological diversity and contribute to sustainable development. In this context, the Sami and other indigenous peoples have knowledge of nature that is important to respect. Natural science shall also help children and young persons attain knowledge and form attitudes that will give them a well balanced view of the interaction between nature, individuals, technology, society and research. This is important for the individual pupil's possibilities to understanding different types of information related to the natural sciences and technology. This shall provide the individual with the basis for participating in processes in society.

Practical and theoretical work in laboratories and in the field using different problems and questions is necessary to gain experience with and develop knowledge of the methods and approaches in natural science. This may contribute to developing creativity, critical abilities, openness and active participation in situations involving natural science knowledge and expertise. Varied learning environments such as fieldwork in nature, experiments in the laboratory and excursions to museums, science centres and business enterprises/industries will enhance the teaching in natural science and impart a sense of wonder, curiosity and fascination. Competence in understanding different types of natural science texts, methods and technological solutions gives a good basis for vocational training, further studies and lifelong learning, both at work and in one's leisure time.

Main subject areas

The subject has been structured into main subject areas for which competence aims have been formulated. The main subject areas complement each other and must be viewed in relation to one another.

The subject is a common core subject for all education programmes in upper secondary education. Learning in the subject shall therefore be made as relevant as possible for pupils by adapting the subject to the different education programmes.

Natural science has competence aims after the second, fourth, seventh and tenth years in primary and lower secondary education, and after Vg1 for college preparatory programmes and in programmes for vocational education in upper secondary education.

Overview of main subject areas:

Year level	Main subject areas					
1-10	The budding	Diversity in nature	Body and		Phenomena and	Technology and design

	researcher		health		substances	
Vg1 programme for general studies	The budding researcher	Sustainable development	Nutrition and health	Radiation and radioactivity	Energy for the future	Biotechnology
Vg1 vocational education programme	The budding researcher	Sustainable development	Nutrition and health		Energy for the future	
Vg3 supplementary studies qualifying for higher education	The budding researcher	Sustainable development		Radiation and radioactivity	Energy for the future	Biotechnology

The budding researcher

Teaching in natural science presents natural science as both a product that shows the knowledge we have acquired thus far in history and as processes that deal with how knowledge of natural science is developed and established. These processes involve the formulation of hypotheses, experimentation, systematic observations, discussions, critical assessment, argumentation, grounds for conclusion and presentation. The budding researcher shall uphold these dimensions while learning in the subject and integrate them into the other main subject areas.

Diversity in nature

A central element of the main subject area is the development of knowledge about and respect for the diversity of nature. Knowledge about biotic and abiotic factors in ecosystems is important to understanding interaction processes in nature. The main subject area also focuses on the requirements for sustainable development, the place of man in nature and how human activities have changed and continue to change the natural environment locally and globally. Fieldwork ensures a good basis for knowledge about and attitudes in this area.

In Vg1 the main subject area is called Sustainable development, which expresses its focus within the main subject area.

Body and health

The main subject area focuses on the structure of our bodies and how the body is affected and changed over time. Knowledge about how the different parts of the body interact and work together are basic in the understanding of how lifestyle influences the body and human health. Body, health, lifestyle and nutrition are frequently mentioned in the media. Knowledge and critical assessment of information in this area are important to enable pupils to assume responsibility for their body and physical and mental health. Respect and care for others are also key elements in this area.

In Vg1 the main subject area is called Body and health, which expresses its focus within the main subject area.

Phenomena and substances

The main subject area focuses on the relationship between natural phenomena and how mankind has learned to exploit various phenomena and substances. The main subject area covers the main elements from physics, chemistry and geo-science subjects. The subject area covers how substances are structured, how they interact with each other and central phenomena like sound, light, electricity and magnetism and energy. Our own solar system, the location of the earth and outer space, research and technology are also dealt with in the main subject area.

In Vg1 the main subject area is split into the areas Energy for the future and Radiation and radioactivity, which expresses their focus within the main subject area.

Technology and design

The main subject area focuses on planning, developing and creating products that are useful in our day-to-day lives. The interaction between natural science, technology and sustainable development is a key part of the main subject area. Technology and design is a multidisciplinary area within the Natural science curriculum that includes mathematics, fine art and arts & crafts.

In Vg1 the main subject area is called Biotechnology, which expresses its focus within the main subject area.

