



Unit 24: Applied Sports Anatomy and Physiology

Delivery guidance

Approaching the unit

This unit gives learners the opportunity to develop an understanding of body systems and their responses to sport and exercise. As an integral aspect of studying sport, the knowledge given in this unit will allow learners to support people in sport and exercise.

The unit includes a number of topics that will be new to some learners. With this in mind, it is important that theoretical content is delivered using a variety of methods including presentations, debates, discussions and posters, as well as in practical activities to demonstrate anatomy and physiology in action.

As this unit is assessed via internal assessment, class notes will be a huge benefit, supporting your learners in achieving success. Reinforcing learning will be extremely important and this should be embedded at all points throughout the delivery of the unit content. Literacy and numeracy skills must be developed, with links made wherever possible to the unit topics and content.

Delivering the learning aims

Learning aim A focuses on the effects of exercise and sports performance on the musculoskeletal system. Delivery can be achieved via a combination of methods focusing largely on learner-centred learning. Teaching methods may include a combination of formal lectures, pair and group research and presentations, as well as independent study and peer teaching. Practical application is encouraged wherever possible and learning can be reinforced by watching video recordings, taking part in class discussions and completing worksheets and practice assessments.

Content on joints and the range of movement at joints can be delivered particularly well in a practical setting, reinforced with formal teaching. Tutor-led delivery can be used to further support theoretical understanding. Case studies can also work well, prompting discussion about how joints are used to create specific movements in different sports.

Learners should be engaged in practical activities during the delivery of content on major muscles, muscular contraction, antagonistic muscle pairs and fibre types. Tutor-led delivery will be important to support theoretical understanding in this area. Guest lecturers from the sports industry, such as personal trainers and sports coaches, can be invited to explore real-life examples of using anatomy and physiology on a daily basis. These speakers can also give first-hand knowledge of the importance of understanding anatomy and physiology, and answer questions from learners.

Learning aims B and C

Learners would benefit from experiencing the changes made by the cardiorespiratory system during exercise. If you have the benefit of respiratory equipment such as a spirometer, it would be helpful to give learners hands-on practical experience of the functions of the respiratory system and allow them to design an experiment on the mechanics of breathing and the process of gaseous exchange. This could also be replicated with heart rate, blood pressure and sweating.

The effects of exercise and sport on the cardiorespiratory system could be explored via a learner-centred approach. Group, pair and individual tasks could be set, with information gathered to encourage peer learning/teaching and the consolidation of knowledge. An example of a group task is using 'jigsaw learning', where learners are given a workbook on one key adaptation and must work as a group to piece together all the adaptations to the respiratory system.



Learner-led learning can also work well to engage learners, including peer teaching using methods such as 'speed teaching' (an adaptation of speed dating) for topics including adaptations and additional factors affecting the cardiovascular system. To help learners develop their knowledge of the cardiorespiratory system, a useful strategy might be to organise a trip to a university, science laboratory or museum. A subsequent group presentation with worksheets and tasks to follow is also another successful means of engaging learners.

Learning aim D

Engage learners in a combination of teaching methods focused largely on learner-centred learning, using practical application wherever possible. Methods including snowball learning can develop peer understanding and learner engagement – this works well with anaerobic energy systems in particular. Practical teaching works particularly well with ATP and the energy systems.

A useful strategy might be to ask a guest coach to run a session exemplifying each energy system in action, coupled with worksheets for learners to complete and a follow-up lesson. Another strategy to consider could be organising a visit to a local university laboratory to investigate the effects of ATP and sports performance further. It is recommended that learners carry out both the Wingate test and VO₂ max test.

Tutor-led delivery may be used to further support theoretical understanding, with worksheets that confirm learning before the adaptations of the system are explored.



Assessment model

Learning aim	Key content areas	Recommended assessment approach
A Examine the function of the musculoskeletal system and how it responds to exercise	A1 Structure of skeletal system A2 Function of skeletal system A3 Structure and function of joints A4 Structure of muscular system A5 Function of muscular system A6 Muscle fibre types A7 Musculoskeletal responses to acute exercise A8 Musculoskeletal responses to long-term exercise	A presentation evaluating the structure and function of the skeletal and muscular systems, how these produce effective movement, including the effects of acute and long-term exercise on the musculoskeletal system.
B Examine the function of the cardiovascular system and how it responds to exercise	B1 Structure of cardiovascular system B2 Function of cardiovascular system B3 Cardiovascular responses to acute exercise B4 Cardiovascular responses to long-term exercise	A report evaluating the structure and function of the cardiovascular and respiratory systems, how these work together and how they adapt to respond to exercise. Learners could draw the structure of the heart and key blood vessels and include pictures or diagrams of the respiratory system to illustrate their report.
C Examine the function of the respiratory system and how it responds to exercise	C1 Structure of respiratory system C2 Function of respiratory system C3 Respiratory response to acute exercise C4 Respiratory long-term response to exercise	
D Explore the different types of energy systems and how they are used in exercise	D1 Energy systems D2 Energy system response to acute exercise D3 Energy system response to long-term exercise	A presentation evaluating the different energy systems and the benefits of their adaptations for use in sport and exercise activities.



