

Cambridge TECHNICALS

2016

#### Cambridge **TECHNICALS LEVEL 3**

## SPORT AND PHYSICAL ACTIVITY

### Unit 10

# Biomechanics and movement analysis

#### L/507/4461

Guided learning hours: 60 Version 5 - revised August 2022 \*changes indicated by black line

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#### LEVEL 3

#### **UNIT 10: Biomechanics and movement analysis**

#### L/507/4461

#### **Guided learning hours: 60**

**Essential resources required for this unit:** For LO3 and LO4, it would be advantageous for learners to be able to access video recording equipment and/or movement analysis software.

#### This unit is internally assessed and externally moderated by OCR.

#### UNIT AIM

In order to set themselves apart from others and have a real impact on the performance of their athletes or clients, coaches and personal trainers need to have an in-depth understanding of how the body moves and how to get the most strength, power and speed from it. By being able to analyse an athlete's or client's movement and understanding how and why forces affect sporting performance, a coach or personal trainer can get their athletes or clients to make the adjustments to their style or technique, which could mean the difference between winning and losing or reaching a personal best.

In this unit you will learn the axes and planes of movement, types of movement and levers that the body uses. You will also gain an understanding of Newton's Laws of Motion, forces and stability and how the application of these can affect a performer in a sporting environment. You will also learn how to analyse movement in order to improve the performance of an athlete or performer.

#### **TEACHING CONTENT**

The teaching content in every unit states what has to be taught to ensure that learners are able to access the highest grades.

Anything which follows an i.e. details what must be taught as part of that area of content. Anything which follows an e.g. is illustrative; it should be noted that where e.g. is used, learners must know and be able to apply relevant examples in their work, although these do not need to be the same ones specified in the unit content.

For internally assessed units you need to ensure that any assignments you create, or any modifications you make to an assignment, do not expect the learner to do more than they have been taught, but must enable them to access the full range of grades as described in the grading criteria.

Learning outcomes	Teaching content		
The Learner will:	Learners must be taught:		
1. Understand movement in relation to sport and physical activity	<ul> <li>1.1 Planes and axes of movement sport and physical activity, i.e.</li> <li>planes, i.e. <ul> <li>sagittal</li> <li>transverse</li> <li>frontal</li> </ul> </li> <li>axes, i.e. <ul> <li>transverse</li> <li>longitudinal</li> <li>frontal</li> </ul> </li> <li>1.2 Movements on each plane in sport and physical activity, i.e.</li> <li>flexion <ul> <li>extension</li> <li>abduction</li> <li>adduction</li> <li>plantar flexion</li> <li>lateral rotation</li> <li>horizontal abduction</li> </ul> </li> <li>1.3 Levers and their use in sport and physical activity, i.e.</li> <li>definition of mechanical advantage</li> <li>first order or class 1</li> <li>second order or class 2</li> <li>third order or class 3</li> <li>fulcrum (e.g. elbow when performing a bicep curl)</li> <li>load (e.g. the bicep when performing a bicep curl)</li> </ul>		
2. Understand motion and force in relation to sport and physical activity	<ul> <li>Definitions relating to biomechanical principles, i.e.</li> <li>momentum</li> <li>inertia</li> <li>mass</li> <li>weight</li> <li>force</li> <li>stability</li> </ul>		

Learning outcomes	Teaching content			
The Learner will:	Learners must be taught:			
	<ul> <li>2.2 Newton's Laws of Motion, i.e.</li> <li>First Law: Law of Inertia (e.g. muscular contractions required to stop an athlete from running)</li> <li>Second Law: Law of Acceleration or Force = Mass × Acceleration (e.g. the force with which a cricket player hits a moving ball will determine the rate at which the ball will accelerate)</li> <li>Third Law: Law of Counterforce or Action : Reaction (e.g. the impact different playing surfaces can have on performance in tennis)</li> </ul>			
	<ul> <li>2.3 Forces, i.e.</li> <li>internal forces (e.g. muscle contraction, bone support, connective tissue)</li> <li>external forces (e.g. gravity, air resistance, other participants/objects)</li> <li>net force (i.e. the overall force acting on the body/object), balanced force and unbalanced force</li> <li>free body diagrams to show forces acting on a performer or object</li> <li>the application of forces in sport (e.g. where force is applied on a football determining direction of spin/curve, sequencing of muscular contraction in a long jump to increase distance, 'shining' a cricket ball to increase spin)</li> </ul>			
	<ul> <li>2.4 Stability, i.e.</li> <li>centre of mass (e.g. identifying height and location of centre of mass to improve balance in gymnastics)</li> <li>base of support (e.g. adopting appropriate stance when batting in rounders to increase force that can be applied)</li> <li>body mass (e.g. heavier rugby players are harder to bring down in a tackle than lighter ones)</li> <li>the application of stability in sport (e.g. manipulation of centre of mass during high jump)</li> </ul>			
3. Be able to analyse movement in sport and physical activity	<ul> <li>3.1 Methods for analysing movement (e.g. against technical models (in the PER phases), through peer/coach observation (objective and subjective), slow motion video, software/apps (e.g. iCoachView))</li> <li>3.2 Movement analysis, i.e.</li> <li>specific sporting movements (e.g. tennis serve, golf swing, somersault in trampolining)</li> <li>phases of movement (e.g. preparatory phase, execution phase, recovery phase)</li> <li>joints involved and their sequence of movement (e.g. a shot putter using ankle, knee, hip, shoulder, elbow, wrist and finger joints in the right order to increase the distance of their throw)</li> <li>plane(s) and axes in which the movement occurs</li> <li>muscles involved and their function (e.g. agonists, antagonists)</li> <li>type of contraction (e.g. concentric, eccentric)</li> </ul>			

