COURSE SYLLABUS
Pathway for Natural Sciences, 37.5 credits

Pathway for Natural Sciences, 37,5 högskolepoäng

Course Code:	PNSX00	**Education Cycle:**	Basic level
Confirmed by:	Utbildningsrådet Apr 8, 2019	**Disciplinary domain:**	Natural sciences (80%) and social sciences (20%)
Valid From:	Jan 13, 2020	**Subject group:**	NA9
Version:	1	**Specialised in:**	GXX

Intended Learning Outcomes (ILO)

On successful completion of the Pathway for Natural Sciences students will be able to:

Knowledge and understanding
1. Display knowledge of polynomial-, power-, exponential- and trigonometric functions
2. Display knowledge of the concept of the geometric sum and of linear optimization
3. Display knowledge of radians
4. Display knowledge of numerical methods to calculate integrals
5. Display knowledge of the structure of the atom and chemical bonds
6. Show familiarity with some elementary acid-base reactions
7. Demonstrate comprehension of energy changes in chemical reactions
8. Demonstrate comprehension of oxidation-reduction reactions and of some of their applications
9. Show familiarity with risks of working in a laboratory
10. Demonstrate knowledge of physical quantities and units
11. Demonstrate an understanding of the concepts of force and energy
12. Demonstrate an understanding of the concepts of electromagnetism
13. Demonstrate knowledge of atomic physics
14. Understand the main content and essential details of English spoken at a relatively rapid pace, and in written English of various genres, and in more formal contexts
15. Know general principles of academic writing and formal composition
16. Know how to plan and deliver a formal presentation in English using rhetorical principles
17. Know how to apply and use a range of academic study techniques and language strategies

Skills and abilities
18. Demonstrate ability to transform and simplify algebraic expressions
19. Demonstrate skills of solving equations of various sorts
20. Demonstrate skills of calculating derivatives and basic integrals involving the above-mentioned elementary functions
21. Demonstrate ability to use derivatives in order to analyze the properties of a given function

and to methodically solve optimization problems

22. Demonstrate ability to transform and simplify rational expressions

23. Demonstrate skills of using trigonometric formulas to solve problems for triangles

24. Demonstrate skills of solving trigonometric equations

25. Demonstrate ability to transform and simplify trigonometric expressions

26. Demonstrate skills of using integrals to solve geometrical problems

27. Show ability to search information about labelling and handling of chemicals

28. Show ability to handle laboratory equipment, to perform experiments and interpret and process the results

29. Demonstrate ability to perform calculations in stoichiometry

30. Demonstrate ability to perform simple ph calculations

31. Demonstrate ability to write and interpret chemical formulas for some chemical compounds and reactions

32. Demonstrate skills in using experimental methods in laboratory

33. Show ability to apply newton's laws and conservation of energy

34. Demonstrate skills in using the concepts of torque, momentum, impulse, pressure, heat, temperature, electrostatic forces and fields in calculations

35. Demonstrate skills in calculating current, voltage, potentials and resistance in dc circuits

36. Demonstrate skills in applying the special theory of relativity

37. Demonstrate skills to interpret and carry out basic calculations in nuclear physics

38. Show ability to solve problems concerning motion in two dimensions

39. Show ability to apply theory concerning mechanical oscillations and waves

40. Show ability to perform calculations on electric- and magnetic fields

41. Demonstrate skills concerning electromagnetic induction and alternating currents

42. Demonstrate skills concerning electromagnetic waves and their properties

43. Show ability to solve problems concerning the electron structure of atoms

44. In oral and written production and interaction in English students will demonstrate the ability to present and discuss information accurately and clearly with some adaptation to purpose, recipient and situation.

45. Carry out effective research based on different research methods, using a range of sources, and critically assess and evaluate these.

46. Participate actively in classroom activities and be able to perform a range of task both individually and in a group setting.

47. Be familiar with different aspects of Scandinavian society and culture.

Judgement and approach

48. Self and peer reflection on the development of skills and abilities.

49. Critical evaluation of relevant information related to the different parts of the course.

Contents

The Pathway for Natural Sciences course is a preparatory course for students who do not meet the level of required Mathematics, Physics and Chemistry for University studies in Sweden.

A horizontal aim is to develop and strengthen student skills within higher education through group work, social engagement, peer learning, reflective learning and autonomous learning whilst developing intercultural communication skills, metacognitive skills, information literacy and critical thinking.