Assessment guidance

This unit is internally assessed. There is a maximum number of three summative assignments for this unit. Tutors should refer to the assessment guidance in the specification for specific detail, particularly in relation to the requirements for Pass, Merit and Distinction grades.

It is suggested that **learning aim A** is assessed via a presentation. Within the presentation, learners must label diagrams of the skeletal and muscular system. There should be blank diagrams that they label by hand. Learners should then discuss the function of the skeletal and muscular systems. Learners will then include a section on the three types of joint in the body and further detail on the six types of synovial joint, including the movement available at each joint. They will then consolidate this information by discussing the acute and long-term adaptations of the musculoskeletal system to exercise. This discussion should be enhanced with examples from sport.

To support learners in the creation of their presentation, they should be encouraged to use different slides for different topics and annotations such as pictures and diagrams to support explanations.

Learning aims B and C are recommended to be assessed via a report.

In the report, learners should initially describe the structure and function of both the cardiovascular and respiratory systems. This should include hand-labelled diagrams and a discussion of the function of each structure. Learners will then consider topics such as; delivery of oxygen and removal of waste products, gaseous exchange, thermoregulation, the function of blood, mechanics of breathing and lung volumes. Learners will then examine how the cardiovascular system and the respiratory system react to acute and long-term exercise. Learners should be encouraged to use examples from their chosen sport to demonstrate their understanding of the benefits of the body system's adaptations.

Learning aim D requires the production of a presentation that discusses the three main energy systems. Learners will need to link each energy system to a sport or position and discuss recovery times. They should then explore the energy system's responses to acute and long-term exercise. Learners should be encouraged to use a range of sports to strengthen their review of each energy system. Comparisons between different sports and/or positions in team sports would also be beneficial.



Getting started

This gives you a starting place for one way of delivering the unit, based around the recommended assessment approach in the specification.

Introduction

Introduce the unit to learners by using a series of activities on anatomy and physiology, identifying any prior knowledge and understanding. Outline that the unit explores the effects of exercise and sports performance on the body systems, as well as additional factors and adaptations. Explain that learners will be equipped with the skills to apply anatomical knowledge to other units and vocational employment opportunities. This unit will also give learners a good understanding of physiological effects on the systems.

Learning aim A: Examine the function of the musculoskeletal system and how it responds to exercise

- Introduce the learning aim.
- Learners take part in an activity to locate different skeletal bones on a peer. Use formal delivery of the location of major bones, types of bone, the axial and appendicular skeleton, curvature of the spine and the process of bone growth. Incorporate various tasks to maintain learner-led learning. Delivery should be visual, using video clips and photographs where possible. Use learners to peer teach where possible to aid ownership of learning.
- Introduce A2 after recapping previously learned content, using the internet and textbooks. For each function of the skeletal system and type of bone, learners should research and provide detail. They can then work together to share knowledge and develop understanding, feeding back to the rest of the group.
- For joints, a group discussion is a good starting point to provide an overview of the classification of joints, and their structure and function. Use visual prompts, including video clips and photographs wherever possible. Ask learners to label joints and then create information booklets and other sources to use as notes for the assessment.
- Introduce the muscular system by discussing different muscular injuries or occurrences related to the muscular system. Lead a discussion on the muscular system and functions of the different types of muscle within the human body. Learners can use this knowledge to design an information leaflet to use as reference notes.
- Small group activities are a useful way of delivering A4 and A5. 'Pin the muscle on the body' is a good starter activity (you may wish to use an alternative to pins). Follow this by allocating each group a different sporting action. The task is to identify the muscle(s) of the agonist, antagonist, synergist and fixator. On completion, get the groups to feed back to the class.
- Practical workshops can allow learners to understand the relationship between the theory and sports activities. This can be done in the classroom or sports hall. Learners take part in a range of movements/activities that include aspects of A1–A7; this is particularly fitting with A5.



- Introduce the topic of responses of the musculoskeletal system to a single sport or exercise session. Groups of learners can then produce a presentation with supplemented demonstrations to show the responses.
- Adaptations of the musculoskeletal to exercise can be introduced and taught using a 'knowledge cafe' or 'carousel'. Learners should be given an information pack to represent one key adaptation. They are then given time to read, annotate and gain a sound understanding in the field. On completion, learners become tutors to create a knowledge cafe where learners teach among themselves.
- Pairs could work together to create a poster concerning musculoskeletal adaptations to exercise.
- Guest speakers (e.g. a personal trainer) could discuss all aspects of their role, incorporating the importance of understanding anatomy.

