



Higher National Unit specification

General information

Unit title: Sports Therapy: Anatomy and Physiology (SCQF level 7)

Unit code: H7VD 34

Superclass: RH

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Unit purpose

This Unit is designed to provide learners with underpinning knowledge of the structure and function of the human body necessary to the professions of sports massage/therapy. It also provides underpinning knowledge for many other Units and the National Occupational Standards in Sports Therapy.

Outcomes

On successful completion of the Unit the learner will be able to:

- 1 Describe the structure, organisation and function of the human body.
- 2 Describe the structure and function of the skeletal system.
- 3 Describe the structure and function of the muscular system.
- 4 Describe the structure and function of the nervous and endocrine systems.
- 5 Describe the structure and function of the respiratory, cardiovascular and lymphatic systems.
- 6 Describe the formation, use and replenishment of energy substrates.

Credit points and level

2 Higher National Unit credits at SCQF level 7: (16 SCQF credit points at SCQF level 7)

Recommended entry to the Unit

This is a mandatory Unit in the Group Awards HNC Soft Tissue Therapy/HND Sports Therapy. It is anticipated that learners will have studied some Human Anatomy at SCQF level 6 prior to undertaking this Unit. However, entry is at the discretion of the delivering centre.

Higher National Unit specification: General information (cont)

Core Skills

Opportunities to develop aspects of Core Skills are highlighted in the Support Notes for this Unit specification.

There is no automatic certification of Core Skills or Core Skill components in this Unit.

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.

The content of this Unit underpins much of the material within HNC/HND Fitness, Health and Exercise. Consideration should be given to this when timetabling and delivering the Unit.

The Assessment Support Pack (ASP) for this Unit provides assessment and marking guidelines that exemplify the national standard for achievement. It is a valid, reliable and practicable assessment. Centres wishing to develop their own assessments should refer to the ASP to ensure a comparable standard. A list of existing ASPs is available to download from SQA's website (<http://www.sqa.org.uk/sqa/46233.2769.html>).

Equality and inclusion

This Unit specification has been designed to ensure that there are no unnecessary barriers to learning or assessment. The individual needs of learners should be taken into account when planning learning experiences, selecting assessment methods or considering alternative evidence.

Further advice can be found on our website www.sqa.org.uk/assessmentarrangements.

Higher National Unit specification: Statement of standards

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Acceptable performance in this Unit will be the satisfactory achievement of the standards set out in this part of the Unit specification. All sections of the statement of standards are mandatory and cannot be altered without reference to SQA.

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. Learners 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

Describe the structure, organisation and function of the human body.

Knowledge and/or Skills

- ◆ Structure of the human body
- ◆ Organisation of the human body
- ◆ Function of the human body
- ◆ Inter-relationship of cells, tissues, organs and body systems

Outcome 2

Describe the structure and function of the skeletal system.

Knowledge and/or Skills

- ◆ Anatomy of the axial and appendicular skeleton
- ◆ Vertebral column
- ◆ Classification and function of bone types
- ◆ Structure and development of long bones
- ◆ Structure and classification of major synovial joints
- ◆ Effects of exercise on skeletal system

Outcome 3

Describe the structure and function of the muscular system.

Knowledge and/or Skills

- ◆ Functions of the muscular system
- ◆ Structure and location of skeletal muscle
- ◆ Types of muscle fibres
- ◆ Physiology and classification of muscle contraction
- ◆ Neuromuscular control of movement and posture
- ◆ Effects of exercise on skeletal muscle

Higher National Unit specification: Statement of standards (cont)

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Outcome 4

Describe the structure and function of the nervous and endocrine systems.

Knowledge and/or Skills

- ◆ Structure of the nervous system
- ◆ Structure and function of neurons
- ◆ Conduction in a neurone
- ◆ Structure of the spinal cord
- ◆ Reflexes and reflex arc
- ◆ Structure and function of the brain
- ◆ Structure of the endocrine system
- ◆ Feedback systems
- ◆ Function of hormones
- ◆ Nervous and endocrine responses to physical stressors
- ◆ Endocrine maintenance of bone health
- ◆ Endocrine regulation of blood glucose levels
- ◆ Endocrine regulation of fluid

Outcome 5

Describe the structure and function of the respiratory, cardiovascular and lymphatic systems

Knowledge and/or Skills

- ◆ Structure and function of the respiratory system:
 - Mechanism of breathing at rest and during exercise
 - Exchange of air volumes at rest and during exercise
 - Neural control of respiratory system
- ◆ Structure and function of the heart and vascular system:
 - Physiology of blood
 - Nervous control and redistribution of blood to meet the demands of exercise
- ◆ Structure and function of the lymphatic system

Outcome 6

Describe the formation, use and replenishment of energy substrates.

