Next Generation Higher National Unit Specification

Anatomy and Physiology for Exercise and Human Movement (SCQF level 7)

Unit code: J6E7 47

SCQF level: 7 (16 SCQF credit points)

Valid from: session 2024–25

Prototype unit specification for use in pilot delivery only (version 2.0) August 2024

This unit specification provides detailed information about the unit to ensure consistent and transparent assessment year on year.

This unit specification is for teachers and lecturers and contains all the mandatory information required to deliver and assess the unit.

This edition: August 2024 (version 2.0)

Unit purpose

This unit provides learners with the knowledge, skills and understanding of the body systems in relation to physical activity and human movement. The target group for the unit is learners who want to develop as a professional in the physical activity and health industry. Knowledge of anatomy, physiology and biomechanics, with an understanding of how to apply this to the training process, is vital.

Entry requirements and progression routes

Entry to this unit is at your centre's discretion. However, we recommend that learners have or completed one or more of the following:

- knowledge of basic human anatomy and physiology at SCQF level 6
- Higher Physical Education
- Higher Biology or Higher Human Biology

You should deliver the unit as a stand-alone unit or with the following units:

- Training Principles for Exercise (SCQF level 7)
- Exercise Practitioner 1 (SCQF level 7)
- Preparation to Work in the Physical Activity and Health Industry (SCQF level 7)
- Health Promotion, Behaviour Change and Nutrition (SCQF level 7)

The unit is a part of the Higher National Certificate (HNC) in Physical Activity and Health. Learners can progress from this group award to:

- Higher National Diploma (HND) Physical Activity and Health at SCQF level 8
- local agreements for advanced entry into university degree programmes

Unit outcomes

Learners who complete this unit can:

1 explain the structure and function of the skeletal system which underpins human movement in the context of physical activity
2 explain the structure and function of the muscular and nervous system which underpins human movement in the context of physical activity
3 explain the structure and function of the cardio-respiratory system in relation to physical activity
4 explain the structure and function of the digestive system in relation to healthy nutrition
5 interpret and present physical activity data in relation to the human energy systems

Evidence requirements

Learners can generate evidence in the form of a stand-alone assessment, oral questioning or as part of an overall project integrated with other units in the group award. 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. The standard of evidence should be consistent with the SCQF level of this unit.

Outcomes 1, 2, 3 and 4

Learners can generate evidence by taking a stand-alone assessment, answering oral questions or from a project covering the following units in the group award:

- Training Principles for Exercise (SCQF level 7)
- Exercise Practitioner 1 (SCQF level 7)
- Preparation to Work in the Physical Activity and Health Industry (SCQF level 7)
- Health Promotion, Behaviour Change and Nutrition (SCQF level 7)

Any practical activity used to generate evidence should reflect the knowledge and skills identified in the evidence requirements for each outcome.

These outcomes are suitable for sampling. Where you assess evidence for these outcomes on a sample basis, you should include at least 50 per cent of the knowledge items for each outcome. For each outcome, you must teach all content in the ‘Knowledge and skills’ section and learners should not know the items they are assessed on before the assessment. When you use sampling, you should sample different items on each assessment occasion.

Explain the structure and function of the skeletal system which underpins human movement in the context of physical activity (outcome 1) and Explain the structure and function of the muscular and nervous system which underpins human movement in the context of physical activity (outcome 2)

To successfully achieve these outcomes, learners must provide the following evidence:

- Describe the structure, classification and function of bones in the axial and appendicular skeleton.
- Describe the structure of the spine and optimum postural alignment, and recognise client postural deviations.
- Describe the structure of bone and stages of growth, and select exercises when programming that are appropriate to a client's stage of life.
- Classify joint types and describe the structure of a synovial joint.
- Apply basic mechanical principles, including movement terminology, anatomical planes, axis of rotation and lever systems, when describing movement patterns.
- Describe the types, characteristics and functions of muscle tissue:
  - cardiac
  - smooth
  - skeletal
- Identify the structure of skeletal muscle.
- Locate anterior and posterior skeletal muscles using appropriate anatomical terminology.
- Describe the structure and function of the pelvic floor muscles.
- Link the role of a muscle to its action and type of contraction in exercises or movement patterns.
- Describe the structure and function of the nervous system (central and peripheral).
- Describe the principles of muscle contraction.
- Link adaptations of the muscular system following exposure to different training types to changes in the characteristics of muscle fibres.
- Discuss the short- and long-term effects of exercise on the skeletal and neuromuscular system.
- Apply knowledge of anatomy and physiology of the skeletal and neuromuscular system, alongside associated features, in the planning of safe and effective exercise programmes for a range of clients.

Explain the structure and function of the cardio-respiratory system in relation to physical activity (outcome 3)

To successfully achieve this outcome, learners must provide the following evidence:

- Describe the functions of the structures in the circulatory system.
- Describe systemic and pulmonary circulation.
- Describe the function and passage of blood flow through the heart.
- Educate clients about blood pressure measurements and provide an accurate classification for a blood pressure reading including signposting, where necessary.

- Describe the structure, function and passage of air through the respiratory tract:
  - oral cavity
  - nasal cavity
  - pharynx
  - larynx
  - trachea
  - bronchi
  - bronchioles
  - alveoli
- Describe the mechanics of breathing, both at rest and during exercise.
- Describe the process of internal and external respiration.
- Discuss the short- and long-term effects of exercise on the cardio-respiratory system.
- Apply knowledge of anatomy and physiology about the cardio-respiratory system in the planning of safe and effective exercise programmes for a range of clients.

Explain the structure and function of the digestive system in relation to healthy nutrition (outcome 4)

To successfully achieve this outcome, learners must provide the following evidence:

- Describe the structure and function of each section of the digestive system.
- Describe how fats, proteins and carbohydrates are digested and absorbed, and the main enzymes involved.
- Describe the role of dietary fibre in the maintenance of gut function.
- Describe the role of the liver and pancreas in assisting digestion.
- Identify the timescales for digestion and importance of fluid.
- Apply knowledge of anatomy and physiology of the digestive system and accessory organs when educating a range of clients, supporting healthy nutrition and lifestyle choices.

Interpret and present physical activity data in relation to the human energy systems (outcome 5)

Learners should produce a one-page lab report as evidence which presents the graphical data and an explanation of effects on performance as a result of the dominant shifts between the three energy systems. The lab report should be meet the standards expected at SCQF level 7. You can deliver this outcome as a stand-alone unit or with Research Skills for Sport, Physical Activity and Health at SCQF level 7 unit.

To successfully achieve this outcome, learners must provide the following evidence:

- Select and conduct one appropriate physical activity test which causes a change in dominance of adenosine triphosphate (ATP) resynthesis from the three energy systems listed in the human energy systems knowledge section.
- Produce a graph displaying the data collected.

- Analyse the collected data in relation to the impact on performance following the repetition of the chosen physical activity.
- Provide an overview of the energy systems and the role that they play in the performance of the chosen physical activity.

Knowledge and skills

The following table shows the knowledge and skills covered by the unit outcomes:

Knowledge	Skills
Outcome 1 Learners should understand the: ♦ structure and function of the skeleton: — structures of the axial and appendicular skeleton — functions including muscle attachments and levers, protection of internal organs, red and white blood cell production and mineral storage ♦ classification, structure and function of bones: — long — short — flat — sesamoid — irregular ♦ structure of the spine: — cervical — thoracic — lumbar — sacral — coccygeal ♦ deviations of the spine: — kyphosis — lordosis — scoliosis ♦ structure of bone: — compact and spongy or cancellous tissue — articular cartilage — epiphysis — diaphysis — periosteum — epiphyseal plates — bone marrow	**Outcome 1** Learners can: ♦ apply knowledge of anatomy and physiology of the skeletal system and associated features in the planning of safe and effective exercise programmes for a range of clients ♦ describe optimum postural alignment and recognise client postural deviations ♦ describe the process of bone growth relating to the different structures ♦ classify different types of joints and recognise their movement potential using appropriate terminology ♦ describe the features of a synovial joint and its associated functions ♦ link movement patterns to the lever system(s) deployed and plane(s) of movement utilised ♦ discuss the short- and long-term effects of exercise on the skeletal system and select exercises when programming that are appropriate to a client's stage of life

