

# Unit 32: Mobility and Exercise for Health and Social Care

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| <b>Unit code:</b>             | <b>R/600/8987</b>    |
| <b>QCF Level 3:</b>           | <b>BTEC National</b> |
| <b>Credit value:</b>          | <b>10</b>            |
| <b>Guided learning hours:</b> | <b>60</b>            |

## ● Aim and purpose

This unit aims to enable learners to understand the structure and function of the musculo-skeletal system and mechanics of movement, gain knowledge of balance and posture and understand common disorders and injuries of the musculo-skeletal system.

## ● Unit introduction

This unit focuses on the anatomy and physiology of the musculo-skeletal system, including the mechanisms involved in movement and locomotion. The structure of the skeleton will be explored in some detail, including the names of all major bones. Learners will explore how bone develops through membranous or epiphyseal ossification and link this to an understanding of the internal tissue structure of different types of bone.

The structure of different types of joint and the relationship between joints, muscles and range of movement will be investigated. The concept of suppleness and mobility around joints will be discussed. Learners will examine the physiology of muscle contraction, and the difference between isometric and isotonic contraction will be related to muscle tone, fitness and stamina.

The gross anatomy of the major muscle groups in the body will be explored, and their actions in producing movement around joints will be investigated. Learners will explore the action of muscle groups in maintaining an upright posture and in producing movement. Proprioceptors in joints and muscles and the vestibular apparatus in the ear contributing to the maintenance of balance will be explored. Learners will be introduced to anatomical and physiological explanations of common disorders and injuries associated with musculo-skeletal functioning.

Successful completion of this unit will help to equip learners with a good understanding of the physiology of the major body systems to support progression into professional training in nursing and several of the professions allied to medicine.

## ● Learning outcomes

**On completion of this unit a learner should:**

- 1 Understand the anatomy of the skeletal system
- 2 Know the mechanisms of muscle contraction
- 3 Know about factors that affect movement, balance and posture
- 4 Understand common injuries and disorders of the musculo-skeletal system.

# Unit content

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## 1 Understand the anatomy of the skeletal system

*Ossification:* intramembranous, endochondrial

*Development of the skeleton:* skeletal growth – lengthening of bones, closure of epiphyses, development of normal spinal curvatures (cervical, thoracic, lumbar); mineral storage, the dynamic state of bone, function of ligaments

*Structure of the skeletal tissues:* histology of skeletal tissues – ligaments, tendons, cartilage, bone (compact, cancellous); structure of long bones, flat bones, bone marrow

*Bones of the skeleton:* location of major bones (cranium, clavicle, ribs, sternum, humerus, radius, ulna, scapula, ilium, pubis, ischium, carpals, metacarpals, phalanges, femur, patella, tibia, fibula, tarsals, metatarsals, vertebral column, vertebrae – cervical, thoracic, lumbar sacrum, coccyx)

*Types of bone:* relationship between structure, shape and function; main identifying features of – mandible and maxillae, bones of cranium, spine, girdles, limbs, chest

*Joints:* classifications (fixed, slightly moveable, freely moveable/synovial joints), types of synovial joint; joint structure, movements allowed at each joint, eg flexion, extension, circumduction, adduction, abduction

*Influencing factor on the skeletal system:* genetics, age, diet, effect of weightbearing exercise, disease

## 2 Know the mechanisms of muscle contraction

*Types of muscle:* voluntary (skeletal); involuntary (smooth); cardiac

*Histology of muscles:* cell shape, alignment; myofibril ultra structure – sarcomeres, actin, myosin; neuromuscular junction

*Muscle contraction:* sliding filament theory (actin, myosin, sarcomere, troponin, tropomyosin, calcium ions, ATPase); types of contraction (concentric, eccentric, isometric); muscle fatigue, recovery

*Mechanical aspects:* antagonistic muscle pairs; synergist, musculo-skeletal adaptations to regular exercise, eg increase in muscle size, increase in tendon strength, reduced risk of injury

## 3 Know about factors that affect movement, balance and posture

*Movement:* muscles acting on skeleton as levers; principle of levers – effort, fulcrum, load; classes of lever (first class, second class, third class); examples of levers in the body, eg nodding of head, straightening of bent arm, standing on tiptoe

*Proprioception:* receptors in the tendons (golgi tendon organ), receptors in muscle (muscle spindles), proprioception reflexes

