



Higher National Unit specification

General information for centres

Unit title: Chemistry and Physics for Life Sciences

Unit code: F21J 34

Unit purpose: This Unit aims to introduce to the candidate some basic concepts in the fields of chemistry and physics. It has been designed at a generic level and is suitable for inclusion within any science-based Course. Candidates will be made aware of the importance of these fields of science and their relevance to their chosen program of study. The knowledge gained from this Unit will facilitate study in other Units present in the first and subsequent years of study.

On completion of the Unit the candidate should be able to:

- 1 Explain the basic principles of physical chemistry.
- 2 Explain the basic principles of inorganic chemistry.
- 3 Explain and predict situations using the physical properties of matter.
- 4 Explain and solve problems using the concepts of heat and energy transfer.

Credit points and level: 1 HN credit at SCQF level 7: (8 SCQF credit points at SCQF level 7*)

**SCQF credit points are used to allocate credit to qualifications in the Scottish Credit and Qualifications Framework (SCQF). Each qualification in the Framework is allocated a number of SCQF credit points at an SCQF level. There are 12 SCQF levels, ranging from Access 1 to Doctorates.*

Recommended prior knowledge and skills: While access to this Unit is at the discretion of the centre, a prior knowledge of Chemistry and Physics at Standard Grade SCQF level 5 or equivalent would provide underpinning knowledge, candidates lacking on one or both of these fields of science would still be able to undertake the study of the Unit to a successful Outcome.

Core Skills: There are opportunities to develop the Core Skill Communication to SCQF level 6, the component Using Number of the Core Skill Numeracy and the component Reviewing and Evaluating of the Core Skill Problem Solving to SCQF level 6 in this Unit, although there is no automatic certification of Core Skills or Core Skills components.

Context for delivery: If this Unit is delivered as part of a Group Award, it is recommended that it should be taught and assessed within the subject area of the Group Award to which it contributes. This Unit is appropriate for any land-based, biological or environmental Group Award.

Assessment: This assessment should be assessed by supervised closed book assessments. It is expected that Outcomes 1&2 will be assessed by a single holistic supervised closed book assessment. Outcomes 3 & 4 could be assessed in a single holistic supervised closed book assessment, with a short practical assessment for the remainder of Outcome 3.

Higher National Unit specification: statement of standards

Unit title: Chemistry and Physics for Life Sciences

Unit code: F21J 34

The sections of the Unit stating the Outcomes, Knowledge and/or Skills, and Evidence Requirements are mandatory.

Where evidence for Outcomes is assessed on a sample basis, the whole of the content listed in the Knowledge and/or Skills section must be taught and available for assessment. Candidates should not know in advance the items on which they will be assessed and different items should be sampled on each assessment occasion.

Outcome 1

Explain the basic principles of physical chemistry

Knowledge and/or Skills

- ◆ Atomic Structure
- ◆ Bonding
- ◆ Chemical units
- ◆ Nature of chemical reactions
- ◆ Balancing Equations
- ◆ Rates of Reaction
- ◆ Equilibrium and equilibrium constants
- ◆ Radioactivity

Evidence Requirements

Candidates will need to provide evidence to demonstrate their Knowledge and/or Skills by showing that they can:

- ◆ explain the nature of elements in terms of their atomic structures
- ◆ for given compounds, explain different types of bonding
- ◆ explain the significance and relevance of units used in Chemistry
- ◆ explain the use of balancing equations for molecular equations
- ◆ explain the nature of chemical reactions, and how their rates may be altered
- ◆ evaluate the significance of equilibrium and how it can be manipulated
- ◆ determine the equilibrium constant for different reactions
- ◆ explain radioactive decay of matter

Assessment Guidelines

Outcomes 1 and 2 could be assessed as a single holistic supervised closed book assessment. The questions should reflect a representative sample from the knowledge and/or skills of each Outcome. Sampling should cover at least 5 knowledge and/or skills from Outcome 1 and at least 4 knowledge and/or skills from Outcome 2. The assessment should be approximately 60 minutes in duration and have an appropriate pass mark.

Higher National Unit specification: statement of standards (cont)

Unit title: Chemistry and Physics for Life Sciences

Outcome 2

Explain the basic principles of inorganic chemistry

Knowledge and/or Skills

- ◆ Properties of acids and alkalis
- ◆ pH for weak and strong acids and alkalis
- ◆ Hydrogen ion concentration
- ◆ Buffers and buffering capacity
- ◆ Chemical oxidation
- ◆ Chemical reduction

Evidence Requirements

Candidates will need to provide evidence to demonstrate their Knowledge and/or Skills by showing that they can:

- ◆ explain the properties of two strong acids and two weak acids in terms of pH
- ◆ explain the properties of two strong alkalis and two weak alkalis in terms of pH
- ◆ calculate the hydrogen ion concentration for different acids of known pH
- ◆ explain the term buffering capacity and give an example of buffers in action
- ◆ explain the nature of chemical reactions involving oxidation and reactions involving reduction

Assessment Guidelines

Outcomes 1 and 2 could be assessed as a single holistic supervised closed book assessment. The questions should reflect a representative sample from the knowledge and/or skills of each outcome. Sampling should cover at least 5 knowledge and/or skills from Outcome 1 and at least 4 knowledge and/or skills from Outcome 2. The assessment should be approximately 60 minutes in duration and have an appropriate pass mark.

