

Unit 37: Scientific Principles for Beauty Therapy

Unit code: D/601/4470

QCF Level 3: BTEC Nationals

Credit value: 6

Guided learning hours: 49

● Aim and purpose

This is a preparation for work unit, which is based on knowledge and understanding. It is about the scientific principles which underpin an understanding of beauty therapy. This includes biological principles relevant to beauty therapy, the chemical processes that occur in the body and the salon and the principles of physics in relation to beauty treatments.

● Unit introduction

In order to perform beauty treatments safely and effectively, it is important that beauty therapists have a sound understanding of the underlying scientific principles. They need a basic understanding of the chemical, biological and physical processes which occur in the body and salon.

In this unit, learners will study biological processes, such as cell respiration, enzyme reactions and diffusion, and learn about the effects of humidity on the body and in the salon. They will develop an understanding of the chemical structure of important substances used in beauty therapy and explore ideas such as pH. The handling and storage of potentially dangerous chemicals will be covered, as well as microbiological hazards and the importance of hygiene in the salon.

Learners will also find out how scientific ideas of physical science such as force, friction, pressure and levers apply to body movement and exercise. Because of the popularity and importance of electrical treatments, learners will study the basic principles and terminology of electricity, which will enable them to understand how these treatments work and help them to perform them safely and efficiently. The nature and properties of electromagnetic radiation will also be explored, together with its effects on the skin.

● Learning outcomes

On completion of this unit a learner should:

- 1 Understand biological principles in relation to beauty therapy
- 2 Understand the chemical processes that occur in the body and in beauty therapy
- 3 Understand the principles of physics in relation to beauty treatments in the salon.

Unit content

1 Understand biological principles in relation to beauty therapy

Osmosis and diffusion: meaning of osmosis, diffusion and active transport; selectively permeable membranes; applications in the body (nutrients, oxygen, water)

How the body obtains energy: food as a fuel; breakdown of nutrients eg glucose, amino acids and fatty acids; three macronutrients (carbohydrates, protein and fat) required in correct amounts to keep energy levels at their best

Enzymes: idea of catalysts; lock and key theory; examples of enzymes and their substrates; factors affecting rate of enzyme reactions

Evaporation and humidity: latent heat; cooling effect of evaporation; humidity; factors affecting rate of evaporation; ventilation in salon/laboratory

Cross-infection: how cross-infection can occur (direct, indirect); personal and salon hygiene measures which help prevent cross-infection

2 Understand the chemical processes that occur in the body and in beauty therapy

Basic terminology: mixture; element; compound; solution; solvent; solute; emulsion; foam; acid; alkali; pH; oxidising agent; examples from beauty therapy

Chemical elements in the body: oxygen; carbon; hydrogen; nitrogen; calcium; phosphorous; functions of elements

Basic molecular structure of common compounds: glucose; ethanol; water; acetone; carbon dioxide; ethyl ethanoate

Hazardous and volatile: flammable; inhalation of fumes; ways of storing and using (secure bottle tops, darkened, lockable storage cupboard)

3 Understand the principles of physics in relation to beauty treatments in the salon

Basic terminology: force; pressure; friction; examples in beauty therapy

Movements and levers: movements and levers relating to muscles and exercise

Electricity: terms (current, voltage, resistance, power, energy, frequency); electrical units (amps, volts, ohms, watts and kilowatts, hertz); static and current electricity; conductors and insulators; alternating and direct current; uses (heating, lighting, equipment); possible causes of electric shock in salon (loose wires and plug sockets, water and electrical equipment, failure to follow manufacturer's instructions)

Light: reflection; refraction; main areas of electromagnetic spectrum; UV light (effects, dangers)

Assessment and grading criteria

In order to pass this unit, the evidence that the learner presents for assessment needs to demonstrate that they can meet all the learning outcomes for the unit. The assessment criteria for a pass grade describe the level of achievement required to pass this unit.

Assessment and grading criteria		
To achieve a pass grade the evidence must show that the learner is able to:	To achieve a merit grade the evidence must show that, in addition to the pass criteria, the learner is able to:	To achieve a distinction grade the evidence must show that, in addition to the pass and merit criteria, the learner is able to:
P1 describe how nutrients, oxygen and water enter and leave cells by diffusion and osmosis	M1 explain the importance of osmosis and diffusion in the kidneys and skin	D1 evaluate the implications of bodily processes on beauty therapy treatments
P2 describe how the body obtains and uses energy		
P3 describe the nature and functions of enzymes [IE2]	M2 explain factors affecting the rate of enzyme reactions	
P4 explain the effect of humidity on the human body	M3 analyse the importance of the cooling effect of evaporation with reference to the body and beauty therapy	
P5 describe the cooling effect of the evaporation of sweat from the skin		
P6 explain the importance of ventilation in the salon or laboratory		
P7 describe how personal and salon hygiene measures help prevent cross-infection [CT3]	M4 explain how personal and salon hygiene measures help prevent cross-infection	D2 evaluate the effectiveness of salon hygiene measures in preventing cross-infection
P8 explain the meaning of the terms: <ul style="list-style-type: none">◊ mixture◊ element◊ compound	M5 compare and contrast the composition and properties of common compounds and mixtures encountered in beauty therapy	D3 explain how the composition and chemical structure of common compounds and mixtures encountered in beauty therapy affects their properties and the ways in which they should be handled and stored
P9 state the important chemical elements in the body and their functions [IE3]		