Knowledge and/or Skills

- ◆ Aerobic production systems
- ◆ Anaerobic production systems
- ◆ Use and replenishment of substrates during exercise

Higher National Unit specification: Statement of standards (cont)

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Evidence Requirements for this Unit

Learners will need to provide evidence to demonstrate their Knowledge and/or Skills across all Outcomes by showing that they can:

Outcome 1

This Outcome should be assessed by an open-book project forming a portfolio of evidence.

- ◆ identify and describe the structure and functions of the components of a typical animal cell
- ◆ describe methods of transport in cells by diffusion, osmosis and active transport
- ◆ identify, locate and describe the main functions of body tissues:
 - identify the organs of each body system
 - describe the major functions of each body system
- ◆ describe the organisation and relationship between: cells and tissues; tissues and organs; organs and systems
- ◆ describe the inter-relationship of all systems to each other

Outcome 2

This Outcome should be assessed by a closed-book restricted response paper.

- ◆ identify the main components of the axial and appendicular skeleton
- ◆ identify the structure of the vertebral column and the main components of vertebrae
- ◆ identify components of a typical synovial joint and describe their functions
- ◆ describe bone types by classification, function and location
- ◆ identify and describe major synovial joints by classification and movement patterns
- ◆ describe the structure and development of a long bone at a cellular and vascular level
- ◆ describe the long term effects of exercise on the skeletal system including Wolff's law)

Outcome 3

This Outcome should be assessed by a closed-book restricted response paper.

- ◆ identify major muscles by position (minimum 20 selected, evenly distributed, muscles)
- ◆ describe the structure of skeletal muscle
- ◆ describe the process of contraction of skeletal muscles
- ◆ identify the main components of different types of muscle fibres
- ◆ describe the neuromuscular control of movement
- ◆ describe the effects of long term exercise on skeletal muscle

Higher National Unit specification: Statement of standards (cont)

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Outcome 4

This Outcome should be assessed by a time-limited, supervised open-book, restricted response paper with restrictions on the information that can be accessed during the assessment (two sides of A4 hand-written, fully-referenced notes, submitted with assessment).

- ◆ describe the main components of the nervous system:
 - identify parts of a myelinated neuron
- ◆ describe the functions of sensory, motor and relay(inter/association) neurons
- ◆ describe the events in an action potential including the process of depolarisation and repolarisation
- ◆ identify and describe the main components and functions of the brain
- ◆ describe reflexes and explain a simple reflex arc
- ◆ identify the endocrine glands and the function of hormones:
 - describe negative and positive feedback loops in maintaining homeostasis
 - describe nervous and endocrine responses to physical stressors
 - describe the endocrine maintenance of bone health
 - describe endocrine regulation of blood glucose levels
 - describe endocrine regulation of fluid in the body

Outcome 5

This Outcome should be assessed by a closed-book restricted response paper.

- ◆ identify the structures of the Respiratory Systems and outline their functions:
 - explain the mechanism of breathing, and the process of gas exchange
 - describe the respiratory volumes
 - describe neural control of respiration
 - describe the anatomy of the heart and circulatory system
 - describe the physiology of the heart, blood vessels and blood
- ◆ Identify the structure of the Cardiovascular System
- ◆ Describe the functions of the Cardiovascular System
- ◆ describe the nervous control of blood through the heart and the redistribution of blood flow during exercise
- ◆ Identify the structure of the Lymphatic System and outline its functions

Outcome 6

This Outcome should be assessed by closed-book restricted response paper.

- ◆ describe aerobic and anaerobic energy production including Glycolysis; Krebs Cycle; Electron Transport System; Phosphagen system, Anaerobic Glycolysis
- ◆ describe the use and replenishment of energy substrates
- ◆ identify the effects of metabolic waste products developed during exercise



Higher National Unit Support Notes

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Unit Support Notes are offered as guidance and are not mandatory.