Outcome 3

Explain and predict situations using the physical properties of matter

Knowledge and/or Skills

- ◆ Physical properties of matter
- ◆
- ◆ Environmental factors
- ◆ Diffusion
- ◆ Measurement of physical properties

Higher National Unit specification: statement of standards (cont)

Unit title: Chemistry and Physics for Life Sciences

Evidence Requirements

Candidates will need to provide evidence to demonstrate their Knowledge and/or Skills by showing that they can:

- ◆ explain a practical situation demonstrating the use of the physical properties of matter
- ◆
- ◆ predict the impact on matter of changing one environmental parameter
- ◆ describe how altering two factors may influence diffusion according to Fick's Law
- ◆ use instruments to take two different measurements for the physical properties

Assessment Guidelines

Outcomes 3 and 4 could be assessed as a single holistic supervised closed book assessment for the theoretical content. The questions should reflect a representative sample from the knowledge and/or skills of each Outcome. Sampling should cover at least 2 knowledge and/or skills from Outcome 3 and at least 3 knowledge and/or skills from Outcome 4. The assessment should be approximately 60 minutes in duration and have an appropriate pass mark. Outcome 3 will also have a practical assessment.

Outcome 4

Explain and solve problems using the concepts of heat and energy transfer

Knowledge and/or Skills

- ◆ Concepts of heat and energy
- ◆ Effects of heat
- ◆ Transfer of energy
- ◆ Laws of Thermodynamics and Kinetic theory
- ◆ Energy requirement calculations

Evidence Requirements

Candidates will need to provide evidence to demonstrate their Knowledge and/or Skills by showing that they can:

- ◆ explain the effects of heat on matter in relation to temperature and change of state
- ◆ explain three means of energy transfer
- ◆ explain the significance of the 1st and 2nd Laws of Thermodynamics
- ◆ use the Kinetic Theory of Matter to explain P, V or T observations
- ◆ determine the energy exchange occurring within a simple system

Assessment guidelines

Outcomes 3 and 4 could be assessed as a single holistic supervised closed book assessment for the theoretical content. The questions should reflect a representative sample from the knowledge and/or skills of each Outcome. Sampling should cover at least 2 knowledge and/or skills from Outcome 3 and at least 3 knowledge and/or skills from Outcome 4. The assessment should be approximately 60 minutes in duration and have an appropriate pass mark.

Administrative Information

Unit code:	F21J 34
Unit title:	Chemistry and Physics for Life Sciences
Superclass category:	RA
Original date of publication:	September 2007
Version:	02 (July 2013)

History of changes:

Version	Description of change	Date
02	Amendments made to Assessment Guidelines reducing the amount of assessment.	10/07/13

Source: SQA

© Scottish Qualifications Authority 2007, 2013

This publication may be reproduced in whole or in part for educational purposes provided that no profit is derived from reproduction and that, if reproduced in part, the source is acknowledged.

SQA acknowledges the valuable contribution that Scotland's colleges have made to the development of Higher National qualifications.

Additional copies of this Unit specification can be purchased from the Scottish Qualifications Authority. Please contact the Customer Contact Centre for further details, telephone 0845 279 1000.

Higher National Unit specification: support notes

Unit title: Chemistry and Physics for Life Sciences

This part of the Unit specification is offered as guidance. The support notes are not mandatory.

While the exact time allocated to this Unit is at the discretion of the centre, the notional design length is 40 hours.

Guidance on the content and context for this Unit

This Unit has been designed to provide candidates with a solid understanding and awareness of basic (practical and theory) chemical and physical principles, which can then be applied to particular subject areas and/or vocational contexts. It has been deliberately designed at a very generic level and is suitable for inclusion within any science-based Course.

Outcomes 1 and 2

These Outcomes should be taught with reference to examples of physical and inorganic chemistry respectively. In the chemistry sections, Outcomes 1 and 2 may explore the principles of physical chemistry and consider the structure of materials and the language that is used to describe substances reactions and radioactive decay. Candidates should have the opportunity to consider inorganic materials (that is materials not based on Carbon) and develop the ability to interpret basic chemical situations and understand the reactions. Candidates should be provided with examples of how atoms bond in different ways into compounds and the different types of bonds that are possible such as ionic, covalent, polar covalent and hydrogen.

For the physics section, Outcomes 3 and 4, it might be appropriate to talk initially about the physics of solids liquids and gases and the real meaning of terms like weight, pressure and density. Other early topics could involve the study of the physics of heat and how it is measured and practice of working out the heating or cooling requirement for simple situations.