Teaching hours

Teaching hours are given in 60-minute units:

PRIMARY SCHOOL

Year Levels 1–7: 328 teaching hours

LOWER SECONDARY LEVEL

Year Levels 8-10: 256 teaching hours (249 hours from the autumn of 2013 due the introduction of elective subjects at this level)

PROGRAMME FOR GENERAL STUDIES

Vg1: 140 teaching hours

VOCATIONAL EDUCATION PROGRAMME

Vg1: 56 teaching hours

SUPPLEMENTARY STUDIES QUALIFYING FOR HIGHER EDUCATION FOR VOCATIONAL EDUCATION PROGRAMMES

Vg3: 84 teaching hours

Basic skills

Basic skills are integrated in the competence aims where they contribute to the development of competence in the subject, while also being part of this competence. In the subject of Natural science the basic skills are understood as follows:

Oral skills in Natural science means listening, speaking and conversing to describe, share and develop knowledge with content about natural science related to observations and experiences. This involves using natural science concepts to communicate knowledge and to formulate questions, arguments and explanations. Furthermore, it involves adapting to different forms of expression, concepts and examples to suit the objective and recipient. Development of oral skills in Natural Science begins with being able to listen and converse about experiences and observations so pupils can present and discuss more and more complex themes. This involves an increasing use of natural science concepts to express understanding, to form opinions and to participate in academic discussions.

Being able to express oneself in writing in Natural science means using text genres from the natural sciences to formulate questions and hypotheses, write plans and formulate explanations, compare and reflect on information and use sources in a purposeful manner. This also involves describing one's observations and experiences, comparing information, argumenting one's viewpoints and reporting from field work, experiments and processes related to technological development. The writing process starts with planning and moves to preparing and presenting texts and involves the use of natural science and scientific concepts, diagrams and symbols that are suited to the objective and the recipient. Development of writing proficiency in the subject of Natural science begins with using simple forms of expression to gradually using more precise natural science and scientific concepts, symbols, graphic presentation and argumentation. This involves being able to write more and more complex texts based on critical and varied use of sources that are suited to the objective and the recipient.

Being able to read in Natural science means understanding and using natural science and scientific concepts, symbols, diagrams and arguments through goal-oriented work with natural science texts. This involves being able to identify, interpret and use information from composite texts in books, newspapers, operating manuals, rules, brochures and digital sources. Reading in Natural science includes critical assessment of how information is presented and used in arguments, e.g. by being able to distinguish between data, assumptions, assertions, hypotheses and conclusions. The development of reading proficiency in Natural science begins with finding and using expressed information from simple texts to understanding texts with more and more complex terminology, symbols, diagrams, tables and implicit information. The demand to read critically, the ability to identify relevant information and evaluate the credibility of a source increases from being able to use appropriate sources to being able to gather and compare information from different sources and evaluate their relevance.

Numeracy in Natural science means gathering, processing and presenting figures and numbers. This involves using concepts, measuring instruments, measuring devices, formulas and visual graphics. Math related to the subject of Natural science involves being able to compare, evaluate and argue for the validity of calculations, results and presentations. The development of simple calculation proficiency in the subject of Natural science begins with using simple methods for counting and classification to being able to evaluate the choice of methods, concepts, formulas and measuring instruments. Furthermore, it involves gradually being able to make more advanced presentations and assessment and using math in academic argumentation.

Digital skills in Natural science means using digital tools to explore, record, calculate, visualise, document and publish data from own and other's studies, experiments and fieldwork. This also involves using tools to search for information, mastering searching and research strategies, learning to evaluate sources critically and selecting relevant information about themes within natural sciences. The development of digital skills in Natural science begins with digital literacy to gradually learn more complex degrees of independence and judgment in choosing and using digital sources, tools, media and information.

Competence aims

Competence aims after Year 2

The budding researcher

The aims of the studies are to enable pupils to

- ask questions, talk and philosophise about experiences in nature and man's place in nature
- use one's senses to explore the world in the local neighbourhood

- describe, illustrate and converse about one's own observations from experiments and in nature
- recognise the symbols for hazardous substances and for dangerous lights

Diversity in nature

The aims of the studies are to enable pupils to

- carry out activities in nearby surroundings to learn about nature and converse about why this is important
- observe and describe the characteristics of the seasons and explain how Sami people divide the year
- recognise and describe some plant and animal species from one's nearby surroundings and sort them into groups

Body and health

The aims of the studies are to enable pupils to

- name and describe the function of some external and internal body parts
- discuss about setting limits and understanding and respecting one's own body and those of others
- describe and discuss about our senses and use them deliberately during indoor and outdoor observations and activities