While the exact time allocated to this Unit is at the discretion of the centre, the notional design length is 80 hours.

Guidance on the content and context for this Unit

The Unit is mandatory in the HNC Soft Tissue Therapy and HND Sports Therapy and is intended to introduce the learner to the fundamental concepts of anatomy and physiology required in a Sports Massage/Therapy context, helping to prepare learners for roles in these professions and for progression to higher level study. The knowledge and skills in this Unit underpin other mandatory Units and the National Occupational Standards for Sports Therapy.

Outcome 1 examines the basic anatomy of the body beginning with the cellular components and outlining the levels of organisation from cellular to system and the inter-relations of the levels to ensure human function with particular relevance to sporting individuals. Components of cells: mitochondria, nucleus, ribosome, golgi apparatus, lysosomes, rough endoplasmic reticulum, smooth endoplasmic reticulum, cytoplasm, cell membrane.

Body tissues: epithelial (*squamous, columnar, cuboid, simple, stratified, transitional*), connective (*fibrous: areolar, adipose, dense, elastic, reticular; cartilage: hyaline/articular, fibrocartilage, elastic;*) muscular (*skeletal, visceral, cardiac*) nervous (*neurons, glial cells*).

Body Systems: skeletal, muscular, nervous, endocrine, respiratory, circulatory, digestive, urinary, lymphatic and immune. Major functions of each system, organs within each system and relationship between the systems should be described.

Outcome 2 continues to develop the learners' knowledge of the skeletal system in terms of anatomy, physiology, and development. The following areas should be covered:

Bones of the axial skeleton: cranium, spine (cervical vertebrae, thoracic vertebrae, lumbar vertebrae, sacrum, coccyx), ribs, sternum.

Bones of the appendicular skeleton: shoulder girdle (clavicle, scapula); bones of upper limb (humerus, radius, ulna, carpal bones, metacarpals, phalanges); pelvic girdle.

(ischium, ilium, pubis); bones of lower limb (femur, tibia, fibula, patella, tarsal bones, metatarsals, phalanges).

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Vertebral column: structure — cervical, thoracic, lumbar, sacral, coccyx.

Vertebrae structure: body, vertebral foramen, pedicle, lamina, spinous process, transverse processes, superior and inferior articulation points.

Components of synovial joints: capsule, articular cartilage, synovial membrane, synovial fluid, intra and extra capsular ligaments.

Bone types: long, short, flat, irregular, sesamoid.

Joints: ball and socket, hinge, pivot, condyloid/ellipsoid, gliding/planar, saddle.

Structure of long bone: periosteum, diaphysis, epiphyses, epipheseal plate/line, spongy/cancellous bone, compact bone, medullary cavity, site of red bone marrow storage, site of yellow bone marrow storage.

Microstructure: haversian system, trabeculae.

Development of long bone: process of endochondral ossification from hyaline cartilage model to termination of growth with major developmental timescales.

Long term effects of exercise: mineralisation, lines of stress, Cartilage, Ligaments, collagen, density.

Outcome 3 pays particular attention to skeletal muscle and develops knowledge of the mechanics of human movement by describing major muscle groups and the interaction of muscular and skeletal systems:

Major muscles:

Gluteals; Iliopsoas; tensor fascia lata; adductors; rectus femoris; vastus lateralis; vastus medialis; semi tendonosis/membranosis; biceps femoris; gastrocnemius; soleus; tibialis anterior; fibularis/peroneals; deltoid; biceps brachii, tricep brachii, flexor and extensor muscles of the forearm; pectoralis major, latissimus dorsi; teres major; supraspinatus; infraspinatus; teres minor; subscapularis; trapezius; serratus anterior; erector spinae; quadratus lumborum; transversus abdominus; rectus abdominus; internal oblique; external oblique; sternocleidomastoid.

Gross structure: tendon, epimysium, perimysium, endomysium, fasciculi.

Micro structure: myofibrils, sarcomere, myofilaments, t-tubules, sarcoplasmic reticulum, actin and myosin, sarcomere arrangement.

Sliding filament theory.

Fibre types: type I, IIa, IIb.