The purpose of the course is to provide post-secondary supplementary Mathematics, Physics and Chemistry education in which the content
corresponds to the content of Swedish upper secondary school courses Mathematics 3b and 3c, Physics 1
and Physics 2 and Chemistry 1 as a pathway to a programme at Jönköping University.

The purpose is also to prepare students for Higher Education in Sweden by giving support in adjusting to the demands, challenges and expectations of Swedish Higher Education.

The course consists of six sub-courses; Pathway Mathematics 1, Pathway Mathematics 2, Pathway Chemistry, Pathway Physics 1, Pathway Physics 2 and Pathway Academic English. Knowledge will be gained through lectures, assignments, laboratory exercises and mentoring sessions. Weekly tasks will be set and marked to track progress.

Sub Courses

Pathway Mathematics 1, 7,5 credits
The course includes the following elements:
- Basic algebra
- Geometric sums
- Studies of polynomial, power and exponential functions
- Logarithms
- Derivatives and differentiation rules for the functions mentioned above
- Applications using the derivative to solve optimization problems
- Integrals

Pathway Mathematics 2, 3,5 credits
The course includes the following elements:
- Trigonometric formulas and identities
- Introduction to trigonometric functions
- Vectors

Pathway Chemistry, 5,0 credits
The course includes some basic chemical concepts about the structure and the functions of the matter, the transformations of the substances within chemical reactions and the importance of Chemistry to people and societies.

The course includes the following elements:
- The risks of work in a laboratory including labeling and handling of chemicals
- Matter and chemical bonding

- Chemical formulas and calculations
- Energy changes in chemical reactions
- Acids and bases
- Redox reactions and electrochemistry
- Analytical chemistry

Pathway Physics 1, 8,0 credits

The course introduces the basic physics and the science of working with experiments, analysis and interpretation of measurements using models. In addition, the course will provide familiarity with the use of mathematical concepts in physics and algebraic handling of formulas and expressions.

The course includes the following topics:
- Units and unit conversions, vectors and scalars, the SI-system
- Velocity and speed, acceleration, laws of motion with constant acceleration
- Newton's laws, normal force, gravitational force, Hooke's Law, friction, inclined plane
- Work, potential energy, kinetic energy, power and efficiency, conservation of energy
- Momentum, conservation of momentum, impulse, elastic and inelastic collisions
- Density, pressure, pressure in liquids, Archimedes' principle
- Thermodynamics; pressure in gases, the ideal gas law, phase transitions and calorimetry
- Electric charges and forces, electric fields, electric current, voltage and potentials, resistance and resistivity, electrical energy and power
- DC circuits, series and parallel circuits involving resistors
- Nuclides, nuclear reactions, activity and half-life, ionizing radiation
- The special theory of relativity, light speed, time dilation and length contraction, relativistic energy

Pathway Physics 2, 6,0 credits

The course introduces additional basic physics and principles of scientific work with experiments, analysis and interpretation of measurements using models. More mathematical concepts in physics are introduced and applied.

The course includes the following topics:
- Torque with application to static balance
- Motion in two dimensions; projectile motion, circular motion and the centripetal force
- Mechanical oscillations and waves; springs, pendulums, resonance
- Sound and properties of sound waves, sound level
- Electric and magnetic fields; capacitance and the capacitor, magnetic flux and magnetic field strength, charged particles in magnetic fields, the Biot-Savart law, electromagnetic induction, Lenz' law, coils, electromotive force, Faraday's law of induction
- Alternating currents; the generator, the transformer, AC circuits with capacitor and coil, self inductance
- Light as electromagnetic waves; the electromagnetic spectrum, reflection, refraction and Snell's

law, diffraction, interference

- Atomic physics; photons, propertied of atomic electron structure, absorption and emission, emission spectra, the photoelectric effect

Pathway Academic English, 7,5 credits

The course consists of lectures, seminars and group activities in various fields of academic English and has been designed specifically to meet the needs of non-native English speakers who wish to develop their English language competencies and be able to communicate effectively in an academic environment. In addition to the development of the four main areas of language (reading, writing, speaking and listening), there is also a strong focus on academic skills including research ethics, critical thinking, academic writing and presentations. English will be taught in an international context with a strong focus on active participation and group discussion. Students will be given opportunities to share their own experiences and in turn gain a deeper knowledge of living conditions, social issues and cultural features in different parts of the world.