Phenomena and substances

The aims of the studies are to enable pupils to

- describe and illustrate how the earth, moon and sun move in relation to one another and explain the annual seasons, day/night and the phases of the moon
- describe and sort substances based on observable characteristics
- perform experiments with water and light and discuss the observations

Technology and design

The aims of the studies are to enable pupils to

- make artefacts that are able to move with the help of water or air and tell others about how they work
- make artefacts that use reflection of light and tell others about how they work

Competence aims after Year Level 4

The budding researcher

The aims of the studies are to enable pupils to

- use natural science terms to describe and present one's own observations in various ways and recommend and converse about the possible explanations for what one has observed
- use measuring instruments, systematised data, evaluate whether results seem reasonable or not, and present the data with or without using digital aids and tools
- write reports and descriptions, revise the content of the report after feedback, evaluate the content of texts written by others and create simple digital composite texts

- gather and process information about natural science themes from different sources and provide sources

Diversity in nature

The aims of the studies are to enable pupils to

- talk about and compare the lifecycles of some plant and animal species
- observe, register and describe the changes that occur in a tree or another perennial plants over time
- describe the ways in which some extinct animal groups lived by gathering and systematising information from different sources
- tell about animals from nearby surroundings, discuss animal welfare and distinguish between opinion and fact
- investigate biologic decomposition and describe the cycle of nature
- practice recycling and discuss why recycling is important
- describe what can be done to care for nature in one's own surroundings and argument for consideration when visiting nature

Body and health

The aims of the studies are to enable pupils to

- describe in general terms the structure of the human body
- describe the form and functions of the digestive system
- describe the human skeleton and muscles and elaborate on how the body moves
- explain why we vaccinate against certain illnesses, use information from brochures and digital texts to describe a common illness and how it can be prevented
- observe and describe how the body reacts in different situations, talk about different emotional reactions and the relationship between physical and mental health

Phenomena and substances

The aims of the studies are to enable pupils to

- create a digital composite text about some of the planets in our solar system by finding information about them and state sources
- recognise and point out some stellar constellations, tell and talk about myths and sagas related to the night sky and the northern lights in Sami and Norwegian traditions
- carry out experiments showing that substances and compounds may change their nature when subjected to various influences
- explore phenomena related to air and sound, describe observations and provide some explanations
- register and describe one's own observations about the weather, measure temperature and rain and present the results in a graph

Technology and design

The aims of the studies are to enable pupils to

- plan, build and test simple models of building constructions and document the process from idea to finished product using text and illustrations
- describe constructions and discuss why some are more stable and can withstand greater loads than others
- recognise and describe load-carrying structures in various buildings in one's neighbourhood

Competence aims after Year Level 7

The budding researcher

The aims of the studies are to enable pupils to

- formulate natural science questions about something one wonders about, provide possible explanations, create a plan and carry out examinations and investigations
- converse about why it is important to make and test hypotheses in natural science through systematic observations and experiments, and why it is important to compare results
- use digital aids to register, prepare and publish data from experimental work and fieldwork
- extract and process natural science information from texts from different media and create a presentation
- read and understand hazard labels on everyday products

Diversity in nature

The aims of the studies are to enable pupils to

- plan and execute investigations in at least one nature zone, register one's own observations and systemise the results
- examine and describe flowering plants and explain the functions of the different parts of a plant using text and illustrations
- examine and discuss some of the factors that influence the germination and growth of plants
- describe the characteristics of some plants, mushrooms and animal species and put them in systematic order
- tell others about how some plants, mushrooms and animal species are used according to tradition, including Sami traditions, and discuss whether this use is sustainable

Body and health

The aims of the studies are to enable pupils to

- talk about the development of the human body from conception to adulthood
- explain what happens during puberty and talk about gender identities and variation in sexual orientation
- describe the main features of the circulatory system and what functions it has within the body
- explain how the body protects itself against illness and how one can prevent and treat infectious diseases
- collect information and statistics and discuss dangers to one's health that can result from substance abuse

Phenomena and substances

The aims of the studies are to enable pupils to

- use animation and other kinds of models to describe planetary and moon movements and explain how the reasons for the earth's seasons and the phases of the moon
- describe how some minerals and rock types were formed and examine some of these types from nearby surroundings

- elaborate on the use of some sources of energy, past and present, and gather information and statistics from different sources to describe the possible local and global consequences for the natural environment when using such energy
- explain the concept of climate, be familiar with some causes of climate change and investigate and record the consequences of extreme weather
- investigate phenomena related to sound, hearing and noise, discuss these observations and explain how sound can damage hearing
- carry out experiments with magnetism and electricity and explain and present results
- describe central characteristics of gases, liquids, solids and phase transitions using the particle model
- explain the structure of substances and how substances may be transformed, by using the concepts of atoms and molecules
- carry out experiments with different chemical reactions and describe what characterises them

