

Geosciences - Programme subject in programme for Specialization in General Studies

Laid down as a regulation by the Norwegian Directorate for Education and Training on 6 February 2006, as delegated in a letter of 26 September 2005 from the Ministry of Education and Research pursuant to the Act of 17 July 1998 no. 61 relating to primary and secondary education (Education Act) Section 3-4 first paragraph.

Established: 06.02.2006

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Purpose

Geosciences is concerned with the basic elements of natural environments, such as bedrock, loose masses, air and water. These are natural resources that play fundamental social and economic roles in local and global society. Norway's natural resources ensure the country's sound economy, and Norway is a major contributor to research in the geosciences.

Today, earth, air and water are influenced by human activity to such a great degree that the natural biotope is deteriorating or threatened with destruction. Extreme climatic and weather conditions and natural disasters can take many lives, leaving enormous destruction behind and leading to great human, social and economic suffering. Competence in preventive work and early warning systems is fundamental to local and global perspectives. The programme subject shall give pupils insight into this field, giving them a better grasp of international environmental debates and discussions on sustainable development.

Research in the geosciences and the exploitation of geosciences resources often involve difficult ethical challenges. Environmental debates present observations with a degree of reservation and uncertainty. The programme subject shall give pupils an understanding of discussions surrounding research methods and the validity and uncertainty of their findings. One objective of the programme subject is to help individuals understand that trustworthy early warning methods do, in fact, exist and that international cooperation is necessary for getting the most out of early-warning systems and for preventing damage. The programme subject shall also give the pupil an understanding of how early warning systems for forecasting threats to climatic and weather situations in Norway are constructed. Teaching in the subject of local, national and international geoscientific conditions shall provide knowledge about the geosciences and the importance of evaluating and understanding news articles and discussions on sustainable development and geopolitical policies.

In the subject of *Geosciences*, individuals shall gain experience in research methods used in the natural sciences through independent activities in their local community. The programme subject may help create a basis for further study in one or more subject areas of Geology, Geophysics or Natural Geography.

Structure

Geosciences is comprised of three programme subjects: *Geosciences 1*, *Geosciences 2* and *Geosciences X*. *Geosciences 1* and *Geosciences 2* are built up so that one can choose either subject, independent of the other. *Geosciences X* is especially designed for pupils at level Vg2 who choose Mathematics as a programme subject. Only *Geosciences 1* and *Geosciences 2* provide complete specialization.

Geosciences 1 and *Geosciences X* have three main subject areas in common: *A changing earth*, *Natural disasters* and *The Tools of Geosciences*. *Geosciences 1* also comprises the main subject area *Geosciences Research*.

These programme subjects have been structured into main subject areas, for which competence aims have been formulated. The main subject areas complement each other, and should be viewed in relation to one another.

Overview of the main subject areas:

Programme subject	Main subject areas			
Geosciences X		A changing	Natural	Tools of geosciences

Geosciences 1	Geosciences research	earth	disasters	
Geosciences 2	Geosciences research	A changing earth	Climate change	Geoscientific resources

Main subject areas

Geosciences X

A changing earth

The main subject area is concerned with how rock types and land forms are created. The subject discusses natural process that lead to changes to rock types, land forms and the atmosphere. The main subject area also covers the fact that these changes occur along a time scale that stretches from billions of years after the earth's formation up to the hours and minutes of local weather phenomena.

Natural disasters

The main subject area is concerned with how natural disasters affect nature, society and human beings. It also involves the consequences of natural disasters and how they are presented in the media. The main subject area also covers organized initiatives during natural disasters, such as early warnings, preparedness and physical measures, and the significance of international cooperation and assistance efforts.

Tools of geosciences

The main subject area is concerned with practical work with the different tools used in the geosciences. Maps and surveying are discussed here, as well as digitalized maps and Global Position Systems (GPS). This main subject area also covers Geography Information systems (GIS) and other background information, such as statistics, satellite images, radar plotting, weather maps and weather forecasting.

Geosciences 1

Geosciences research

The main subject area is concerned with experiments and research related to geoscientific conditions within a chosen area outside of Scandinavia. The interrelationships between the environment, natural conditions and resources are a part of this main subject area.