Assessment and grading criteria

To achieve a pass grade the evidence must show that the learner is able to:	To achieve a merit grade the evidence must show that, in addition to the pass criteria, the learner is able to:	To achieve a distinction grade the evidence must show that, in addition to the pass and merit criteria, the learner is able to:
P10 describe the molecular structure of common compounds encountered in beauty therapy, including glucose, ethanol, water, acetone, carbon dioxide, ethyl ethanoate		
P11 explain the meaning of 'mixture', 'solution', 'solvent', 'solute', 'emulsion' and 'foam', using examples from beauty therapy		
P12 explain the meaning of 'acid', 'alkali', 'pH', 'oxidising agent', using examples from beauty therapy		
P13 state potential hazardous and volatile substances used in the salon or laboratory [IE1]	M6 explain how safe working practices can reduce the risks associated with potentially hazardous and volatile substances	
P14 describe how potential hazardous and volatile substances should be used and stored in the salon or laboratory		
P15 explain the meaning of 'force', 'pressure', 'friction', using examples from beauty therapy	M7 justify how principles behind 'force', 'pressure', 'friction' 'movements and levers' can be of use during beauty therapy treatments	
P16 explain what is meant by movements and levers, relating this to muscles and exercise [CT3]		
P17 explain the meaning of electrical terms (current, voltage, resistance, power, energy, frequency), stating their units	M8 classify the different electrical devices in a salon, with regard to their function, consumption of energy, the principles on which they work, and rules for safe use	D4 compare the different electrical devices in a salon, with regard to their function, consumption of energy, the principles upon which they work, and rules for safe use

Assessment and grading criteria

To achieve a pass grade the evidence must show that the learner is able to:	To achieve a merit grade the evidence must show that, in addition to the pass criteria, the learner is able to:	To achieve a distinction grade the evidence must show that, in addition to the pass and merit criteria, the learner is able to:
P18 describe the use of static and current electricity, conductors and insulators, and alternating and direct current in beauty therapy		
P19 describe possible causes of electric shock in the salon or laboratory		
P20 describe what is meant by reflection and refraction	M9 explain the potential effects of UV tanning.	D5 evaluate the effects of UV tanning.
P21 describe the main areas of the electromagnetic spectrum [IE2]		
P22 describe the effect, uses and dangers of ultraviolet light. [IE2]		

PLTS: This summary references where applicable, in the square brackets, the elements of the personal, learning and thinking skills applicable in the pass criteria. It identifies opportunities for learners to demonstrate effective application of the referenced elements of the skills.

Key	IE – independent enquirers CT – creative thinkers	RL – reflective learners TW – team workers	SM – self-managers EP – effective participators
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Essential guidance for tutors

Delivery

It is advised that the delivery of this unit is as practical-based as possible, to stimulate and motivate learners. Tutors should use a variety of delivery methods to achieve this, which could include: lectures, class discussions, simple experiments in the laboratory, guest speakers from a science department to talk about the molecular structure of compounds and methods used to create chemical reactions in products such as solvents and emulsions.

For learning outcome 1, learners could investigate osmosis and diffusion using Visking tubing, and burn foods such as sugar and cooking oil in simple calorimeters to increase their understanding of how the body utilises fuel and oxygen. They could investigate the effect on the rate of enzyme reactions of varying the temperature, concentration and pH. Wet and dry bulb thermometers could be used when delivering sessions on humidity and evaporation. The speed at which bacteria reproduce and the importance of salon and personal hygiene could be demonstrated using simple experiments with agar plates, taking swabs from equipment and nails.

For learning outcome 2, learners would benefit from carrying out simple chemical reactions and from building and handling three-dimensional models of organic molecules. The pH of beauty products such as cuticle remover could be investigated, and learners should have the opportunity to handle and examine different solutions and emulsions. Comparing the vitamin C content of fruit juices using 2, 6-dichlorophenolindophenol is a good example of an experiment using an oxidation reaction.