*Balance:* vestibular apparatus, centre of gravity; base of support, postural sway

*Posture:* correct standing posture, correct sitting posture, correct lifting posture, benefits of a good posture

## 4 Understand common injuries and disorders of the musculo-skeletal system

*Injuries:* sprain, strain, fracture, dislocation, back pain, paralysis

*Disorders:* kyphosis, scoliosis, lordosis; osteoporosis, osteoarthritis

## 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: |
| <b>P1</b> explain the structure and development of the skeletal system<br>[IE2; IE4]                |   |   |
| <b>P2</b> explain the structure and function of each classification of joints<br>[IE2; IE4]         | <b>M1</b> assess the effects of different factors on the development of the skeletal system                     |   |
| <b>P3</b> describe the structure and contraction of different types of muscle tissue<br>[IE2; IE4]  | <b>M2</b> compare the structure and function of two different types of muscle                                   | <b>D1</b> analyse the effects of chronic exercise on the musculo-skeletal system  |
| <b>P4</b> describe how muscle groups work as levers to produce movement around a joint              |   |   |
| <b>P5</b> describe how proprioception helps to maintain balance, posture and movement<br>[IE1]      | <b>M3</b> assess how muscle groups maintain posture and produce movement.                                       | <b>D2</b> analyse the impact of common musculo-skeletal disorders on mobility and locomotion.                                   |
| <b>P6</b> explain the causes of common structural musculo-skeletal injuries and disorders.<br>[CT2] |   |   |

**PLTS:** This summary references where applicable, in the square brackets, the elements of the personal, learning and thinking skills which are embedded in the assessment of this unit. By achieving the criteria, learners will have demonstrated effective application of the referenced elements of the skills.

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

# Essential guidance for tutors

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## Delivery

This unit can be delivered using a wide variety of methods including lectures, tutorials, presentations, videos, worksheets, anatomy models, laboratory work and internet research.

Learners could be introduced to this unit by familiarising themselves with the names and unique characteristics of all the bones of the body. Opportunities to examine a model skeleton, including a skull, and to relate bone shape and size to function within the skeleton would be useful. If possible, the opportunity to look at fresh specimens of bone from a butcher would help to support understanding of the structure of moveable joints and the characteristics of the different tissues, for example hyaline cartilage, long bones, flat. X-rays can also be used to illustrate the different bones in the skeleton.

The content covering the muscular system requires pictures of, or access to, microscopes and prepared histology slides and to electron micrograph images and slides of cardiac, skeletal, and smooth muscle in order for learners to see the differences between the structure of the tissues. This information will help inform teaching of the function of each of these types of muscle.

Diagrams of the muscular system that show all the main muscle groups will also be required. Software is available for learners to see 3D images of the muscular system and would be very useful in delivering the unit content.

It would be useful if learners could watch a video or view an animation on a suitable internet site that shows how the muscles relax and contract as antagonistic muscle pairs. Teaching on the sliding filament theory would follow this. This is quite a challenging concept for many learners to grasp, so it is highly recommended that a suitable video, CD ROM or internet sites are used, which provide animated diagrams illustrating the process.

Simple tests with lever systems could be used to gain an understanding of the relationships between joint structure, the relative positions of muscle groups lying around the joint, and the efficiency of the work carried out.

Diagrams and worksheets can be used to explain proprioception and the different apparatus in the body that help provide feedback on the body's position. Before exploring the actions of muscles around joints, it would be worth raising learner awareness of their own fitness, suppleness and stamina by participation in a keep fit type activity led by a suitably qualified expert. The effects of regular exercise and training on musculo-skeletal performance could involve exploring different training strategies for different sports and activities.

The use of guest speakers such as physiotherapists or sports therapists could be valuable to enhance learner understanding of different approaches to maintaining and maximising musculo-skeletal mobility health, as well as exploring how different disorders and injuries affect this.