Throughout the Unit candidates should be given opportunities during class time to develop the ability to use current chemical and physical terminology, chemical symbols and SI units as they study.

Outcome 3

This Outcome lays a foundation for an understanding of the important properties of matter: state, volume, mass, density and pressure. The candidate should be introduced to the concepts of diffusion. This could be taught in the context of the individual's area of study: for example the irradiation of food for food technology candidates, and soil moisture measurements for agricultural science candidates

Outcome 4

This Outcome looks at energy transfers and their importance in both natural and man-made processes. A variety of energy transformations should be considered within the framework of the 1st and 2nd Laws of Thermodynamics. The effect of adding heat energy to a material is considered, as well as the processes of heat transfer.

Higher National Unit specification: support notes (cont)

Unit title: Chemistry and Physics for Life Sciences

Guidance on the delivery and assessment of this Unit

The delivery of this Unit could be by variable methods including formal lectures, tutorials, discussions and specific problem solving exercises. Additional material such as presentations, additional supplemental reading and problem based exercises could be placed on a VLE system. This will facilitate out of college learning and understanding.

Outcomes 1 and 2 could utilise problem based solving exercises to aid the understanding and resolving capacity of the candidates. Suitable assessments are likely to consist of restricted response questioning and could be combined with those other Outcomes using the same assessment instrument.

If emphasis on the measurement of properties and associated variables such as temperature, flow rate and level is introduced to the candidate through practical experience in the selection and use of measuring instruments or techniques, this would assist with the development of oral communication skills and problem solving skills and develop competent laboratory skills in **Outcome 3**. It is recommended that this **Outcome 4** be taught through a series of lectures and tutorials supplemented where necessary and appropriate with practical based exercises.

Opportunities for developing Core Skills

There are opportunities to develop the Core Skills of Communication (written or oral Communication) to SCQF level 6 and Numeracy (Using Number) and Problem Solving (Reviewing and Evaluating) to SCQF level 6 in this Unit, although there is no automatic certification of Core Skills or Core Skills components.

Candidates may be asked to express complex ideas such as the nature of atomic structure and its relationship to molecular forms as part of their assessment, potentially offering opportunities to develop the Core Skills of Communication (written or oral Communication) to SCQF level 6. The Unit also presents opportunities to develop Numeracy (Using Number) and Problem Solving (reviewing and evaluating) to SCQF level 6 such as in Outcome 4 which requires the candidate to carry out calculations and to problem solve using the concepts of heat and energy transfer.

Open learning

Elements of this Unit could be delivered via distance learning or indeed via a flexible learning approach. Certain aspects though, such as the measurement of physical variables would require the candidate to be present at the centre. Where any evidence requires to be generated in a closed-book, supervised manner, the delivering centre should ensure that measures have been put in place to assure the authenticity of the candidates' submission

Candidates with disabilities and/or additional support needs

The additional support needs of individual candidates should be taken into account when planning learning experiences, selecting assessment instruments, or considering alternative Outcomes for Units. Further advice can be found in the SQA document *Guidance on Assessment Arrangements for Candidates with Disabilities and/or Additional Support Needs* (www.sqa.org.uk).

General information for candidates

Unit title: Chemistry and Physics for Life Sciences

This Unit is designed to enhance your capability to resolve problems and explain observations through developing your knowledge of basic science. This is a useful skill for anyone, no matter their vocation, however it is essential for any science candidate. Science is all about providing explanations for the things we observe in the world around us. In some cases the explanation lies with the properties and behaviour of substances and their reactions with each other, which is termed chemistry. In other cases the explanation will be found in the laws of the natural world, of energy, matter and gravitation, which is the branch of science referred to as physics. This Unit introduces you to both the basic principles of chemistry and physics.

In the chemistry sections, Outcomes 1 and 2, you will explore the principles of physical chemistry. You will consider the structure of materials and the language that is used to describe substances and reactions. You will then go on to consider inorganic materials (that is materials not based on Carbon) and you will develop your ability to interpret basic chemical situations and understand the reactions.

For the physics section, Outcomes 3 and 4, you will start to learn about the physics of solids liquids and gases and the real meaning of terms like weight, pressure and density. You will also study the physics of heat and how it is measured and end up by being able to work out the heating or cooling requirement for simple situations.

Throughout this Unit you will also develop your ability to use terminology, symbols and units correctly.

Supervised closed-book restricted response questioning could be undertaken for Outcome 1, 2 and 4 and a practical exercise combined with supervised closed-book questioning used for Outcome 3.

Candidates may be asked to express complex ideas such as the nature of atomic structure and its relationship to molecular forms as part of their assessment, potentially offering opportunities to develop the Core Skills of Communication (written or oral Communication) to SCQF level 6. The Unit also presents opportunities to develop Numeracy (using number) and Problem Solving (reviewing and evaluating) to SCQF level 6 such as in Outcome 3 and 4 which requires you to carry out calculations and to problem solve using the concepts of heat and energy transfer.