Knowledge	Skills
Outcome 1 (continued) Learners should understand the: ♦ stages of growth: — remodelling process — ageing process ♦ joint type classifications: — fibrous — cartilaginous — synovial ♦ structure of synovial joints: — joint capsule — synovial membrane — synovial fluid — ligaments — tendons — cartilage ♦ lever systems: — first class — second class — third class ♦ joint movement terminology: — flexion and extension — adduction and abduction — circumduction — supination and pronation — plantar flexion and dorsiflexion — lateral flexion and extension — horizontal flexion and extension — elevation and depression — inversion and eversion ♦ anatomical planes of movement: — frontal (coronal) — sagittal — transverse ♦ effect of exercise on the skeletal system: — short-term — long-term	

Knowledge	Skills
Outcome 1 (continued) Learners should understand the: ♦ life-course of the musculoskeletal system: — young people (13 to 18 years) — antenatal and postnatal period — older adults (50 plus years)	
Outcome 2 Learners should understand the: ♦ types, characteristics and functions of muscle tissue: — cardiac — smooth — skeletal ♦ structure of skeletal muscle: — epimysium — perimysium — endomysium — fasciculi — muscle fibre — myofibril — sarcomere — myosin — actin ♦ location of anterior and posterior skeletal muscles, using terminology such as: — superior and inferior — anterior and posterior — medial and lateral — proximal and distal — superficial and deep ♦ structure and function of the pelvic floor muscles	**Outcome 2** Learners can: ♦ apply knowledge of anatomy and physiology of the neuromuscular system in the planning of safe and effective exercise programmes for a range of clients ♦ identify and locate the major anterior and posterior skeletal muscles using anatomical terms of location ♦ describe joint actions brought about by specific muscle group contractions ♦ link adaptations of the muscular system following exposure to different training types to changes in the characteristics of muscle fibres ♦ discuss the short- and long-term effects of exercise on the neuromuscular system

Knowledge	Skills
Outcome 2 (continued) Learners should understand the: ♦ muscle roles: — prime mover (agonist) — antagonist — fixator — synergist ♦ types of muscle contraction and action: — concentric and eccentric (isotonic) — isometric and isokinetic ♦ structure and function of the: — nervous system — central nervous system and peripheral nervous system — neurons — motor units — proprioceptors (muscle spindles and Golgi tendon organs) ♦ principles of muscle contraction: — all-or-none law — sliding filament theory — stretch reflex and reverse stretch reflex — size principle of motor unit recruitment ♦ muscle fibre types: — slow twitch type 1 (slow oxidative) — fast twitch (type 2a: fast oxidative glycolytic and type 2b: fast glycolytic) ♦ effect of exercise on the neuromuscular system: — short-term — long-term — enhancement of neuromuscular connections — improvement of motor fitness	

Knowledge	Skills
Outcome 3 Learners should understand the: ♦ structure of the circulatory system: — heart (atria, ventricles and valves) — arteries — arterioles — veins — venules — capillaries ♦ systemic and pulmonary circulation ♦ function of the heart ♦ blood flow through the four chambers of the heart ♦ structure and functions of blood vessels ♦ blood pressure (systolic and diastolic) and classifications ♦ structure, function and passage of air through the respiratory tract: — oral cavity — nasal cavity — pharynx — larynx — trachea — bronchi — bronchioles — alveoli ♦ mechanics of breathing: — at rest — during exercise ♦ process of gaseous exchange of oxygen and carbon dioxide in the body: — internal respiration — external respiration	**Outcome 3** Learners can: ♦ apply knowledge of anatomy and physiology about the cardio-respiratory system in the planning of safe and effective exercise programmes for a range of clients ♦ educate clients around blood pressure measurements ♦ provide clients with an accurate classification for a blood pressure reading and signpost if necessary ♦ discuss the short- and long-term effects of exercise on the cardio-respiratory system