Learning outcomes	Teaching content		
The Learner will:	Learners must be taught:		
4. Be able to use movement analysis to improve performance in sport and physical activity	<ul> <li>4.1 Planning for improvement in performance, i.e.</li> <li>identification of areas of improvement through analysis of a specific sporting movement (e.g. positioning of feet, lowering centre of mass, striking ball in a different place)</li> <li>feedback to performer (e.g. using software, using demonstration)</li> <li>use of practice methods in improvement plan (e.g. whole practice, part practice, whole-part-whole practice)</li> <li>review of performance (e.g. complete further analysis)</li> <li>measurement of improvement (e.g. jumping further, faster sprint time, scoring more aces)</li> <li>evaluation of improvement plan, i.e. <ul> <li>against initial movement</li> <li>successful aspects</li> <li>unsuccessful aspects</li> <li>suggested improvements</li> </ul> </li> </ul>		

#### **GRADING CRITERIA**

LO	Pass	Merit	Distinction
	The assessment criteria are the Pass requirements for this unit.	To achieve a Merit the evidence must show that, in addition to the Pass criteria, the candidate is able to:	To achieve a Distinction the evidence must show that, in addition to the pass and merit criteria, the candidate is able to:
<ol> <li>Understand movement in relation to sport and physical activity</li> </ol>	P1*: Describe the planes and axes of movement used in different sporting activities	M1: Define mechanical advantage with reference to levers and their use in sport and physical activity	D1: Classify the different types of levers and give examples of how they produce movement in different sporting activities.
	P2*: Explain movements on each plane using examples from different sporting activities		
2. Understand motion and force in relation to sport and physical activity	P3: Define momentum, inertia, mass, weight, force, stability	M2: Apply understanding of forces to a range of examples from sport and physical activity	D2: Explain stability, factors which affect it and how it can be applied to performance in sport and physical
	P4: Explain Newton's Laws of Motion in relation to sport	M3: Draw and label a free-body diagram to show the forces acting on	activity
	affect sporting performance	physical activity	
3. Be able to analyse movement in sport and physical activity	P6*: Analyse a specific sporting movement using appropriate method(s)	M4: Assess the suitability of different methods of movement analysis in relation to sport and physical activity	
4. Be able to use movement analysis to improve performance in sport and physical activity	P7*: Plan for improvement in a specific sporting movement, based on movement analysis	M5: Evaluate the effectiveness of the plan for improvement in a specific sporting movement	

#### SYNOPTIC LEARNING AND ASSESSMENT

It will be possible for learners to make connections between other units over and above the unit containing the key tasks for synoptic assessment, please see section 6 of the centre handbook for more details. We have indicated in this unit where these links are with an asterisk and provided more detail in the assessment guidance section below.

#### **ASSESSMENT GUIDANCE**

LO1 Understand movement in relation to sport and physical activity

Learners must describe the planes and axes of movement and explain movements on each plane for at least two different sporting activities. These must be 'complex' activities such as a golf swing, tennis serve, somersault, etc. For M1, learners must define mechanical advantage with reference to sport and physical activity; these references can be to more 'simple' movements such as bicep curls. For D1, learners must give sport or physical activity examples for each of the three classes of lever. For this LO, learners will benefit from drawing on learning from mandatory Unit 1, Body systems and the effects of physical activity – LO1 Understand the skeletal system in relation to exercise and physical activity and LO2 Understand the muscular system in relation to exercise and physical activity and LO2 Understand the muscular system in relation to exercise and physical activity and Unit 18, Practical skills in sport and physical activities.