Learning aim B: Examine the function of the cardiovascular system and how it responds to exercise

- Introduce learning aim B with a walkthrough of the pathway of blood through the heart. Learners should follow the route of oxygenated blood through the heart, which is made out of cones laid out on the floor. Learners can perform functions in the heart, such as valves and represent structures so that when they return to class, they can recall between them the whole pathway.
- You can then facilitate an activity labelling the structures of the heart. Follow this with a class discussion and tutor-directed questions. Learners can then work independently to develop their subject knowledge in an area within this topic. Give them ideas, facilitate their learning and support as necessary.
- You could use formal delivery for the functions of the cardiovascular system, supported by tutor-directed Q&A. You can also use 'marketplace learning': individually or in groups, learners research to become knowledgeable in a function. In the structure of a marketplace, learners then walk among the different 'stalls' to share learning and content.
- Lead a discussion on thermoregulation. On completion of this, explore its practical application using additional clothing, sweat vests etc. Oversee the activities and demonstrate what the body does to maintain homeostasis.
- Case studies can be used to demonstrate responses of the cardiovascular system to a single sport or exercise session. Direct learners to depict responses and explain/justify why they are occurring, and feed back to the rest of the class.
- The peer teaching method 'speed teaching' can be used to cover the adaptations of the cardiovascular system to exercise. Small groups/pairs are given a content area to research to increase their knowledge in the field. Groups rotate round to teach each other the content in the format of speed dating. Ask individuals to collate a workbook of content and score each other's teaching.
- ABC learning can be a useful way of introducing the additional factors affecting the cardiovascular system. Each key additional factor is labelled A, B or C. Learners are given a letter and must research independently to form an information booklet. On completion, they should merge their work with others working on the same aspect, and then teach the rest of the class.



- Consolidate learner understanding by producing online quizzes or using dominoes for the learners.

Learning aim C: Examine the function of the respiratory system and how it responds to exercise

- Introduce learning aim C on the structures of the respiratory system. Learners label the structures of the respiratory system using a diagram with labels and a choice of structures to aid their understanding.
- Have a group discussion on the functions of the respiratory system, making sure it covers what learners consider to be the key functions. There is an opportunity for independent study where learners research the mechanics of breathing.
- For a practical application, ask learners to measure vital capacity using the balloon method (method available online). If available, use a peak flow and spirometer to measure lung volumes and capacity.
- You can use learner-led research to cover the control of breathing. Give learners articles (from credible sources) with the task of answering questions on neural and chemical control of breathing. On completion, use the 'snowball method', with learners feeding back in pairs, then in small groups and then as a class to discuss.
- Allow learners to participate in short experiments to see if there are different reactions from the body in terms of different forms of exercise.
- 'Think, pair, share' activity to list, discuss and explain long-term adaptations of the respiratory system. Learners initially have time to think on their own, then they share ideas with a partner and eventually bring their lists together with another pair to consolidate learning.
- To demonstrate the responses of the respiratory system to exercise, you could allocate one key response to groups and ask them to create a presentation to deliver to the rest of the class.
- Consolidate individual learner understanding by getting learners to produce plenary quizzes for each other.

Learning aim D: Explore the different types of energy systems and how they are used in exercise

- Introduce learning aim D with a group discussion about energy, ATP and its role in sport and exercise. Introducing the practical effects of this early can be very effective. A simple experiment using five balloons can demonstrate how energy is created and recreated (one balloon represents the adenosine molecule, with a further four balloons available to represent the role of phosphate molecules). This can be followed by learners practising extended writing, looking specifically at ATP and energy production.
- You could use learner-led research for the ATP-PC system, using articles (from credible sources) and getting them to answer questions on the ATP-PC system. On completion, use the 'snowball method', with learners feeding back first in pairs, then in small groups and finally as a class to discuss. Video clips can be a useful support to help learners with this topic.



- Use formal delivery for the lactate system in exercise and sports performance, followed by pair work to create an information leaflet to be presented to the rest of the group and used as a revision aid.
- Practical sessions will allow learners to apply the theory to sporting activities. A local sports coach could be invited to run a session exemplifying each anaerobic system in action.
- The aerobic system could be taught through formal delivery. Use videos to supplement understanding.
- Learners can work in groups to prepare a presentation on the adaptations of the energy systems. This can then be followed with a whole-class debate, encompassing all aspects of ATP and the energy systems during sport and exercise performance.
- You could arrange a laboratory trip to a local university to investigate effects of ATP and energy systems further (to include the Wingate tests and VO₂ max). This will also help to motivate those learners thinking of moving in to higher education.