Knowledge	Skills
Outcome 3 (continued) Learners should understand the: ♦ effects of exercise on the cardio-respiratory system: — short- and long-term effects on blood pressure — aerobic respiration — venous return — the implications of blood pooling	
Outcome 4 Learners should understand the: ♦ structure and function of each section of the digestive system: — mouth — oesophagus — stomach — small intestine — large intestine ♦ process of how fats, proteins and carbohydrates are digested and absorbed, and the main enzymes involved ♦ role of dietary fibre in the maintenance of gut function ♦ role of the liver and pancreas in assisting digestion ♦ timescales for digestion ♦ importance of fluid	**Outcome 4** Learners can: ♦ apply knowledge of anatomy and physiology about the digestive system and accessory organs when educating a range of clients, supporting healthy nutrition and lifestyle choices

Knowledge	Skills
Outcome 5 Learners should understand the: ♦ human energy systems: — aerobic — anaerobic (lactate and creatine phosphate) ♦ use of the three energy systems during aerobic and anaerobic exercise according to different type, duration, and intensity of exercise ♦ anabolism, catabolism and excess post-exercise oxygen consumption (EPOC) ♦ by-products of the three energy systems and their significance in muscle fatigue ♦ effect of endurance training and advanced training methods on the use of fuel (carbohydrates, fats and proteins) for exercise ♦ use of data collection and interpretation	**Outcome 5** Learners can: ♦ apply knowledge of the energy systems in the planning of safe and effective exercise programmes for a range of clients ♦ consider the energy demands of different activities when tailoring exercise to individual client needs and goals ♦ select and conduct an appropriate physical activity test which causes a dominance of ATP resynthesis from the three energy systems ♦ collect and interpret physical activity data that is reliable, valid and objective ♦ produce and interpret graphical data ♦ report and present physical activity data

Meta-skills

Throughout the unit, learners develop meta-skills to enhance their employability in the physical activity and health sector.

Self-management

This meta-skill includes:

- focusing: sorting information into categories, understanding the relationship between information
- adapting: critically reflecting on new knowledge and experiences to gain a deeper understanding, embedding and extending learning
- initiative: decision-making, employing a considered choice after appropriately using intuition and careful thought

Social intelligence

This meta-skill includes:

- communicating: receiving information, understanding and mentally processing verbal or written communication
- collaborating: building relationships when supporting and educating your client, identifying and initiating connections to develop mutual benefit

Innovation

This meta-skill includes:

- curiosity: asking questions, researching and engaging with and understanding industry practice
- creativity: generating ideas, visualising and problem-solving
- sense-making: the process of organising, manipulating, pruning and filtering gathered data into cohesive structures for information building
- critical thinking: logical thinking through identifying, analysing and evaluating situations, ideas and information to formulate responses to problems

Delivery of unit

This is a mandatory unit in the HNC in Physical Activity and Health.

The notional design length is 80 hours. However, the amount of time you allocate to each outcome is at your centre's discretion.

This unit can be delivered as a stand-alone unit or with the following mandatory units:

- Exercise Practitioner 1 (SCQF level 7)
- Health Promotion, Behaviour Change and Nutrition (SCQF level 7)
- Preparing to Work in the Physical Activity and Health Industry (SCQF level 7)
- Training Principles for Exercise (SCQF level 7)

There are opportunities for cross assessment or holistic assessment across the mandatory units in the HNC in Physical Activity and Health. Centres should refer to the Next Generation Higher National Educator Guide for guidance and support notes.

Professional recognition

Learners completing the HNC in Physical Activity and Health can become a member of the Chartered Institute of Management of Sport and Physical Activity (CIMSPA) as a gym instructor practitioner, group exercise instructor practitioner, and health navigator.