A changing earth

The main subject area is concerned with how rock types and land forms are formed. The subject discusses natural process that lead to changes to rock types, land forms and the atmosphere. The main subject area also covers the fact that these changes occur along a time-line that stretches from billions of years after the earth's formation up to the hours and minutes of local weather phenomena.

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Geosciences 2

Geosciences research

The main subject area is concerned with current research within the geosciences. It focuses on investigation of the conditions in a geotope. The term 'geotope' in the main subject area is used to signify a delimited geographic area and to describe characteristic conditions of bedrock, land forms, water, loose masses and local climates in this area. The main subject area also is concerned with how weather reports are prepared.

A changing earth

The main subject area is concerned with water currents in the seas and oceans and how these affect the climate. Furthermore, the focus is on ongoing natural process that lead to changes in the seas, oceans and the atmosphere. The main subject area also covers the subject of climatic changes that might be caused by human beings.

Climate change

The main subject area is concerned with climate change following the last Ice Age, the extent to which latest climate changes are caused by natural processes, or whether these are caused by human beings. Climate change in polar areas and the consequence of this are central themes in this main subject area.

Geoscientific resources

The main subject area is concerned with how society can utilize rock types, loose masses, water and the atmosphere. It focuses on how rock types and loose masses can be used as raw materials for industry, road construction and building and construction. It also is concerned with earthly resources as sources of energy. Technologies that use solar energy, thermal energy from the earth, air and water, and wind or wave energy are important parts of this main subject area.

Teaching hours

Teaching hours are given in 60-minute units:

Geosciences X: 84 teaching hours per year

Geosciences 1: 140 teaching hours per year

Geosciences 2: 140 teaching hours per year

Basic skills

Basic skills are integrated into the competence aims for this course in areas where they contribute to the development of and are a part of the basic subject competence. In the Geosciences programme subject, basic skills are understood as follows:

Being able to express oneself orally and in writing in Geosciences involves describing experiences, observations and gathering information by using the concepts and terminology from geosciences. It also means relating critically to information collected from geosciences and formulating hypotheses that can be investigated further. It also means being able to argue for solutions, and give feedback.

Being able to read in Geosciences involves extracting, interpreting and reflecting on texts from newspapers, professional journals, books and the Internet, as well as being able to read and understand different kinds of maps. It will also be important to understand reasoning and scenarios, and evaluate the quality of geoscientific information.

Numeracy in Geosciences involves using figures, making calculations, registering, working with and presenting results from measurements taken. It means using graphs, tables and statistics that result from geoscientific research based on mathematical models. It also means being able to understand concepts such as scenario, prognosis and probability.

Being able to use digital tools in Geosciences involves gathering, registering and preparing information, and presenting results with digital means. Furthermore, it means using animation, simulations, digital maps and digital navigation systems.

Competence aims

Geosciences X

A changing earth

The aims of the studies are to enable pupils to

- give an account of geological time scales and methods used to establish relative and absolute ages
- explain the formation of magmatic and metamorphic rock types using plate tectonics theories
- give an account of the formation of sediments and sedimentary rock types
- explain the basics of climatic and weather conditions by using theories of radiation balance, water circulation and atmospheric currents
- observe, describe and name landscape formations formed by glaciers, and consider the processes that can lead to these forms

Natural disasters

The aims of the studies are to enable pupils to

- explain the cause of earthquakes, tsunamis and volcanic eruptions using plate tectonics theory
- give an account of the causes of tropical hurricanes and other types of extreme weather

- describe different types of avalanches, and elaborate on and discuss the causes of avalanches
- explain the causes of extreme floods and droughts
- create a summary of different news media presentations of natural disasters, and evaluate the geoscientific descriptions critically
- give an overview of measures taken to prevent damage and injury during natural disasters
- give an account of how international cooperation can assist in surveillance and early warnings for natural disasters

Tools of geosciences

The aims of the studies are to enable pupils to

- extract and analyze information from different kinds of Geoscientific maps, airplane photos, radar plotting and satellite images
- gather, prepare and present geoscientific information by using digital tools

Geosciences 1

A changing earth

The aims of the studies are to enable pupils to

- give an account of geological time scales and methods used to establish relative and absolute ages
- explain the formation of magmatic and metamorphic rock types using plate tectonics theories
- give an account of the formation of sediments and sedimentary rock types
- explain the basics of climatic and weather conditions using theories about radiation balance, water circulation and atmospheric currents
- observe, describe and name landscape formations formed by glaciers, and consider the processes that can lead to these forms