Neuromuscular control: motor Unit structure and recruitment, neuromuscular junction, sensory receptors (muscle spindle, golgi tendon organ).

Higher National Unit Support Notes (cont)

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Outcome 4 introduces the learner to the nervous and endocrine systems.

Components of nervous system: central nervous system: brain spinal cord; peripheral nervous system: cranial nerves (12 pairs), spinal nerves (31 pairs); somatic nervous system, autonomic nervous system — parasympathetic and sympathetic branches.

Location of major spinal nerves (radial, median, ulnar, sciatic, femoral, tibial, common peroneal), plexi (cervical, brachial, lumbar, sacral).

Sensory neurons: mechanoreceptors, thermoreceptors, chemoreceptors, nociceptors, photoreceptors.

Components of brain: meninges, brain stem (mid brain, pons, medulla oblongata), cerebellum, cerebrum, hypothalamus, thalamus, pituitary, ventricles, cerebrospinal fluid.

Endocrine glands: hypothalamus, anterior and posterior pituitary, pineal, thyroid, parathyroid, thymus, adrenal glands, kidneys, pancreatic islets, gonads.

Nervous and endocrine response to physical stressors: sympathetic nervous system stimulation to adrenal medulla, neurotransmitters adrenalin/noradrenalin and body responses (fight-flight), endocrine response- hypothalamus-pituitary-adrenal (HPA axis), release of ACTH, Growth Hormone, Glucocorticoids and body responses.

Endocrine function in bone health — thyroid (calcitonin) and parathyroid (parathyroid hormone) mechanisms.

Endocrine regulation of blood glucose — pancreatic islet beta cells (insulin) and alpha cells (glucagon) mechanisms.

Endocrine regulation of fluid — hypothalamus, pituitary, antidiuretic hormone, distal convoluted tubule and collecting duct responses, concentration and quantity of urine.

Outcome 5 continues to develop the learners knowledge of the respiratory and cardiovascular systems and their responses to exercise.

Structure of the Respiratory System: oral and nasal cavities; pharynx; larynx; trachea, epiglottis; bronchus/bronchioles; alveolar structure.

Physiology of the Respiratory System: gas exchange; diffusion; pressure gradient; Oxygen Delivery; Carbon Dioxide.

Mechanism of breathing at rest and during exercise: Inspiration and Expiration.

Volume and pressure changes; use of ancillary muscles; increased respiratory rate.

Exchange of air volumes during exercise: Total Lung volume; Tidal volume; Vital Capacity; Residual volume; Expiratory reserve; Inspiratory Reserve.

Higher National Unit Support Notes (cont)

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Structure: Heart structure (Atria, Ventricles, Aorta, Pulmonary vessels, Superior and Inferior Vena cavae, Valves); Blood vessels — structure and function of arteries, arterioles, veins, venules, capillary network.

Physiology of blood (Red blood cells; white blood cells, platelets, plasma).

Blood flow through the heart.

Cardiac Conduction system.

Redistribution of blood to meet demands of exercise: Vasodilation/Vasoconstriction,

Cardiac Function in response to exercise: Cardiac output, Blood pressure, Heart rate.

Outcome 6 concentrates on the use and replenishment of energy substrates in exercise, in particular the processes of aerobic and anaerobic energy production, when such energy is used and associated metabolic by-products.

Guidance on approaches to delivery of this Unit

Due to the nature of the subject matter, it is suited to delivery over a longer period (perhaps the whole of the HNC year or HND first year) in order that learners can assimilate and understand the material.

It is suggested that learners are introduced to all of the concepts in Outcome 1 however; the Evidence Requirements can be achieved over a longitudinal period building up a portfolio of evidence over the course of the Unit and continually being reminded of the inter-relation of different body systems as they are covered in further Outcomes. The nature of this Outcome lends itself to a degree of self-study. Similarly, the final Outcome highlights some important differences between the sexes and changes which occur with aging, these can be covered during the delivery of specific Outcomes and learners may build up a portfolio of evidence throughout the Unit which covers the ER for this Outcome. Alternatively, this may be set as a final guided project.

Models, diagrams, animations, video clips and practical activities should be used as much as possible to demonstrate the concepts being presented. Learners should have the opportunity to work independently and in groups on directed study to extend their knowledge and skills.