Additional guidance

The guidance in this section is not mandatory.

This unit gives learners knowledge of the basic components of anatomy, physiology and biomechanics, and understanding in their application to exercise and human movement. To develop as a professional in the industry, it is vital to have knowledge of anatomy, physiology and biomechanics alongside an understanding of how to apply it to the training process. Where possible, you should deliver the unit in a practical environment to allow for contextualisation.

Approaches to delivery

We suggest that you deliver outcomes in numerical order. Possible delivery methods include classroom activities, field trips, visits, and group work. We encourage the use of learning and teaching approaches that are varied and appropriate to the objectives of the unit.

Explain the structure and function of the skeletal system which underpins human movement in the context of physical activity (outcome 1) and Explain the structure and function of the muscular and nervous system which underpins human movement in the context of physical activity (outcome 2)

You can teach aspects of these outcomes in a practical or gym environment to demonstrate and participate in exercises that involve different movement patterns. These outcomes are designed to be delivered as a stand-alone unit or with the following units:

- Training Principles for Exercise (SCQF level 7)
- Exercise Practitioner 1 (SCQF level 7)
- Preparation to Work in the Physical Activity and Health Industry (SCQF level 7)
- Health Promotion, Behaviour Change and Nutrition (SCQF level 7)

Any practical activity used to generate evidence should reflect the knowledge and skills identified in the evidence requirements.

Explain the structure and function of the cardio-respiratory system in relation to physical activity (outcome 3) and Explain the structure and function of the digestive system in relation to healthy nutrition (outcome 4)

Learners can measure VO_2 max and peak tests by using Cortex gas analyser software and equipment. Additionally, they can measure these tests predictively using a Wattbike and beep test VO_2 max table. Learners can use heart rate monitors to measure maximal heart rate, predicted cardiac output, and heart rate variability. Additionally, they can use blood pressure monitors to measure blood pressure, differences between systolic and diastolic pressure, and resting pulse rate through health screening activities. Any practical activity used to generate evidence should reflect the knowledge and skills identified in the evidence requirements.

Explain the structure and function of the digestive system in relation to healthy nutrition (outcome 4)

You can deliver aspects of this outcome with the Health Promotion, Behaviour Change and Nutrition unit, in relation to healthy nutrition and positive lifestyle choices.

Interpret and present physical activity data in relation to the human energy systems (outcome 5)

It is recommended that learners identify changes in athletic performance and changes in dominance of energy system by performing repeat bout tests. Given the volume of research present for this type of exercise, it complements the understanding of high intensity training for future potential learning, for example at degree level. Repeat sprint ability protocol testing could be mimicked or adapted using alternative activity from the appropriate research methodology. Equipment used to measure this could extend to Wattbikes, Monark Ergometers (along with Monark software) and speed gates.

Approaches to assessment

The unit has five outcomes with various forms of evidence gathering where you can choose to use closed-book or open-book assessments. For example, knowledge and skills could be evidenced by a test containing multiple-choice, short response and/or extended response questions. We encourage the delivery of theory, experiential participation and practical instruction embedded in the delivery of gym and group exercise programmes. We recommend that you deliver the outcomes with the units Training Principles for Exercise at SCQF level 7 and the Exercise Practitioner 1 at SCQF level 7, where knowledge and understanding supports the client consultation, health and fitness testing, resulting in the planning of safe and effective exercise programmes for a range of clients.

The portfolio generated across these units may provide opportunities to gather evidence for this unit. Due to the nature of the subject matter, you should deliver the unit over a longer period of time so that learners can assimilate and understand the material. 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. An example of potential integration and evidence gathering could involve creating an exercise library. This library could provide an opportunity to describe a range of exercises and/or movement patterns deemed suitable for teaching purposes, as shown in the CIMSPA Gym Instructor Practitioner standards.

A range of knowledge requirements in outcomes 1 and 2 could be evidenced through the identification of:

- joint movement
- joint type
- movement terminology
- prime mover, fixator and synergist
- type of muscle contraction
- plane of motion and axis of rotation (if applicable)

- lever system deployment

Centres should consider how to authenticate the learner's evidence for each outcome in the unit.