Course content and objectives include:
- Applied grammar (individualised)
- Vocabulary building - academic language. Both general and subject specific.
- Academic reading
- Listening comprehension
- Academic writing - summary writing, research papers, essays
- Language strategies
- Oral proficiency - presentation, group discussion and debating skills, pronunciation
- Introduction to rhetoric - the art of persuasive speaking and writing

Type of instruction

Lectures, laboratory exercises and mentoring sessions.

The teaching is conducted in English.

Prerequisites

High School Diploma and English language skills corresponding to:
IELTS 6.5 or the equivalent
Mathematics 2a, 2b, 2c or the equivalent

Examination and grades

The course is graded Fail (U) or Pass (G).

The examination consists of written assignments, laboratory experiments and written exams. Active participation throughout the course is required.

Registration of examination for the sub-course 'Pathway Mathematics 1':

Name of the Test	Value	Grading

Pathway Mathematics 1 - Written exam[1]	7.5 credits	U/G

[1] ILOs: 1, 2, 4, 18-22, 26

Registration of examination for the sub-course 'Pathway Mathematics 2':

Name of the Test	Value	Grading
Pathway Mathematics 2 - Written exam[1]	3.5 credits	U/G

[1] ILOs: 1, 3, 23-25

Registration of examination for the sub-course 'Pathway Chemistry':

Name of the Test	Value	Grading
Pathway Chemistry - Written exam[1]	4 credits	U/G
Pathway Chemistry - Laborations[2]	1 credit	U/G

[1] ILOs: 5-8, 29-32

[2] ILOs: 9, 27, 28

Registration of examination for the sub-course 'Pathway Physics 1':

Name of the Test	Value	Grading
Pathway Physics 1 - Written exam[1]	6 credits	U/G
Pathway Physics 1 - Laborations[2]	2 credits	U/G

[1] ILOs: 10, 11, 33-37

[2] ILOs: 9, 27, 32

Registration of examination for the sub-course 'Pathway Physics 2':

Name of the Test	Value	Grading
Pathway Physics 2 - Written exam[1]	4 credits	U/G
Pathway Physics 2 - Laborations[2]	2 credits	U/G

[1] ILOs: 12, 13, 37-43

[2] ILOs: 9, 27, 42

Registration of examination for the sub-course 'Pathway Academic English':

Name of the Test	Value	Grading
Pathway Academic English - Academic paper[1]	4 credits	U/G
Pathway Academic English - Oral presentation[2]	2 credits	U/G
Pathway Academic English - Life and Studies in Scandinavia[3]	1.5 credits	U/G

[1] ILOs: 14-15, 17, 44-45, 48-49

[2] ILOs: 16, 44, 46, 48-49

[3] ILOs: 47-49

Other information

Qualification Requirements

To obtain the Course Certificate the student shall complete the course requirements of 37.5 credits where 7.5 credits constitute Pathway Mathematics 1, 3.5 credits constitute Pathway Mathematics 2, 5 credits constitute Pathway Chemistry, 8 credits constitute Pathway Physics 1, 6 credits constitute Pathway Physics 2 and 7.5 credits constitute Pathway Academic English. Active participation required in lectures, workshops, assignments, laboratory exercises and tutorials is compulsory in order to meet the requirements of the course.

Continuation Requirements

Students who successfully complete the Pathway for Natural Science, 37.5 credits, may, if preselected and eligibility assessed, without any further testing enter:
- The Bachelor program Sustainable Supply Chain Management at JU
- The Bachelor program Prosthetics and Orthotics at JU

Title of qualification

The course gives you a Course Certificate demonstrating skills equivalent to the corresponding requirements of Swedish upper
secondary school courses Mathematics 3b and 3c, Physics 1, Physics 2 and Chemistry 1, qualifying you for admission to a specific programme at Jönköping University.

Course literature

Pathway Mathematics 1 & 2
Ibrahim Wazir, Tim Garry: *Pearson Baccalaureate, Standard Level Mathematics*, 2012 edition, ISBN: 9780435074975. Pearson 2012.
https:*openstax.org/subjects/math*
Additional handouts from JU

Pathway Physics 1 & 2
*Openstax College Physics, https:*openstax.org/details/books/college-physics
Additional handouts from JU

Pathway Chemistry
https:*openedgroup.org/books/Chemistry.pdf*
*https:*www.ck12.org/c/chemistry/ (web material linked to the pdf above)
https://openstax.org/details/books/chemistry
Additonal handouts from JU

Pathway Academic English
All reference books and work books are provided on an individual and whole class basis. Bespoke teaching materials and handouts for English and Life and Studies will be distributed by the class teacher or lecturer.