Guidance on approaches to assessment of this Unit

Evidence can be generated using different types of assessment. The following are suggestions only. There may be other methods that would be more suitable to learners.

Centres are reminded that prior verification of centre-devised assessments would help to ensure that the national standard is being met. Where learners experience a range of assessment methods, this helps them to develop different skills that should be transferable to work or further and higher education.

Higher National Unit Support Notes (cont)

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Outcome 1 can be set as an open-book guided project.

It is necessary for learners to develop a sound understanding of the anatomy and physiology of the specified systems and Outcomes 2, 3 and 5 and 6 are best suited to closed-book, restricted response/short answer papers. Learners may use limited resources (maximum two A4 sides of handwritten notes — handed in with assessment) for the assessment for Outcome 4.

Opportunities for e-assessment

E-assessment may be appropriate for some assessments in this Unit. By e-assessment we mean assessment which is supported by Information and Communication Technology (ICT), such as e-testing or the use of e-portfolios or social software. Centres which wish to use e-assessment must ensure that the national standard is applied to all learner evidence and that conditions of assessment as specified in the Evidence Requirements are met, regardless of the mode of gathering evidence. The most up-to-date guidance on the use of e-assessment to support SQA's qualifications is available at www.sqa.org.uk/e-assessment.

Opportunities for developing Core and other essential skills

Learners should be encouraged in the use of information technology as they develop their knowledge and understanding of the anatomy and physiology of the human body as affected by exercise. Instruction in the effective use of learning resource centre systems (including online learning, VLE, and similar electronic media) will support learners to access and analyse factual information and current theories on the impact of exercise.

Editing and collating of notes from a range of sources could be particularly useful in the development of an academic approach to underpinning knowledge. Teaching should support analytical and critical evaluation of information accessed, encouraging and allowing learners to become autonomous learners.

The need to develop efficient systems of recording, coding and storing personal notes for ease of reference should be emphasised. Where practical, learners should have opportunities for e-learning and be aware of the importance of information backup.

History of changes to Unit

Version	Description of change	Date

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General information for learners

Unit title: Sports Therapy: Anatomy and Physiology (SCQF level 7)

This section will help you decide whether this is the Unit for you by explaining what the Unit is about, what you should know or be able to do before you start, what you will need to do during the Unit and opportunities for further learning and employment.

On completion of this Unit you should have gained an understanding of the skeletal, muscular, nervous, endocrine, respiratory, and cardiovascular systems of the human body. You will also be able to describe the ways which the body uses energy substrates in exercise and how all systems work together to maintain health.

This knowledge is fundamental to your understanding of human performance and will be built upon in other mandatory Units within the HNC Soft Tissue Therapy/HND Sports Therapy awards.

In addition to tuition, you will be encouraged to use your VLE and other support materials widely as a significant amount of self-study and review is essential for successful completion of this Unit.

In Outcome 1 you will study the structure and function of the cells and tissues of the human body. This will help you to understand the basic structure and organisation of the body, which will put the remaining Outcomes into context. You will also build on this knowledge in the other Outcomes.

In Outcome 2 you will study the structure, function and effects of exercise on the skeletal system. This will include the bones, their structure and development, and the tissues which connect them together.

In Outcome 3 you will study the structure, function, and effects of exercise on the muscular system. You will look in detail at how muscles contract, and where they are located. Both Outcome 2 and 3 are closely related to, and support, the *Functional Anatomy* Unit.

In Outcome 4 you will study the structure and functions of the nervous and endocrine systems. These systems control what goes on in our bodies and important in maintaining homeostasis (internal balance).

In Outcome 5 you will study the structure, function and effects of exercise on the respiratory and cardiovascular systems. You will look at how the respiratory system responds to the demands placed on it by exercise, and how the body adapts in order to maintain the supply of oxygen to the tissues. You will also see how the heart and vascular system delivers blood, hormones and nutrients to the working muscles, and how waste products are removed. You will examine the electrical system of the heart.

In Outcome 6 energy systems are studied, and the body's different responses to the requirement for energy examined closely.

Outcome 1 is assessed through a project and Outcome 4 is assessed through an open-book, supervised assessment. All other Outcomes are assessed through closed-book question papers.