Details of links to other BTEC units and qualifications, and to other relevant units/qualifications

This unit links to

- Unit 1: Health, Wellbeing and Sport
- Unit 2: Careers in the Sport and Active Leisure Industry
- Unit 3: Research Project in Sport
- Unit 6 Exercise and Fitness Skills Development
- Unit 9: Nutrition for Physical Activity and Exercise
- Unit 15: Developing Coaching Skills
- Unit 16: Applied Coaching Skills
- Unit 25: Sports Injuries Management
- Unit 28: Fitness Testing
- Unit 29: Technical and Tactical Skills in Sport
- Unit 31: Influence of Technology in Sport and Physical Activity
- Unit 35: Practical Sports Performance
- Unit 36: Functional Sports Massage.

Resources

In addition to the resources listed below, publishers are likely to produce Pearson-endorsed textbooks that support this unit of the BTEC International L3 Qualifications in Sport. Check the Pearson website at: (<http://qualifications.pearson.com/endorsed-resources>) for more information as titles achieve endorsement.

Textbooks

The following textbooks offer comprehensive coverage of the unit, enabling learners to develop their understanding of anatomy and physiology while developing their personal learning skills. The range of resources also enables learners to see where this unit makes links with many other aspects within the field of sport.

Adams M et al, *BTEC Level 3 National Sport Book 1*, Pearson, 2010 ISBN 9781846906510

Adams M et al, *BTEC Level 3 National Sport Book 2*, Pearson, 2010 ISBN 9781846906503

Adams M et al, *BTEC Level 3 National Sport Teaching Resource Pack (Second Edition)*, Pearson, 2010 ISBN 9781846906541

Howley ET and Franks BD, *Health Fitness Instructor's Handbook (Fourth Edition)*, Human Kinetics Publishers, 2003 ISBN 9780736042109

Marieb EN and Hoehn K, *Human Anatomy & Physiology (10th Edition)*, Pearson, 2015 ISBN 9781292097060

Palastanga N, Soames RW and Field D, *Anatomy and Human Movement: Structure and Function (Fifth Edition)*, Butterworth-Heinemann, 2006 ISBN 9780750688147



Sharkey BJ and Gaskill SE, *Fitness and Health (Sixth Edition)*, Human Kinetics Publishers, 2006 ISBN 9780736056144

Stafford-Brown J, Rea S and Chance J, *BTEC National Sport and Exercise Science (Second Edition)*, Hodder Education, 2007 ISBN 9780340939512

Tortora GJ and Derrickson BH, *Principles of Anatomy and Physiology (12th Edition)*, John Wiley & Sons, 2008 ISBN 9780470233474

Journals

The following journals give comprehensive and up-to-date research into the fields of anatomy and physiology, demonstrating the impact on health and wellbeing as well as how the human body functions and sustains life.

American College of Sport Medicine's Health and Fitness Journal

British Journal of Sports Medicine Exercise and Sport Sciences Reviews

International Journal of Sports Science and Coaching Journal of Anatomy

Medicine and Science in Sports and Exercise Research Quarterly for Exercise and Sport

Videos

www.youtube.com/watch?v=0cYal_hitz4

Joints – this video discusses the six types of synovial joint.

www.youtube.com/watch?v=l80Xx7pA9hQ

Antagonistic muscle pairs – this video discusses antagonistic muscle pairs and gives examples of each. The video only needs to be played until about four minutes.

<https://www.youtube.com/watch?v=KSbbDnbSEyM>

Circulatory system Rap – a fun video where a rap is used to discuss the functions of the heart.

<https://www.youtube.com/watch?v=CWFyxn0qDEU>

The Heart and Circulatory system – How they work – this video discusses how the heart works to pump blood around the body.

<https://www.youtube.com/watch?v=dWe8vtztW-4&t=98s>

Energy Systems – ATP Energy in the Body - this video discusses the three energy systems in the body, ATP energy, aerobic energy, anaerobic energy, adenosine triphosphate, creatine phosphate and ways to train the energy systems in the body.



Websites

The following websites give further information on a range of topics and work well in association with the recommended textbooks and journals. They provide good sources for information, ranging from anatomy and physiology in exercise through to its application to the National Health Service and sports coaches.

www.acsm.org – American College of Sports Medicine

www.heart.org – American Heart Association

www.bases.org.uk – The British Association of Sport and Exercise Sciences

www.humankinetics.com – Human Kinetics

www.nhs.uk – National Health Service

www.sportscoachuk.org – Sports Coach UK

www.sportsci.org – Sport Science

www.topendsports.com – Topend Sports

Pearson is not responsible for the content of any external internet sites. It is essential for tutors to preview each website before using it in class so as to ensure that the URL is still accurate, relevant and appropriate. We suggest that tutors bookmark useful websites and consider enabling learners to access them through the school/college intranet.