Natural disasters

The aims of the studies are to enable pupils to

- explain causes of earthquakes, tsunamis and volcanic eruptions using plate tectonics theory
- give an account of the causes of tropical hurricanes and other types of extreme weather
- describe different types of avalanches, and elaborate on and discuss the causes of avalanches
- explain the causes of extreme floods and droughts
- create a summary of different news media presentations of natural disasters, and evaluate the geoscientific descriptions with a critical eye
- give an overview of measures that can be taken to prevent damage and injury during natural disasters
- give an account of how international cooperation can assist in surveillance and early warnings for natural disasters

Tools of geosciences

The aims of the studies are to enable pupils to

- extract and analyze information from different kinds of geoscientific maps, airplane photos, radar plotting and satellite images

- gather, prepare and present geoscientific information by using digital tools

Geosciences research

The aims of the studies are to enable pupils to

- plan and execute research of geoscientific conditions in one part of the world, country or area outside of Scandinavia, with and without the use of digital tools, and present their results
- give an account of relationships between bedrock, land forms and geological resources in a chosen area
- give an account of the causes of climatic conditions in one chosen area
- map out hydrological conditions, and elaborate on and discuss access to fresh water in a chosen area
- elaborate on and discuss the risk of environmental natural disasters and the consequences these can have in one chosen area

Geosciences 2

A changing earth

The aims of the studies are to enable pupils to

- give an account of the causes of surface and deep-sea currents in world oceans, and discuss their consequences for the climate
- explain how el Niño and la Niña arise, and describe their influence on the climate
- describe the variations in the ozone layer, and elaborate on and discuss natural and human causes

Geosciences research

The aims of the studies are to enable pupils to

- give an account of problems, methods and results within one field of research in the geosciences
- plan, carry out, present and evaluate research and fieldwork in a geotope
- describe this process from observations, models and weather maps to the final weather reports
- prepare, present and evaluate daily local weather forecasts for a period of one week, with the help of weather maps, satellite images and radar plotting

Climate change

The aims of the studies are to enable pupils to

- describe the main features of climatic development from the latest Ice Age to the present time, and elaborate on and discuss theories about climate change created naturally and by human action
- give an account of discussions within scientific environments about the causes to climate changes
- present information about climate change to polar areas, and give an account of different views as to causes to climate change and the effects of these
- elaborate on and discuss the ethical challenges associated with climate change

Geoscientific resources

The aims of the studies are to enable pupils to

- describe how deposits of oil, coal and natural gas are formed, detected and extracted
- describe how bedrock and loose masses in Norway are extracted and used
- elaborate on and discuss problems associated with fresh water resources, in a global perspective
- give an account of the meaning of water as a source of energy, and illustrate energy amounts and quantities with numerical examples
- describe the exploitation of renewable energy sources of solar, wind, tidal, wave and geothermal energy, and elaborate on and discuss what their importance is for energy supplies in the future
- elaborate on and discuss environmental problems associated with the exploitation of earth-based resources and the technologies used

Assessment

Provisions for final assessment:

Overall achievement grades

Programme subject	Provision
Geosciences X	The pupils shall have an overall achievement mark.
Geosciences 1	The pupils shall have an overall achievement mark.
Geosciences 2	The pupils shall have an overall achievement mark.

Examination for pupils

Programme subject	Provision
Geosciences X	The pupils may be selected for an oral-practical exam.
	The exam is prepared and marked locally.
Geosciences 1	The pupils may be selected for an oral-practical exam.
	The exam is prepared and marked locally.
Geosciences 2	The pupils may be selected for a written or an oral-practical exam.
	The written exam is prepared and marked centrally.
	The oral-practical exam is prepared and marked locally.

Examination for external candidates

Programme subject	Provision
Geosciences 1	The external candidates shall sit for an oral-practical exam.
	The exam is prepared and marked locally.
Geosciences 2	The external candidates shall sit for a written and an oral-practical exam.
	The written exam is prepared and marked centrally.
	The oral-practical exam is prepared and marked locally.

The provisions for assessment are stipulated in the regulations of the Norwegian Education Act.