Opportunities for e-assessment

Assessment that is supported by information and communication technology (ICT), such as e-testing or the use of e-portfolios or social software, may be appropriate for some assessments in this unit.

If your centre wants to use e-assessment, you must ensure that you apply the national standard to all evidence and that conditions of assessment (as specified in the evidence requirements) are met, regardless of the mode of gathering evidence.

Equality and inclusion

This unit is designed to be as fair and as accessible as possible with no unnecessary barriers to learning or assessment.

You should take into account the needs of individual learners when planning learning experiences, selecting assessment methods or considering alternative evidence.

Guidance on assessment arrangements for disabled learners and/or those with additional support needs is available on the assessment arrangements web page: www.sqa.org.uk/assessmentarrangements.

Information for learners

Anatomy and Physiology for Exercise and Human Movement (SCQF level 7)

This section explains:

- what the unit is about
- what you should know or be able to do before you start
- what you need to do during the unit
- opportunities for further learning and employment

Unit information

This unit provides you with the knowledge, skills and understanding of the body systems and basic biomechanical principles that underpin human movement. On successful completion of the unit, you can apply this knowledge in the physical activity and health industry.

On completion of the unit, you should be able to:

1 explain the structure and function of the skeletal system which underpins human movement in the context of physical activity
2 explain the structure and function of the muscular and nervous system which underpins human movement in the context of physical activity
3 explain the structure and function of the cardio-respiratory system in relation to physical activity
4 explain the structure and function of the digestive system in relation to healthy nutrition
5 interpret and present physical activity data in relation to the human energy systems

While working through the unit, you learn about the structure and function of the skeletal, neuromuscular and cardio-respiratory systems which underpin human movement. You can apply knowledge of these systems through the planning of safe and effective exercise programmes for a range of clients. By developing underpinning knowledge of anatomy and physiology of the digestive system, you support client education around healthy nutrition and beneficial lifestyle choices. When you've completed the unit, you are able to collect, interpret and present physical activity data in relation to the human energy systems.

Delivery methods may include varied learning and teaching approaches including:

- classroom activities
- practical sessions
- field trips
- visits
- group work

Assessment of the unit includes a range of approaches which can include:

- stand-alone assignments
- oral questioning
- creation of educational handouts that form part of an overall unit project

The unit is part of the Higher National Certificate (HNC) in Physical Activity and Health. On successful completion of this qualification, you can become a member of the Chartered Institute of Management of Sport and Physical Activity (CIMSPA) as a gym instructor practitioner, group exercise instructor practitioner, and health navigator.

Meta-skills

Throughout the unit, you develop meta-skills to enhance your employability in the creative industries sector.

Meta-skills include self-management, social intelligence, and innovation.

Self-management

This meta-skill includes developing the ability to focus. You sort information into categories and understand the relationship between that information. Adaptability is developed where you refine the ability to critically reflect on new knowledge and experiences to gain a deeper understanding, and embed and extend your learning. The unit supports your ability to make decisions and employ a considered choice after appropriately using intuition and careful thought.

Social intelligence

This meta-skill includes developing your level of communication through the ability to receive, understand and process verbal or written communication. Applying unit knowledge and understanding in client work includes developing your collaboration skills. You gain the ability to build relationships when supporting and educating your client. You identify and initiate connections, developing mutual benefit.

Innovation

This meta-skill encourages curiosity, critical thinking and creativity by asking questions, researching, generating ideas, visualising, problem-solving and engaging with and understanding industry practice. Sense-making is developed through the process of organising, manipulating, pruning and filtering gathered data into cohesive structures for information-building.

Administrative information

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Superclass: PJ

History of changes

Version	Description of change	Date
2.0	Addition of wording to outcome 2 and 5 within the Knowledge table	May 2024

Note: please check SQA's website to ensure you are using the most up-to-date version of this document.