## 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   |
|---|
| Unit introduction.  |
| Tutor input: introduction to ossification – the process of bone development.  |
| Learner activity: complete worksheets and hand draw diagrams of bone growth.  |
| Demonstration: use of model skeleton; development of the skeleton – growth in children, development of the curvature in the spine.  |
| Tutor input and/or DVD: function of skeletal system – mineral storage, dynamic state of bones and the function of the ligaments.  |
| Practical activity: histology and/or microscope slides of ligaments, tendons, cartilage and bone.   |
| Tutor input/practical activity: types of bone – identifying each type of bone on a drawing of a skeleton and a disarticulated model skeleton.   |
| Learner research/work: structure of long and flat bones – labelled diagrams; function of bone marrow.   |
| Practical activity: location of major bones in the skeleton – sticky label game and labelling skeleton diagrams.  |
| DVD/worksheets/learner research: factors affecting the skeletal system.   |
| Worksheets/diagrams: joints structure and function of fixed, slightly moveable and freely moveable joints; dissection of a joint to examine the synovial capsule.                         |
| Tutor input/practical: different types of movement available at different joints in the body.   |
| Tutor input: types of muscle – with prepared microscope slides.   |
| Practical activity: major muscles – diagrams of each major muscle, practical sticky label game.   |
| Worksheets/diagrams: ultra structure of skeletal muscle neuromuscular junction.   |
| <b>Assignment 1: The structure and function of the musculo-skeletal system (P1, P2, P3, M1, M2, D1)</b>   |
| Use of animations: to demonstrate sliding filament theory.  |
| Tutor input/practical: types of contraction – demonstrating each type of contraction.   |
| Practical activities: muscle fatigue and recovery – participation in exercises to produce muscle fatigue, breathing and heart rate recorded during recovery.                              |
| Data from practical activity analysed and explained in theory lesson.   |
| Practical activities: antagonistic muscle pairs – determining which muscles work in pairs.  |
| Tutor input: actions of synergist and effects of regular exercise on the skeletal and muscular systems.   |
| Practical activity: levers – learners could make models of each classification of lever and then carry out research to determine where each type of lever can be found in the human body. |
| Learner research – groups to carry out research on the golgi tendon organ, muscle spindles or proprioception reflexes then feed back information to rest of group.                        |
| Practical workshop: balance – how the centre of gravity and base of support affect a person's balance, postural sway.   |
| Tutor input: vestibular apparatus and postural sway.  |
| Tutor input/practical: analysis of good and bad standing, sitting and lifting postures.   |
| Group discussion: the benefits of a good posture.   |
| <b>Assignment 2: Movement, balance and musculo-skeletal disorders (P4, P5, P6, M3, D2)</b>  |
| Tutor input/practical activities: related to different types of injury.   |

## Topic and suggested assignments/activities and/assessment

Learner research: into different types of musculo-skeletal disorders – feed back to the rest of the group.

Unit review and assessment.

## Assessment

This unit is designed to be assessed through both theory and practically-based course work.

Assessment can be based on documentary evidence that could take the form of informative and detailed wallcharts. Reports and oral presentations, possibly with practical demonstrations, would also be acceptable. It would be expected that diagrammatic and other visual formats, together with detailed annotation, will form the basis of evidence submitted for assessment.

For P1, learners could label skeletal diagrams demonstrating their knowledge of the major bones of the skeleton, and then draw diagrams to illustrate their understanding of the histology of skeletal tissue and the different types of bone. For P2, learners must explain the structure and functioning of each classification of joints. In order to attain M1, learners will need to assess how a range of factors can affect bone growth. For D1, learners will need to analyse the effects on the musculo-skeletal system of chronic exercise.

For P3, learners can examine some prepared slides of different types of muscle tissue and then write a report that describes how each type of muscle contracts. To attain M2, learners could draw up a table to compare two types of muscle and examine their structural and functional similarities and differences. For P4, learners could write an illustrated report that describes the sliding filament theory, antagonistic muscle pairs and the different types of muscle contraction.

For P5, M3 and D2, learners can deliver a presentation that explores movement, balance, proprioception and musculo-skeletal injuries and disorders. To attain M3, learners would need to assess how muscle groups maintain posture and produce movement.

For P6, learners will need to explore a range of musculo-skeletal injuries and disorders. For D2, learners will need to provide more detail including how each injury or disorder would affect a person's mobility.

## 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, M1, M2, D1 | The structure and function of the musculo-skeletal system | You aspire to work as a health professional. Part of this role requires an understanding of the structure of the human body and how it works. Undertake a research activity exploring the skeletal and muscular systems.   | Visual display, presentation and written report.  |
| P4, P5, P6, M3, D2     | Movement, balance and musculo-skeletal disorders          | As a health professional, you need to be able to educate people about how their body works in relation to movement, balance and posture, as well as how injuries and disorders can affect the muscular and skeletal systems.<br><br>Prepare a presentation that you can deliver to adults of all ages. | Presentation with the support of written evidence as appropriate.<br><br>Witness statement. |

## Links to National Occupational Standards (NOS), other BTEC units, other BTEC qualifications and other relevant units and qualifications

This unit forms part of the BTEC Health and Social Care sector suite (see *Appendix A*) and has links with units from other qualifications in that suite. See *Appendix E* for NOS links and *Appendix G* for a mapping of the NHS Knowledge and Skills Framework against particular units in this qualification.