#### LO2 Understand motion and force in relation to sport and physical activity

Learners' work (including M2, M3 and D2) should all be in the context of sport or physical activity using relevant examples. For P5, learners must describe what is meant by internal and external forces and give two examples of each. They also need to describe what net force and balanced and unbalanced forces are. For M3, the free-body diagram may be hand-drawn by the learner (stick people are acceptable) or may be generated using computer software. If computer software is used the learner must be able to evidence that the work is their own.

For this LO, learners will benefit from drawing on learning from mandatory Unit 1, Body systems and the effects of physical activity – LO1 Understand the skeletal system in relation to exercise and physical activity and LO2 Understand the muscular system in relation to exercise and physical activity. Learners may also draw on learning from Unit 7, Improving fitness for sport and physical activity and Unit 18, Practical skills in sport and physical activities.

#### LO3 Be able to analyse movement in sport and physical activity

Learners must analyse movement using a method appropriate to the sport or physical activity they are analysing and the participant(s) performing the movement. All aspects of teaching content 3.2 should be included in the analysis. Learners must analyse a 'complex' movement such as a golf swing, tennis serve, somersault, tennis serve, layup, badminton smash etc. For M4, learners must assess the suitability of at least two different methods of movement analysis.

For this LO, learners will benefit from drawing on learning from mandatory Unit 1, Body systems and the effects of physical activity – LO1 Understand the skeletal system in relation to exercise and physical activity and LO2 Understand the muscular system in relation to exercise and physical activity. Learners may also draw on learning from Unit 5, Performance analysis in sport and exercise; Unit 7, Improving fitness for sport and physical activity and Unit 18, Practical skills in sport and physical activities.

#### LO4 Be able to use movement analysis to improve performance in sport and physical activity

Learners should base their plan on the movement analysed in P6. For M5, learners must have carried out the plan for improvement in order to evaluate its effectiveness. For this LO, learners will benefit from drawing on learning from mandatory Unit 1, Body systems and the effects of physical activity – LO1 Understand the skeletal system in relation to exercise and physical activity and LO2 Understand the muscular system in relation to exercise and physical activity and LO3 Be able to use methods to improve skills, techniques and tactics in sport and LO4 Be able to plan sports and activity sessions. Learners may also draw on learning from Unit 7, Improving fitness for sport and physical activity.

**Feedback to learners:** you can discuss work-in-progress towards summative assessment with learners to make sure it's being done in a planned and timely manner. It also provides an opportunity for you to check the authenticity of the work. You must intervene if you feel there's a health and safety risk.

Learners should use their own words when producing evidence of their knowledge and understanding. When learners use their own words it reduces the possibility of learners' work being identified as plagiarised. If a learner does use someone else's words and ideas in their work, they must acknowledge it,

and this is done through referencing. Just quoting and referencing someone else's work will not show that the learner knows or understands it. It has to be clear in the work how the learner is using the material they have referenced to inform their thoughts, ideas or conclusions.

For more information about internal assessment, including feedback, authentication and plagiarism, see the centre handbook. Information about how to reference is in the OCR Guide to Referencing available on our website: <u>http://www.ocr.org.uk/i-want-to/skills-guides/</u>.

### **MEANINGFUL EMPLOYER INVOLVEMENT** - a requirement for the Foundation Diploma and Diploma (Tech Level) qualifications

The 'Diploma' qualifications have been designed to be recognised as Tech Levels in performance tables in England. It is a requirement of these qualifications for centres to secure employer involvement through delivery and/or assessment of these qualifications for every learner.

The minimum amount of employer involvement must relate to at least one or more of the elements of the mandatory content.

Eligible activities and suggestions/ideas that may help you in securing meaningful employer involvement for this unit are given in the table below.

Please refer to the *Qualification Handbook* for further information including a list of activities that are not considered to meet this requirement.

Meaningful employer involvement	Suggestion/ideas for centres when delivering this unit
<ol> <li>Learners undertake structured work experience or work placements that develop skills and knowledge relevant to the qualification.</li> </ol>	Learners could undertake work experience or complete job shadowing at a local university or professional sports club's sport science lab.
<ol> <li>Learners undertake project(s), exercises(s) and/or assessments/examination(s) set with input from industry practitioner(s).</li> </ol>	
<ol> <li>Learners take one or more units delivered or co-delivered by an industry practitioner(s). This could take the form of master classes or guest lectures.</li> </ol>	An elite sports coach, sport scientist or personal trainer could deliver a lecture on movement analysis or how an understanding of forces, levers, etc. can help improve performance.
4. Industry practitioners operating as 'expert witnesses' that contribute to the assessment of a learner's work or practice, operating within a specified assessment framework. This may be a specific project(s), exercise(s) or examination(s), or all assessments for a qualification.	An elite sports coach, sport scientist or a personal trainer could act as an expert witness to learners analysing movement or planning improvements to performance.

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