For learning outcome 3, learners could experiment with levers, weights and force meters to understand the relationship between muscles and joints. They should have the opportunity to experiment with static electricity to assist with the concept of electrical charge, and with simple electric circuits to investigate conductors, insulators, and Ohm's law. They should see the effect on fuse wire of exceeding the maximum current. A demonstration of electrolysis, showing the formation of lye, could also be useful. To understand the concept of waves it would be beneficial for learners to experiment with trays of water and different shaped barriers as well as with mirrors and lenses for refraction and reflection. A study of equipment used in beauty-related industries and their range on the electromagnetic spectrum would help learners to understand the effects and dangers of light.

To bring the unit to life learners could:

- work in small groups and film each of their experiments as though they were providing a televised lesson or documentary
- create a book of experiments with step by step captions and photographs of experiments.

This unit would suit co-delivery with *Unit 41: Make and Test Beauty Therapy Products* and *Unit 39: Scientific Investigation*.

Outline learning plan

The outline learning plan has been included in this unit as guidance and can be used in conjunction with the programme of suggested assignments.

The outline learning plan demonstrates one way in planning the delivery and assessment of this unit.

Topic and suggested assignments/activities and/assessment
Introduction to the unit.
Assignment 1: Scientific Principles in Beauty Therapy (P1, P2, P3, P4, P5, P6, P7, P8, P9, P10, P11, P12, P13, P14, P15, P16, P17, P18, P19, P20, P21, P22, M1, M2, M3, M4, M5, M6, M7, M8, M9, D1, D2, D3).
Tutor introduction to assignment brief.
Osmosis and diffusion. The tutor could introduce the topic. Learners could carry out experiments with selectively permeable tubing. They could record their results and conclusions on worksheets which would serve as notes and also provide assessment evidence.
Energy. Learners could research calorific values from food labels or the internet, and perform simple calorimetry experiments on foods which burn easily in air eg sugar, cooking oil, peanuts.
Enzymes. The tutor could introduce the topic and explain the lock and key theory. Learners could perform different experiments investigating the effect of temperature and pH on reaction rates and results could then be shared and discussed. Learners could research examples of enzymes and substrates on the internet.
Evaporation, humidity and latent heat. Learners could perform experiments with evaporation, and measure humidity. They could record their results and conclusions on worksheets which would also serve as lecture notes and provide evidence for assessment. They could then inspect a salon to see how the theory has been put into practice, and produce a report on this.
Basic ideas of chemistry. This could be taught through lectures, but should include as many demonstrations and experiments by learners as possible. Again, worksheets could be used to assess many of the pass criteria, or a multiple-choice test could be used. Longer written answers to questions could be used to assess the merit and distinction criteria.
Forces, pressure, moments and levers. This topic will probably require tutor explanation from the tutor but should include as many demonstrations and learner experiments as possible. Levers, force meters, balancing beams and friction planes could be used. Again, worksheets or short-answer questions will be an appropriate form of assessment.
Electricity. This topic will probably require some tutor input and explanation but should include practical experimentation by learners wherever possible.
Light and radiation. Wave-motions could be introduced with experiments or demonstrations using water waves. The tutor could then explain terminology and the relationship between wavelength and frequency. Learners could experiment with mirrors and lenses, and research areas of the electromagnetic spectrum on the internet.
Assignment workshop(s).

Assessment

The unit is assessed by the centre and will be subject to external verification by Edexcel.

Achievement of the assessment and grading criteria should be evidenced through contextualised, vocationally-related experiences, with tasks specifically designed with the assessment and grading criteria in mind.

The theoretical aspects of assessment for this unit can be covered through the learners completing centre-devised assignments, a portfolio of evidence or through adaptation of Edexcel assignments where available. Practical assessment criteria will require observation and completion of relevant documentary evidence by the assessor.

Assessment should be as holistic as possible, with assignments designed to cover multiple assessment criteria, across units where appropriate. Reference to grading criteria should be made in the assessment documentation, to ensure the criteria have been met.

This unit is intended to provide a broad scientific knowledge base for beauty therapists. To avoid a heavy burden of assessment, some of the criteria could be assessed through the completion of class worksheets which could double as lecture notes and as a record of practical work. Many of the pass criteria in particular could be assessed in this way. The emphasis should be on quality and depth of understanding, rather than on quantity.

The pass criteria assess learners' knowledge and understanding of scientific principles, including application within beauty therapy so learners could achieve all the assessment and grading criteria within one holistic assignment, such as a written report on scientific principles in beauty therapy.

Alternatively, learners could sit a short-answer paper, designed by the centre, as a summative assessment. The merit and distinction criteria expect learners to demonstrate a higher level of understanding using skills of evaluation and analysis.

It is essential that learners are given opportunities to achieve all the assessment and grading criteria through the assignments. The theoretical aspects of this unit, such as anatomy and physiology, lend themselves to cross-unit assessment.

It is recommended good practice for tutors to hold regular assignment workshops where learners bring in their assignment work and work on it, consulting with the tutor when necessary.