Technology and design

The aims of the studies are to enable pupils to

- plan, build and test mechanical toys and explain the principles of mechanical transfer
- plan, build and test simple products that use electrical energy and explain and promote the qualities of the finished product
- describe the lifecycle of a product and discuss whether the product is developed in accordance with sustainable development

Competence aims after Year Level 10

The budding researcher

The aims of the studies are to enable pupils to

- formulate testable hypotheses, plan and undertake hypothesis testing and discuss observations and results from trials in a report
- gather and process natural science data, perform calculations and present the results in a graphic manner
- write explanatory and argumentative texts with references to relevant sources, evaluate the quality of one's own texts and those of others making appropriate revisions
- explain the importance of looking for relationships between cause and effect and explain why argumentation, disagreement and publication are important in natural science
- identify natural science arguments, facts and assertions in texts and visual information from newspapers, brochures and other forms of media and evaluate the content of these in a critical manner
- comply with safety measures as described in environment, health and safety (EHS) routines and risk assessments

Diversity in nature

The aims of the studies are to enable pupils to

- explain the main features of the theory of evolution and give an account of observations that support this theory
- describe the structure of animal and plant cells and explain the main characteristics of photosynthesis and cellular respiration
- elaborate on cell division and genetic variation and heritage

- explain the main characteristics of theories on how the earth is changing and has changed over the eons and the underpinning of these theories
- investigate and register biotic and abiotic factors in a local ecosystem and explain the relationship between these factors
- observe and provide examples of how human activities have affected a nature area, investigate the views of different interest groups on these effects and propose measures that might preserve nature for future generations
- give examples of how Sami people exploit resources in nature

Body and health

The aims of the studies are to enable pupils to

- describe the nervous system and the endocrine system and explain how these control body processes
- provide a short description of fetal development and how birth occurs
- formulate assertions and discuss and elaborate on problems related to sexuality, sexual orientation, gender identity, setting limits and respect, sexually transferrable diseases, prevention and abortion
- explain how one's own lifestyle can influence health, including dieting and eating disorders, compare information from different sources and discuss how one can prevent health risks
- provide examples of folk medicine, including Sami folk medicine, and discuss the difference between alternative medicine and academic medicine

Phenomena and substances

The aims of the studies are to enable pupils to

- describe the universe and different theories of how it has developed
- investigate a theme from exploring the outer space; compare and present information from different sources
- assess characteristics of elements and compounds using the periodic table
- examine the properties of some substances used in everyday life and make simple calculations related to diluting solutions
- examine and classify pure substances and compounds based on solubility in water, combustion, acidity and basicity
- plan and carry out experiments with detection reactions, separation of substances in a mixture and analysis of an unknown substance
- examine hydrocarbons, alcohols, carboxylic acids and carbohydrates, describe the substances and give examples of their fabrication and areas of use
- explain how crude oil and natural gas have come about
- use terms such as current, voltage, resistance, output and induction to explain results from experiments with electrical circuits
- explain how we can produce electrical energy from renewable and non-renewable energy sources and discuss the environmental effects that arise from different ways of producing energy
- elaborate on the concepts of velocity and acceleration, measure magnitudes using simple aids and give examples of how power is connected to acceleration
- carry out experiments and simple calculations with work, energy and output
- elaborate on how traffic safety equipment prevents and reduces injuries in accidents
- carry out experiments with light, vision and colour; describe and explain results

Technology and design

The aims of the studies are to enable pupils to

- develop products based on specifications that use electronics, evaluate the design process and assess product functionality, user friendliness and sustainable development
- test and describe the characteristics of materials used in a production process and evaluate the use of materials from an environmental standpoint
- describe an electronic communication system, explain how information is transferred from sender to recipient and give an account of the positive and negative consequences related to this system

Competence aims after Vg1 – programmes for general studies

The budding researcher

The aims of the studies are to enable pupils to

- plan and carry out different types of investigations by identifying variables, gathering and processing data and writing a report that includes discussions about estimating uncertainties of measurements and assess possible sources of errors
- distinguish between results and assertions and discuss the quality of methods and presentation of own data and the data of others and how such data is interpreted
- discuss and elaborate on authentic problems related to natural science based on practical investigations or systematised information from different sources
- use simple computer simulations or animations to illustrate and explain natural science phenomena and test hypotheses