## Essential resources

The following resources are essential for delivery of this unit:

- an appropriately qualified tutor
- library resources with key texts and other reference materials
- life-size model skeleton, skull and vertebral column.

In addition, the following resources are considered to be highly valuable:

- wallcharts
- models of joints
- audio and visual records.

## Employer engagement and vocational contexts

Delivery of this unit will be greatly enhanced by the use of guest speakers such as physiotherapists or sports therapists or from visits to industry where learners can engage with professions allied to medicine/therapy.

### Indicative reading for learners

#### Textbooks

Clancy J and McVicar A – *Physiology and Anatomy: A Homeostatic Approach* (Hodder Arnold, 2002)  
ISBN 9780340762394

Kent M – *Advanced Biology (Advanced Science)* (Oxford University Press, 2000) ISBN 9780199141951

Kingston B – *Understanding Joints – A Practical Guide to Their Structure and Function* (Nelson Thornes, 1997)  
ISBN 9780748753994

Kingston B – *Understanding Muscles – A Practical Guide to Muscle Function* (Nelson Thornes, 2000)  
ISBN 9780748794409

Myers B – *The Natural Sciences* (Nelson Thornes, 2004) ISBN 9780748785834

Shaw L – *Anatomy and Physiology* (Nelson Thornes, 2004) ISBN 9780748785841

Stretch B and Whitehouse M – *BTEC Level 3 Nationals in Health and Social Care Student Book 1* (Pearson, 2010) ISBN 9781846907663

Stretch B and Whitehouse M – *BTEC Level 3 Nationals in Health and Social Care Student Book 2* (Pearson, 2010) ISBN 9781846907470

Toole A and S – *Understanding Biology for Advanced Level* (Nelson Thornes, 1999) ISBN 9780748739578

Tortora G – *Principles of Anatomy and Physiology* (John Wiley and Sons, 2005) ISBN 9780471718710

Ward J, Clarke R W and Linden R – *Physiology at a Glance* (Blackwell Publishing, 2005) ISBN 9781405113281

## 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 ...   |
|------------------------------|---|
| <b>Independent enquirers</b> | [IE1] identifying questions to answer when researching balance, posture and movement<br>[IE2] planning and carrying out research into the musculo-skeletal structure and functions<br>[IE4] analysing and evaluating which information to include in a presentation about the musculo-skeletal system |
| <b>Creative thinkers</b>     | [CT2] asking questions to extend their thinking about the causes of injuries and disorders related to the musculo-skeletal system.  |

## ● Functional Skills – Level 2

| Skill  | When learners are ...  |
|--|--|
| <b>ICT – Find and select information</b>   |  |
| Select and use a variety of sources of information independently for a complex task  | selecting and using a variety of sources of ICT-based information, using multiple search criteria to research the musculo-skeletal structure   |
| Access, search for, select and use ICT-based information and evaluate its fitness for purpose  | accessing and selecting information to use in their assignments  |
| <b>ICT – Develop, present and communicate information</b>  |  |
| Enter, develop and format information independently to suit its meaning and purpose including: <ul style="list-style-type: none"> <li>• text and tables</li> <li>• images</li> <li>• numbers</li> <li>• records</li> </ul> | entering and developing information for its intended purpose to produce a presentation on movement, balance and posture, including text, tables and images   |
| <b>English</b>   |  |
| Speaking and listening – make a range of contributions to discussions and make effective presentations in a wide range of contexts   | contributing to group discussions about common injuries and disorders associated with musculo-skeletal structures<br>making a formal presentation, using images, on the structure and contraction of muscle tissue |
| Reading – compare, select, read and understand texts and use them to gather information, ideas, arguments and opinions   | reading and synthesising a variety of texts about proprioception in relation to maintaining balance, posture and movement  |
| Writing – write documents, including extended writing pieces, communicating information, ideas and opinions, effectively and persuasively  | writing different types of documents, including one extended piece about the structure and contraction of muscle tissue.   |