Signed witness testimonies and observation records must be retained for verification purposes. Supplementary evidence in the form of photographs and consultation record cards could also be provided

Programme of suggested assignments

The table below shows a programme of suggested assignments that cover the pass, merit and distinction criteria in the assessment and grading grid. This is for guidance and it is recommended that centres either write their own assignments or adapt any Edexcel assignments to meet local needs and resources.

Criteria covered	Assignment title	Scenario	Assessment method
P1, P2, P3, P4, P5, P6, P7, P8, P9, P10, P11, P12, P13, P14, P15, P16, P17, P18, P19, P20, P21, P22, M1, M2, M3, M4, M5, M6, M7, M8, M9, D1, D2, D3	Scientific Principles in Beauty Therapy	Produce a report on scientific principles in beauty therapy.	Written report. Supplementary evidence in the form of results from experiments could also be provided and marked and authenticated by the tutor.

Links to National Occupational Standards, other BTEC units, other BTEC qualifications and other relevant units and qualifications

This unit forms part of the BTEC hair and beauty sector suite. This unit has particular links with the following unit titles in the hair and beauty suite:

Level 2	Level 3
The Living Body	Dermatology and Microbiology
	Scientific Investigation
	Scientific Practical Techniques
	Make and Test Beauty Therapy Products

Essential resources

It is recommended that learners have laboratory access, and access to basic tools and equipment.

Employer engagement and vocational contexts

Guest speakers from the hair and beauty sector, such as product and equipment manufacturers, health and safety officers would be beneficial to help learners to appreciate the practical application of scientific principles.

Indicative reading for learners

Textbooks

Bennett R – *Science of Beauty Therapy 3rd Edition* (Edward Arnold, 2004) ISBN 9780340814666

Connor J, Milsom G and Godfrey S – *BTEC National Beauty Therapy Sciences* (Heinemann, 2004)
ISBN 9780435462437

Hiscock J, Stoddard E and Connor J – *Level 3 NVQ/SVQ Diploma Beauty Therapy Candidate Handbook 2nd Edition* (Heinemann, 2010) ISBN 9780435027018

Simmons J V – *The Science of Cosmetics 2nd Edition* (Thomson Learning, 1995) ISBN 9780333638040

Journals and magazines

Guild Gazette (Guild of Professional Beauty Therapists)

Habia News (Seed Publishing Limited)

Health and Beauty Salon Magazine (Reed Business Information)

Websites

www.beautyguild.com

Authenticated by the tutor

www.habia.org

Habia, the Standards Setting Body for the hair and beauty sector

www.hse.gov.uk

Health and Safety Executive

www.rsc.org

Royal Society of Chemistry

Delivery of personal, learning and thinking skills

The table below identifies the opportunities for personal, learning and thinking skills (PLTS) that have been included within the pass assessment criteria of this unit.

Skill	When learners are ...
Independent enquirers	carrying out research into the nature and functions of enzymes, the main areas of the electromagnetic spectrum and the effect, uses and dangers of ultraviolet light [IE2] exploring the important chemical elements in the body and their functions [IE3] identifying questions to ask regarding potential hazardous and volatile substances used in the salon or laboratory [IE1]
Creative thinkers	connecting ideas on how personal and salon hygiene measures help to prevent cross-infection and on movements and levers relating this to muscles and exercise. [CT3]

Although PLTS are identified within this unit as an inherent part of the assessment criteria, there are further opportunities to develop a range of PLTS through various approaches to teaching and learning.

Skill	When learners are ...
Creative thinkers	asking questions to extend their thinking and devising experiments [CT2]
Team workers	collaborating with others, working in a small group when performing experiments or preparing presentations as part of assessment. [TW1]

● Functional Skills – Level 2

Skill	When learners are ...
ICT – finding and selecting information	
Use appropriate search techniques to locate and select relevant information	researching information on the internet eg energy content of food
Select information from a variety of sources to meet requirements of a complex task	researching information on the internet eg energy content of food
ICT – developing, presenting and communicating information	
Enter, develop and refine information using appropriate software to meet requirements of a complex task	collating and comparing the energy content of different foods
Combine and present information in ways that are fit for purpose and audience	researching energy content of food making presentations
Mathematics – representing:	
Understand routine and non-routine problems in familiar and unfamiliar contexts and situations	performing simple calculations involving forces, movements, pressure, wavelength and frequency, and voltage and current
Identify the situation or problems and identify the mathematical methods needed to solve them	performing simple calculations involving forces, movements, pressure, wavelength and frequency, and voltage and current
English – Speaking, Listening and Communication	
Make a range of contributions to discussions in a range of contexts, including those that are unfamiliar, and make effective presentations	making presentations
English – Writing	
Write a range of texts, including extended written documents, communicating information, ideas and opinions, effectively and persuasively	producing leaflets and written explanations.