Sustainable development

The aims of the studies are to enable pupils to

- provide an account of the concept of sustainable development
- investigate and describe succession processes within an ecosystem
- elaborate on factors that influence the size of a population
- map out one's own choices as a consumer and provide logical and ethical arguments for these choices that can contribute to sustainable consumer patterns
- investigate a global conflict of interest related to an environmental question and discuss and elaborate on the quality of arguments and conclusions in a forum for debate

Nutrition and health

The aims of the studies are to enable pupils to

- describe the most important energy-yielding nutrients and their chemical characteristics and give reasons for why they are important for the body
- give examples of vitamins, minerals and trace elements that the body needs and how one can make certain one has a varied diet
- carry out simple chemical detection of nutrients in food and give an account of one's observations
- explain the main characteristics of digestion, transport and transformation of the most important energy-yielding nutrients in the body
- elaborate on some main components in cosmetic products and make such a product with its own content declaration
- discuss and elaborate on issues in connection with dieting, eating disorders, training and how lifestyle diseases affect one's health

Radiation and radioactivity

The aims of the studies are to enable pupils to

- explain how the northern lights arise, and give examples of how Norway has been and is an important country for research in this field
- explain the importance of the ozone layer with respect to solar irradiation of the earth
- explain the greenhouse effect and elaborate on and analyse how human activity is altering the energy balance of the atmosphere
- elaborate on some possible consequences of the increased greenhouse effect, including Arctic areas and lowlands, and discuss and elaborate on the measures being initiated to reduce the increase in the greenhouse effect
- carry out experiments with radioactivity, half-life and background radiation, explain these phenomena and do simple calculations
- describe characteristics of different types of ionising radiation and give examples of how these are used for technical and medical applications
- explain how electromagnetic radiation from space may be interpreted and provide information about outer space

Energy for the future

The aims of the studies are to enable pupils to

- carry out experiments with solar cells, solar collectors and heat pumps, explain the main features of how these work and make simple calculations about their degrees of efficiency
- explain what redox reactions are, carry out experiments with combustion, galvanic elements and electrolysis and elaborate on the results
- describe the principles and areas of use of some common batteries and fuel cells
- elaborate on different uses of biomass as an energy source
- give an account of the difference between energy sources and energy-bearers and a typical energy-bearer for the future

Biotechnology

The aims of the studies are to enable pupils to

- explain genetic coding and the main characteristics of protein synthesis and provide examples of the interconnectedness between heritage and the environment
- explain the concepts of cross-breeding and gene modification and give examples of how biotechnology is used to modify the characteristics of plants and animals
- provide an overview of different medical applications of biotechnology and discuss the opportunities and challenges of such use
- compare arguments on the use of biotechnology and discuss and elaborate on different academic and ethical problems related to these

Competence aims after Vg1 – vocational education programmes

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- carry out experiments with solar cells, solar collectors and heat pumps, explain the main features of how these work and make simple calculations about their degrees of efficiency
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Competence aims after Vg3 - supplementary studies qualifying for higher education

The budding researcher

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Assessment

Provisions for final assessment:

Overall achievement assessment

Year level	Provision
Year level 10	The pupils shall have one overall achievement grade
Vg1 vocational education programme	The pupils shall have one overall achievement grade

Vg3 programme for general studies	
Vg3 supplementary studies qualifying for higher education	

Examinations for pupils

Year level	Provision
Year level 10	The pupils may be selected for an oral examination. The examination is carried out with some practical elements. The examination is prepared and marked locally.
Vg1 vocational education programme Vg1 programme for general studies	The pupils may be selected for an oral examination with some practical elements. The examination is prepared and marked locally.
Vg3 supplementary studies qualifying for higher education	The pupils may be selected for an oral examination. The examination is prepared and marked locally. The examination only includes the subject in the supplementary year qualifying candidates for higher education (84 teaching hours).

Examinations for external candidates

Year level	Provision
Year level 10	See the provisions for primary school education for adults.
Vg1 vocational education programme Vg3 programme for general studies	External candidates shall have for an oral examination with practical elements. The examination is prepared and marked locally.
Vg3 supplementary studies qualifying for higher education	External candidates shall have an oral examination with practical elements. The examination is prepared and marked locally. The examination only includes the subject in the supplementary year qualifying candidates for higher education (84 teaching periods).

The general provisions on assessment have been laid down in the Regulations relating to the Norwegian Education Act.